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Sarah Franzot; Anne-Marie Gendron; Alfredo Staffa; David Ohayon; Marie-Ève SansCartier; Chantal St-Denis; Kathy Low

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Triosyn Corp.
1191 South Brownell Road

Williston, VT 05495 -

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14. ABSTRACT
The FY06-07 goal was to advance the development of the Triosyn Super HEPA (TSH) media as an enhanced filtration material to be included in individual protection and collective protection end-use applications. Work was also done to pursue the development of the Triosyn T-series respirators.

The objectives were achieved and resulted in a mature Triosyn Super HEPA filter material. A manufacturing process to incorporate Triosyn particles to glass fiber HEPA was developed to produce a material which maintains standard HEPA

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Report Title

Individual and Collection Protection Program- Final Report

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The FY06-07 goal was to advance the development of the Triosyn Super HEPA (TSH) media as an enhanced filtration material to be included in individual protection and collective protection end-use applications. Work was also done to pursue the development of the Triosyn T-series respirators.

The objectives were achieved and resulted in a mature Triosyn Super HEPA filter material. A manufacturing process to incorporate Triosyn particles to glass fiber HEPA was developed to produce a material which maintains standard HEPA performance but also displays enhanced antimicrobial and chemical protection properties due to the presence of Triosyn. The antimicrobial performance of this media was demonstrated under a variety of testing conditions and following exposure to different microbial challenges. The Triosynated material's safety profile was also well-defined as measured by the iodine levels released in the effluent air under several exposure conditions. The chemical protection capability of the TSH was demonstrated following exposure of the media to surrogates of chemical warfare agents and potential incompatibilities originating from adverse interactions between iodine and the ASZM-TEDA carbon were investigated. This advanced TSH filter material is now ready for the next research steps which involve prototype designing for insertion into various individual and collective protection applications.

List of papers submitted or published that acknowledge ARO support during this reporting period. List the papers, including journal references, in the following categories:

(a) Papers published in peer-reviewed journals (N/A for none)

Number of Papers published in peer-reviewed journals:

(b) Papers published in non-peer-reviewed journals or in conference proceedings (N/A for none)

Number of Papers published in non peer-reviewed journals:

(c) Presentations

Number of Presentations:

Non Peer-Reviewed Conference Proceeding publications (other than abstracts):

Number of Non Peer-Reviewed Conference Proceeding publications (other than abstracts):

Peer-Reviewed Conference Proceeding publications (other than abstracts):

Number of Peer-Reviewed Conference Proceeding publications (other than abstracts):

(d) Manuscripts

Number of Manuscripts:

Number of Inventions:

Graduate Students

NAME	PERCENT_SUPPORTED

FTE Equivalent:
Total Number:

Names of Post Doctorates

NAME	PERCENT_SUPPORTED

FTE Equivalent:
Total Number:

Names of Faculty Supported

NAME	PERCENT_SUPPORTED

FTE Equivalent:
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Names of Under Graduate students supported

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FTE Equivalent:
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This section only applies to graduating undergraduates supported by this agreement in this reporting period

The number of undergraduates funded by this agreement who graduated during this period:	0.00
The number of undergraduates funded by this agreement who graduated during this period with a degree in science, mathematics, engineering, or technology fields:.....	0.00
The number of undergraduates funded by your agreement who graduated during this period and will continue to pursue a graduate or Ph.D. degree in science, mathematics, engineering, or technology fields:.....	0.00
Number of graduating undergraduates who achieved a 3.5 GPA to 4.0 (4.0 max scale):	0.00
Number of graduating undergraduates funded by a DoD funded Center of Excellence grant for Education, Research and Engineering:	0.00
The number of undergraduates funded by your agreement who graduated during this period and intend to work for the Department of Defense	0.00
The number of undergraduates funded by your agreement who graduated during this period and will receive scholarships or fellowships for further studies in science, mathematics, engineering or technology fields:	0.00

Names of Personnel receiving masters degrees

NAME

Total Number:

Names of personnel receiving PHDs

NAME
Total Number:

Names of other research staff

NAME	PERCENT_SUPPORTED
FTE Equivalent:	
Total Number:	

Sub Contractors (DD882)

Inventions (DD882)

Triosyn Corp.
1191 South Brownell Rd.
Williston, VT 05495
USA

Phone: (802) 865-5084
Fax: (802) 658-2681
info@triosyn.com

Individual and Collective Protection Program

Final Report

Contract Number: W911NF-05-C-0042

Principal Investigator: Pierre Jean Messier, President and CEO

Report prepared for:

Dr. Stephen J. Lee
Chief of Organic Chemistry
Chemical Sciences Division
U.S. Army Research Office
4300 So. Miami Boulevard
P.O. Box 12211
Research Triangle Park, NC 27709-2211
Phone: (919) 549-4365
Fax: (919) 549-4310

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1 INTRODUCTION

Research developed during the FY06 program was part of Triosyn's continued efforts towards integrating the biocidal properties of Triosyn to particulate filters to obtain air filtering systems offering increased safety against microbial entities, especially viruses, for individual and collective protection purposes. The primary goal of the FY06 research effort was to continue the development of the *Triosyn Super HEPA Media (TSH)* to demonstrate its improved microbial and investigate its chemical protection capabilities in IP and CP end-use applications. The *Triosyn Super HEPA Media* was originally developed during the FY05 research program as a possible alternative to the currently used standard glass-fiber HEPA media. It is expected to maintain standard HEPA performance with the added benefit of enhanced antimicrobial properties due to the addition of Triosyn particulates to the glass-fiber HEPA material during manufacturing. As outlined in the Statement of Work, the specific objectives pursued during the FY06 research program were:

1. finalize media design and investigate its typical physical and performance properties;
2. perform material testing against existing standards for HEPA material;
3. demonstrate enhanced microbial filtration capacity of the media;
4. explore the potential of the media in providing chemical protection,
5. investigate potential incompatibilities in end-use applications, with special focus on characterizing the possible effects of iodine on carbon;
6. initiate the regulatory process for use of Triosyn in HVAC applications.

This report describes the final testing performed for the Triosyn Super HEPA Media under development in the areas of engineering, microbiology and chemistry/toxicology. As described in different sections of this report, the bulk of the research during the last quarter involved validation testing of the final selected configuration of the Triosyn Super HEPA media as it relates to its microbial and toxicological performance under a wide range of conditions, including: different environmental and soil loading conditions and different microbial strains (bacteriophage and animal viruses, bacterial cells and spores, and a fungal organism). In addition, a summary of the Triosyn Super HEPA Media longevity study performed over 538 days is provided in the Microbiology and Chemistry sections.

Another important goal achieved during the final quarter of this program referred to chemical agent testing of the Triosyn Super HEPA Media. Initial research involved testing the selected configuration of the Triosyn Super HEPA media against chemical agent surrogates DMMP and Demeton-O, followed by characterization of the by-products of the chemical reaction between Triosyn and DMMP. Additionally, research was performed to characterize the reaction between Triosyn powder and Parathion, a member of the TIC (Toxic Industrial Chemicals) family. Finally, the interaction between iodine and TEDA carbon was investigated under accelerated aging conditions as per military standard MIL-PRF-51560C. All findings pertaining to these tests are presented and discussed in the Chemistry section of this report.

Apart from the research efforts involving development and testing of the Triosyn Super HEPA media, parallel work was devoted to field testing of Triosyn Antimicrobial Respirators. More specifically, a questionnaire and a field test plan were put together, with the ultimate goal to determine how the four different models of Triosyn respirators perform under actual military use. A discussion on this topic is provided in this report (Section 6).

The deliverables required under contract W911NF-05-C-0042 are complete with the issuance of this final report. As mentioned above, this report describes the final research performed on the Triosyn Super HEPA Media in the areas of engineering, microbiology and chemistry/toxicology. It also includes a synopsis of the research carried out in FY06 with the purpose of providing an overview of the technological advances and achievements that took place during this fiscal year.

1.1 SYNOPSIS OF RESEARCH TO DATE

1.1.1 TRIOSYN SUPER HEPA MEDIA

During the FY06 research program, Triosyn continued its efforts to pursue its primary goal – to demonstrate successful integration of Triosyn particles directly into the glass Fiber HEPA to obtain a material displaying improved antimicrobial/chemical protection capability for potential IP/CP end-use applications. In Engineering, the research was focused on media design and manufacturability. Several pilot production runs were performed, which generated different batches of the Triosyn Super HEPA filter material for testing in microbiology and chemistry. Below is a summary of the FY06 research efforts by development area (i.e. engineering, microbiology and chemistry/toxicology).

1.1.1.1 ENGINEERING AND MANUFACTURING EFFORTS

In Engineering, the primary objective was to manufacture and demonstrate successful integration of Triosyn particles directly into the glass Fiber HEPA. The research was focused on media design and manufacturability to reproduce Triosyn Super HEPA media previously manufactured at Lydall Filtration/Separation Group facility in New Hampshire USA, in October 2005. Three manufacturing trial runs were performed in FY06, which included two runs at Lydall (December 2006 and June 2007), and another performed at an alternative production site (Western Michigan University). The materials produced during these trial runs were subjected to a battery of tests including air resistance (Δp), %penetration (DOP), Viral Filtration Efficiency and iodine release in order to quantify its performance and compare it to previous batches.

Early Engineering work in FY06 was dedicated to optimize the Triosyn Super HEPA manufacturing process. The diagram below (Figure 2.1) depicts the process flow. The primary manufacturing approach involved mixing Triosyn particles into the slurry prior to the fibers being laid on the web. Besides this approach, the Engineering team also investigated the possibility of applying the Triosyn particles to the fibers later in the process; more precisely, after they were laid on the web. However, it was noted that the Triosyn particles were not uniformly distributed nor embedded within the media and use of this approach was discontinued. Thus, adding Triosyn into the slurry tanks was the technique selected and applied for all trial runs detailed below. Other manufacturing parameters investigated by the Engineering team included increasing the amount of fibers and latex binder, varying the Triosyn particle size, among others.

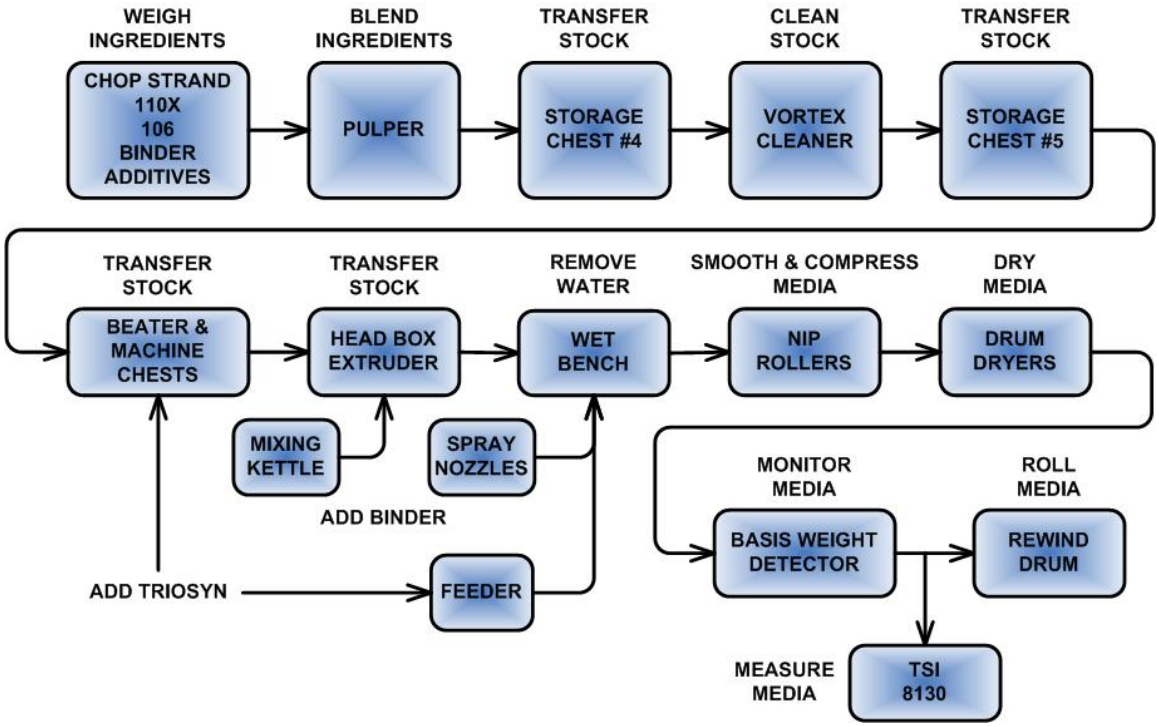


FIGURE 2.1 HEPA MEDIA MANUFACTURING PROCESS FLOW

Three trials runs were performed in FY06 at two manufacturing sites: Lydall and the Western Michigan University (WMU). Technical challenges were encountered in producing HEPA grade media that would meet industry standards at the WMU facility, and no further testing was pursued with the material originated from this site. As per the Lydall production batches, the table below presents a summary of the physical properties of the different Triosyn Super HEPA batches produced during the FY06 program in comparison to the October 05 batch (part of the FY05 program). Along with Triosyn Super HEPA media, standard HEPA without Triosyn was also produced as a control to ensure that the base media met HEPA grade specifications for air resistance and/or penetration; this standard media was also used as a negative control when testing for microbiological performance. For the 2006 and 2007 trial runs, both Triosyn and base media met the HEPA industry standards for penetration and air flow resistance. The industry standard for HEPA grade media tested at a flow rate of 32 litres per minute, on a 100cm^2 sample, is a particle penetration of less than 0.03% and a resistance of less than 40 mm of water column (ΔP).

TABLE 2.1: COMPARISON OF PHYSICAL PROPERTIES OF THE SELECTED HEPA BATCHES PRODUCED AT LYDALL IN 2005, 2006 AND 2007

Production Year	Description	α Number	Δ P (mm H_2O)	Penetration (%)	Thickness (mm)			
					Trial #1	Trial #2	Trial #3	Average
2005	Blank HEPA	14.385	26.8	0.010	0.68	0.70	0.64	0.67
	Triosyn Super HEPA (50 gsm Triosyn, 200-400um particles)	if 53%: 9.965 if 54%: 8.79	33.9	0.027	0.99	0.98	0.97	0.98
2006	Blank HEPA	12.11	29.1	0.030	0.77	0.72	0.74	0.74
	Triosyn Super HEPA (50 gsm Triosyn, 200-400um particles)	12.33	32.15	0.010	0.95	0.93	0.95	0.94
2007	Blank HEPA	11.97	31.6	0.020	0.88	0.87	0.88	0.88
	Triosyn Super HEPA (50 gsm Triosyn, 200-400um particles)	11.04	37.63	0.010	1.11	1.12	1.13	1.12

As mentioned above, a major goal pursued by the Engineering team during FY06 was to produce batches of Triosyn Super HEPA media that displayed the same physical properties and performance as the media manufactured at Lydall in October 2005. It was as a result of this October 05 batch that the HEPA media loaded with 50 g/m^2 200-400 micron Triosyn with a layer of 20 meltblown containing 10 g/m^2 Triosyn was down selected as the preferred configuration, due to its consistent microbial filtration performance displaying 1.5 log higher viral reduction as compared to the blank counterpart. Based on these findings, subsequent production runs at Lydall were aimed at generating greater quantities of this down selected material in order to validate the enhanced microbial filtration capacity of the media and explore its potential in providing chemical protection against surrogates of warfare agents, as outlined in the FY06 Statement of Work. As seen in Table 2.1 above, there was great variation in several physical parameters obtained for the different production batches, even though the manufacturing process remained essentially the same. For example, the media produced in 2007 was thicker than the previous batches; whereas the % penetration seemed to have decreased for the 2006/07 batches as opposed to the original 2005 batch. The microscopic appearance of these different media batches further emphasizes the inconsistency among them (Figure 2.2). At this point, there is no obvious explanation for this variation and it remains to be determined why we were unable to reproduce the 2005 production batch in subsequent trial runs. More time and further research would be required to better elucidate the manufacturing variables affecting media performance and physical properties. All performance testing described in this report used blank and Triosynated media produced in 2005.

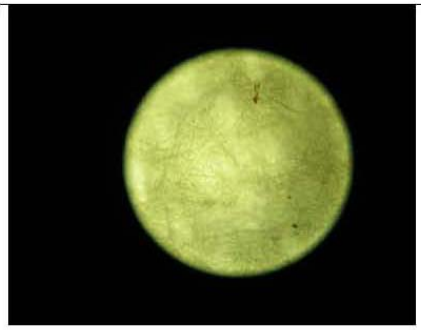
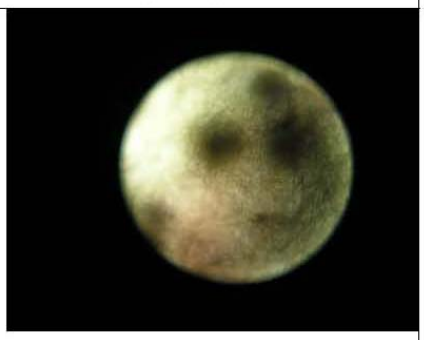
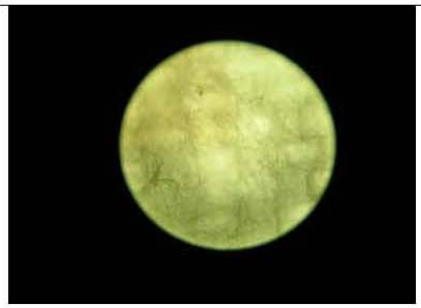
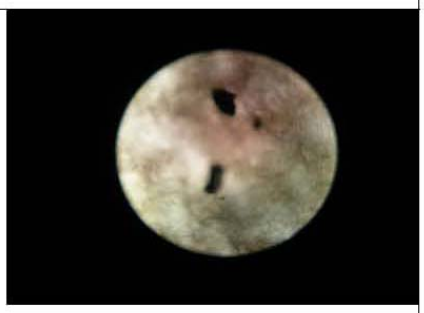
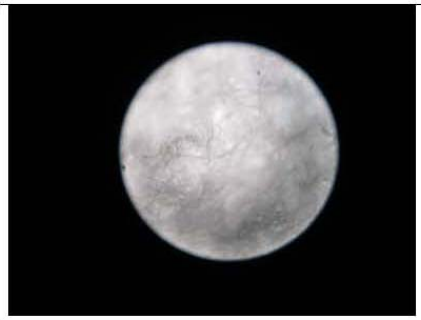
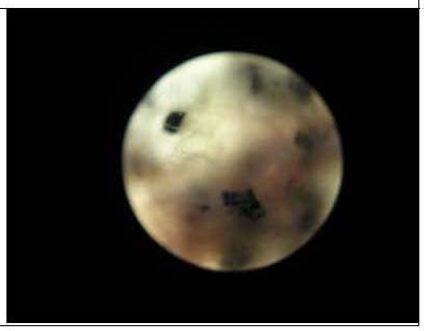
Production Year	Blank HEPA	Triosyn Super HEPA
2005		
2006		
2007		

FIGURE 2.2 MICROSCOPIC VIEW (10X) OF BLANK AND TSH MEDIA PRODUCED IN 2005, 2006 AND 2007

Aside from producing HEPA-grade glass fiber filtration media impregnated with Triosyn resin, another important engineering goal pursued in FY06 was to prepare and evaluate this media for end use products. Some prototypes were produced from the different trial runs to assess the media's workability features. Pleatability was one of the parameters investigated during this research program. Filter prototypes prepared with media produced in December 2006 were showing extensive cracking along their creases when pleated. To address this issue, one of the goals for the June 2007 run was to produce stronger media to allow for the production of higher quality pleated products. Polyester was used as an additive in an attempt to improve media flexibility, along with application of low heat during pleating. As a result, the media showed better pleating characteristics, and the final results are present in the Engineering section of this report (please refer to section 2.3).

1.1.1.2 MICROBIOLOGY

In Microbiology, efforts were focused on testing the microbial filtration efficiency of samples of the Triosyn Super HEPA media obtained from the different trial runs. The selected media configuration contained a Triosyn concentration equivalent to 50 g/m^2 in the form of 200-400 μm particles. This media was tested alone and in combination of a layer of meltblown material impregnated with 10 g/m^2 of Triosyn. Final results from testing comparing different composites of Triosyn Super HEPA media at elevated flow rates indicated that the addition of a layer of this Triosynated 20 meltblown to standard glass-fiber HEPA (non-Triosynated) is sufficient to provide a minimum of 2 log better reduction than the corresponding blank control. This makes this configuration suitable for short-term, individual protection applications especially when considering a cost analysis which clearly demonstrates that the 20XP/Triosyn configuration is much more economical; however, when it comes to collective protection applications, which rely on long-term usage, the addition of Triosyn to both the 20 meltblown and the glass fiber HEPA may be warranted. The presence of Triosyn on both the meltblown and glass fiber layers would also provide a better performance against chemical agents.

The Microbiology section of the present report describes the final microbiological validation testing of the down-selected Triosyn Super HEPA media composite composed of Triosynated meltblown media (with 10 g/m^2 of Triosyn) plus Triosynated HEPA glass fiber media (50 g/m^2 of Triosyn).

A longevity trial was also conducted during FY06 to determine the viral filtration performance of the Triosyn Super HEPA media over time, at face velocities typical of collective protection applications. This test was performed over 538 days. Results indicated that, even after close to 18 months of continuous filtration, the Triosynated filter still provided approximately 2 log better reduction than the non-Triosynated filter when tested against a viral challenge of MS2 coliphage. It is important to mention that this performance was consistently maintained over the course of the entire testing period. At the end of this longevity trial it was decided to evaluate the capacity of the filtration media to kill both viruses and bacteria on contact after being subjected to such lengthy continuous air filtration. To accomplish this, a protocol based on the AATCC 100 Standard was employed and results showed that the Triosynated media retained its ability to self-decontaminate against viral (MS2 coliphage) and bacterial (*Staphylococcus aureus*) contamination even after being subjected to 538 days of continuous air filtration.

1.1.1.3 CHEMISTRY/TOXICOLOGY

In Chemistry/Toxicology, research efforts were focused in two major areas: (i) to determine the iodine content released from the different production batches of Triosyn Super HEPA media, so as to ensure that it remains below the acceptable levels as defined by regulatory authorities (ii) to investigate and quantify the efficiency of the Triosyn HEPA media in terms of chemical protection against warfare agents.

Results obtained from testing the down-selected configuration of the Triosyn Super HEPA media including those with/without polyester, with/without the addition of the Triosynated meltblown media, and at standard and elevated flow rates, emphasized the safety profile of this media. Under all testing conditions, all iodine values were either below of slightly above the detection level and remained well below the TLV value of 1,036 mg/m^3 for individual exposure. In terms of its toxicology performance over time, the iodine levels were also shown to be either below the instrument's detection limit (BDL) or slightly above after over 530 days of continuous air flow under high face velocity conditions.

As mentioned, another important goal related to the development of the Triosyn Super HEPA media was to investigate its chemical protection capability against warfare agents. Testing was performed to characterize the performance of the Triosyn Super HEPA material in breaking down chemical surrogates such as: dimethylmethylphosphonate (DMMP), Demeton-O, and Bis 2-chloroethyl methyl sulphide (CEMS). Results consistently demonstrated that the Triosyn Super HEPA media had an increase in the breaking down capacity against these agents when compared to standard HEPA alone. The present report describes the final work performed in the chemical agent testing area, as outlined in the Statement of Work. This includes: additional testing of the Triosyn Super HEPA media against DMMP and Demeton-O, characterization of the by-products of the chemical reaction between Triosyn and DMMP, and investigation of the reaction between Triosyn powder and Parathion, a member of the TIC (Toxic Industrial Chemicals) family.

In addition to the work reported above, a great deal of research in Chemistry was focused on the carbon component of the Triosynated air filter stacks. Tests were performed to determine the maximum amount of iodine that the ASZM-TEDA carbon could adsorb, before becoming saturated. Different methodological approaches were used and the goal was to load the carbon media with iodine until the carbon reached up to 1,036 mg/mg^3 iodine (equivalent to the TLV). This carbon would then be used in chemical surrogate testing to determine how it would affect the chemical protection capacity of the media containing a heavy excess of iodine in the carbon pores. Also, U.S based carbon manufacturers were researched as an alternative to the Taiwan-based carbon supplier used by Triosyn Corp. Several carbon manufacturers were contacted and carbon samples were obtained and tested according to Triosyn's quality control criteria. The conclusion of this research is present in the Chemistry section of this report.

1.1.2 TRIOSYN ANTIMICROBIAL RESPIRATORS

In FY06 research efforts were also invested in the development and testing of Triosyn respirators. Design work was performed on the exhalation valves used in the T-5000V in order to correct some valve leakage issues. It was noted that valves of these respirators were getting contaminated with carbon granules during the manufacturing process. These issues were resolved with the validation and approval of a new valve design and cleaning procedure.

In terms of performance testing, Triosyn respirators were tested alongside respirators from a leading competitor to determine the product's efficiency to reduce DMMP chemical vapors. The preliminary results demonstrated the efficiency of carbon and Triosyn in a respirator to reduce the amount of DMMP chemical vapors. In Microbiology, results from air filtration testing against Influenza and Rhinovirus challenges comparing Triosyn and N95 respirators indicated that the Triosyn T-5000 P95 respirator allowed below detectable levels of both influenza virus and rhinovirus to penetrate, while two different brands of N95 respirators allowed approximately 10^3 total PFU of each virus to penetrate during the one hour test. Finally, work devoted to field testing of Triosyn Antimicrobial Respirators is presented in this report.

2 PROJECT DEVELOPMENT: ENGINEERING

2.1 LOADING TRIOSYN SUPER HEPA MEDIA

Overview

A key goal of the program is to age the Triosyn Super HEPA media the conduct performance testing. In this quarter, samples of media were loaded with DOP (oily particulate), dust, and smoke to simulate use over the filter's lifetime. After loading, the samples were sent for microbiology testing.

More development was needed for dust and smoke than for DOP loading. DOP loading has an established methodology, and standard equipment is used. For the other two agents, Triosyn engineers had to build an apparatus for loading and define a methodology.

DOP Loading

DOP loading was conducted on the TSI 8130 Automated Filter Tester. Sample size was 100 cm^2, the standard size used by the TSI machine. Samples were loaded at a flow rate of 12.1 lpm to a loading of 28.6 mg of DOP, to represent aging over the filter's life. The total loading and flow rate were calculated based on established test procedures for C2A1 canisters.

Dust and Smoke Loading

The Engineers designed a custom system to load filters with dust. The system uses a screw feeder to dispense ASHRAE Test Dust, which is then transported into a section of ductwork through a venturi pump. The ductwork itself is comprised of two halves that clamp around the test media and its fixture. The dust/air combination is then drawn by an industrial vacuum through this test media loading it as it filters the dust from the air. The percentage of loading can be approximated by the amount of time dust is fed into the system. At the completion of loading, the filter media is removed and tested for airflow resistance to confirm the loading percentage. The same ductwork can be used for smoke loading without the feeder and venturi. Images of the system are shown in Figures 2.1 through 2.5.

FIGURE 2.1: DUST LOADING SYSTEM

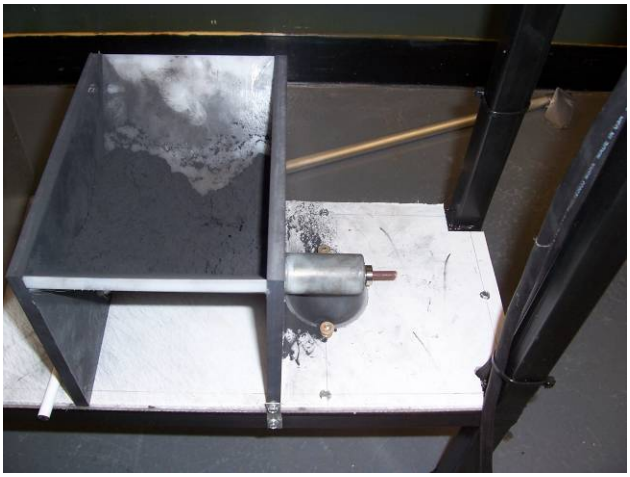


FIGURE 2.2: DUST FEEDER SYSTEM - TOP VIEW

FIGURE 2.3: CONTROLS & VENTURI

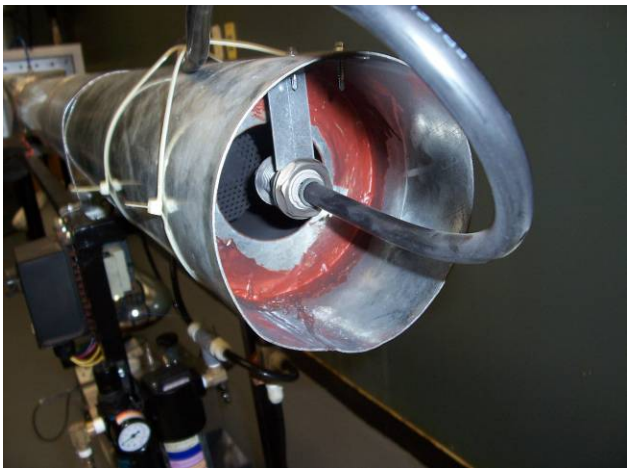


FIGURE 2.4: DUCTWORK INTAKE

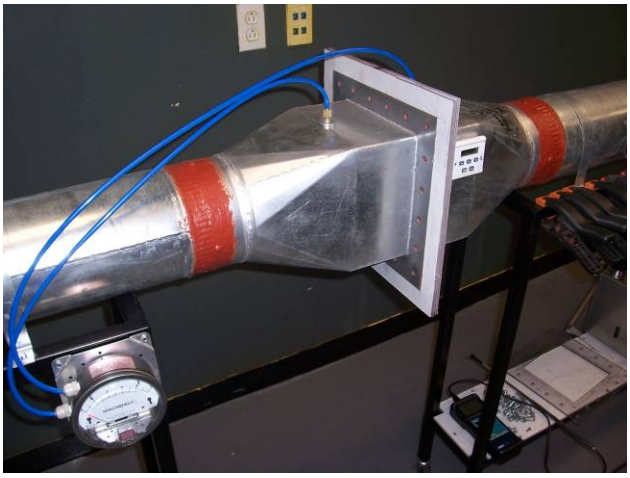


FIGURE 2.5: FILTER HOLDER INSTALLED IN LOADING DUCT

Some challenges were encountered during the design and construction of the loading system. First, the venturi system, which is used to draw the dust into the system, was not entraining enough dust. After consulting with the manufacturer, the engineers learned that the venturi required a larger diameter tube on the outlet than on the inlet to ensure proper air flow and dust distribution. Another challenge was insufficient air flow through the system. It was difficult to pull enough air through the system due to the static pressure created by the media. This issue was highlighted once the venturi was working properly, because the dust-filled air was not being pulled through the system due to lack of air flow. To address this problem, the engineers upgraded the simple duct booster to a high static blower, and finally ended up using an industrial vacuum cleaner. This provided adequate flow to pull the dust through the system properly.

After the system was working as designed, sample loading began. Eight samples (2 per condition) were loaded with ASHRAE Test Dust to 25%, 50%, 75%, and 100% increase in air resistance. Air resistance was measured within an 8 inch x 8 inch area on the samples. This loading represents aging over the filter's life.

Two samples were also loaded with smoke from a cigarette. One cigarette per sample was ignited using a lighter, held at the intake end of the system and fueled by the intake air drawn by the system's vacuum.

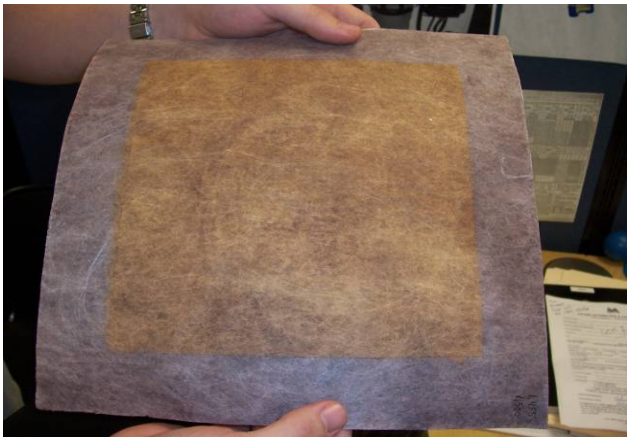


FIGURE 2.6: SMOKE LOADED MEDIA

2.2 TRIOSYN SUPER HEPA MEDIA CONCENTRATION ANALYSIS

In the previous quarterly report, some preliminary observations about the uniformity of media weight and Triosyn concentration were noted. To investigate these observations further, a random weight and concentration analysis was conducted.

To perform the test, four 6 inch x 6 inch samples were cut across the width of each roll at 10 foot intervals for a total of 60 feet. This was done for each of the seven media configurations made in the June 2007 fabrication run (shown in Table 2.1). An average basis weight for the media was calculated by weighing rolls of blank media. For each Triosynated sample, the average media basis weight was subtracted from the total weight measured for the sample, leaving the weight of Triosyn, which was converted to gsm.

TABLE 2.1: HEPA-RATED GLASS FIBER MEDIA PRODUCED IN JUNE 2007

	Triosyn Particle Size			
	Blank	100-200 µm	200-300 µm	200-400 µm
Polyester		X	X	X
No Polyester	X	X	X	X

The resulting data was compiled to show the variation of Triosyn throughout each roll's length and across its width at each 10 foot interval. Note that the control data shown is the base media weight measured, since no Triosyn was used in the control. The results are shown in Figures 2.7 and 2.8.

The data did not support any of the observations noted previously. However, the data did show that the 100-200 gsm glass fiber media without polyester had the greatest uniformity both across the web and along the web out of all variations tested.

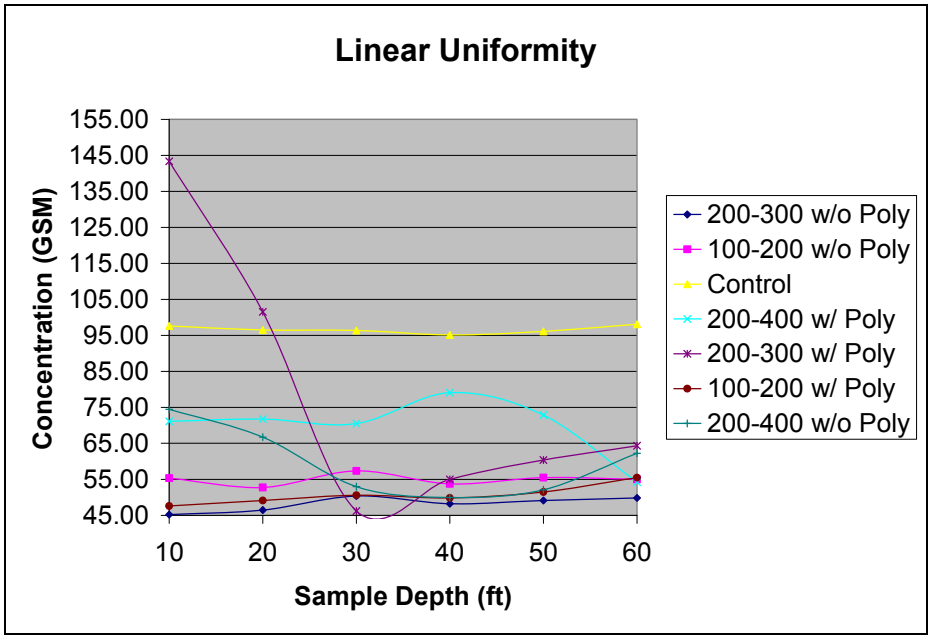


FIGURE 2.7: TRIOSYN CONCENTRATION UNIFORMITY THROUGH LENGTH OF ROLL

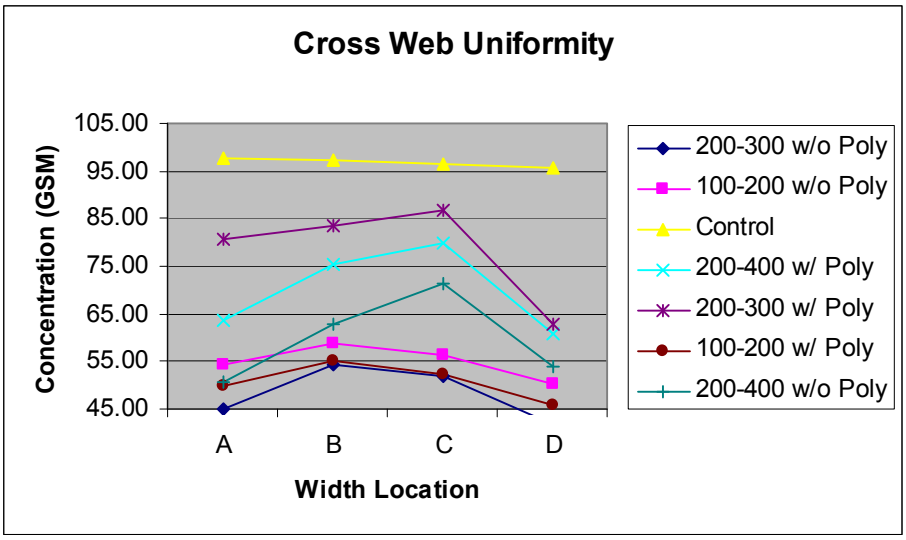


FIGURE 2.8: TRIOSYN CONCENTRATION UNIFORMITY ACROSS WIDTH OF ROLL

2.3 TRIOSYN SUPER HEPA MEDIA PLEAT STRENGTH ANALYSIS

During the June 2007 fabrication run, Lydall introduced a new test that gauges the pleat strength of the glass fiber material. This test is roughly based on the tensile strength of the media after it has been pleated. Called the DF tensile, it is a measure of the force, in gram-forces, at the material's yield point after the material has been folded. While this data should be useful in the future, it cannot be used for comparison to previous runs because previous data does not exist. DF tensile results are shown below in Table 2.2.

TABLE 2.2: TRIOSYN SUPER HEPA DF TENSILE RESULTS

Media	Average DF Tensile	Average DF Tensile per group
Control w/o Poly	714	714
200-400 w/o Poly	692	701
200-300 w/o Poly	689	
100-200 w/o Poly	722	
100-200 w/ Poly	850	874
200-300 w/ Poly	941	
200-400 w/ Poly	831	
Overall Average	**787.51**	

In internal pleating trials, all variations showed better pleating characteristics. Because the improved pleating was noted for all media variations, engineers believe it is a result of heating the media during pleating, rather than a characteristic of the new media formulations. The test data from Lydall indicates that the media with polyester additive should have better pleat strength, however visual observations have not shown a difference.

2.4 TRIOSYN SUPER HEPA MEDIA TESTING

Another key objective of this program is to test the Triosyn Super HEPA media to established standards for HEPA filter media. One relevant standard previously identified is ASME AG-1-2003 Code on Nuclear Air and Gas Treatment, Article FC-I-3000. Some preliminary testing was conducted loosely following the tests called out in this standard during this contract period. A brief summary of the tests conducted and results are shown below. These results, shown in Table 2.3, give an early indication of how the Triosyn Super HEPA media might perform in these areas in the future.

TABLE 2.3: TRIOSYN SUPER HEPA RESULTS OF PRELIMINARY ASME AG-1-2003 TESTING

Test Protocol	Test Name	Results		Requirements		Comments
		Machine direction (MD)	Cross Direction (CD)	Machine Direction (MD)	Cross Direction (CD)	
FC-I-3210	Resistance	33.9	-	<40.6 mm H20	-	
FC-I-3220	Penetration	0.0276	-	<0.03% penetration	-	
FC-I-3231	Dry Tensile & Elongation	3.65	4.3	>2.5lb/in	>2.0lb/in	
		2.92%	3.86%	>.5% elong	>.5% elong	
FC-I-3232	Heat Tensile & Elongation	-	-	-	>.6 lb/in	Sample burned in the oven
FC-I-3233	Wet Tensile & Elongation	-	1.23	-	>1.0 lb/in	
FC-I-3250	Acidity	6.66 pH	-	6.0-8.0 pH	-	
FC-I-3260	Thickness	0.034	-	.015-.40in	-	
FC-I-3270	Combustible	46.20%	-	7% by weight	-	
FC-I-3281	Flexing	**Wire Side**	**Top Side**	**Wire Side**	**Top Side**	
FC-I-3282	Penetration after flexing	0.0135%	0.014%	0.03% penetration	0.03% penetration	

Key

	Pass
	Fail

3 PROJECT DEVELOPMENT: MICROBIOLOGY

Prototypes generated internally by the engineering department were tested by the microbiology laboratories following the test specifications described in the statement of work in order to assess and monitor their antimicrobial efficacy under specific flow rates applicable to individual or collective protection end-use applications.

3.1 METHODS

3.1.1 MICROBIOLOGICAL PERFORMANCE

The ability of an Air Filtration Membrane (AFM) to remove microorganisms is measured by aerosolizing viable challenge microorganisms into an air stream and passing them through the AFM. The antimicrobial performance of the membrane is assessed by comparing the number of viable microorganisms measured in the effluent air stream with the number of viable microorganisms in the challenge (i.e. in the air stream as it reaches the membrane).

The effect of exposure of the AFM to humidity and particles as it occurs during use might be assessed by subjecting the membranes to extended filtration periods (determined in accordance with intended use).

AFMs, in individual and collective protection, are tested at a specified flow rate. Testing conditions might be adjusted to simulate different velocities applicable to various end-use applications.

This procedure provides a reference for comparison of filtration materials. It allows a reproducible biological challenge to be repeatedly delivered to test samples. The technique may be modified to provide different protocol parameters to the test samples.

3.1.2 TEST ORGANISMS

This test method can be adapted for a variety of microorganisms using appropriate standard microbiological preparation methods. The organisms used in this procedure are MS2 coliphage (ATCC 15597-B1), which is representative of viruses, *Staphylococcus aureus* (ATCC 6538) and *Bacillus atrophaeus* spores (ATCC 9372), formerly identified as *Bacillus subtilis* var niger or *Bacillus globigii*. All organisms show excellent resistance to desiccation and are hardy against chemical disinfection, thus making them excellent surrogates for their respective BW counterparts (animal viruses, vegetative bacteria and bacterial spores). They represent reliable models for air studies because of their non-pathogenicity, ease of preparation and assay as well as the stability of the stock suspensions and resistance to aerosolization. The MS2 coliphage is 23 nm in diameter. The propagating host of coliphage MS2 is *Escherichia coli* (ATCC 15597). *Staphylococcus aureus* is a gram positive vegetative bacterium with a mean diameter of 0.5 to 1.5 μm. *Bacillus atrophaeus* (ATCC 9372) is a non-pathogen, sporulating bacteria used for its similarities with *Bacillus anthracis*, a bio-warfare agent. *Bacillus* spores are rod-shaped, measuring 0.95 μm to 1.25 μm long and 0.55 μm to 0.70 μm wide.

In addition, as previously reported, a great deal of effort has been focused on establishing an animal virus model. Unlike our previous model (HRV14), influenza virus is an enveloped virus and we felt that it was important to establish this alternate animal virus model particularly in light of the current threat of an influenza pandemic, possibly triggered by the highly pathogenic H5N1 avian influenza that is

currently spreading among the bird population on several continents. The influenza strain used for this purpose is a tissue culture adapted derivative of the influenza A/PR/8/34 virus (H1N1; ATCC VR-1469).

Test organisms are obtained from an outside source and used to prepare suspensions of the appropriate concentration in order to obtain an influent challenge of $\geq 10^3$ to 10^4 total CFU or PFU for HVAC testing and $\geq 10^4$ to 10^5 CFU / PFU per litre of air for tests in the aerosolizing chamber test apparatus. The detailed procedures for the preparation of stock and nebulizer suspensions are described in Annex 1.

3.1.3 CONTROLS

When testing in the aerosolizing chamber test apparatus, the size of the microbial challenge (control count) is determined for each test by the collection of the air passing through an empty filter holder in the impingement samplers.

When testing in the HVAC high-speed ventilation system, the size of the microbial challenge (control count) is determined for each test by the collection of the air before the AFM in the impingement samplers.

Either blank media or commercial filters in collective protection were used as negative controls in order to obtain comparative data on the efficacy of the addition of Triosyn iodinated polymer.

3.1.4 CHALLENGE PROCEDURE

The aerosolizing chamber test apparatus and the HVAC high-speed ventilation system are set up and operated as per Annex 2 instructions for challenge filtration intervals specified in section 3.1.9.

The microorganism suspension is nebulized to provide the specified concentration of challenge ($\geq 10^3$ to 10^4 total CFU or PFU). When testing in the aerosolizing chamber, the filter holders, including the membranes under test, are attached to the sampling port of the aerosolizing chamber and the all glass impingers arranged to obtain a flow rate of 85.0 LPM for the membrane surface area of 500 cm^2. When testing in the HVAC high-speed ventilation system, the filter holders, including the membranes under test, are inserted in the docking unit and challenged at a flow rate of 650 CFM for a membrane surface area of 2.0 m^2.

When testing in the aerosolizing chamber test apparatus, the air is collected after passing through the filter holders (including the AFM or empty) in the impingement samplers. When testing in the HVAC high-speed ventilation system, only a fraction of the air is collected (either before or after the AFM) at 12 LPM in the impingement samplers at four different sampling ports.

For each run of tests, the microbial challenge number (control count) is determined as described in section 3.1.3 and section 6.4 of Annex 1.

For each AFM tested, the number of microorganism passing through the AFM after specified challenge filtration intervals (effluent count), is determined by the collection of the air passing through the membrane in the impingement samplers, as described in section 6.5 of Annex 1. The impinger collection fluid is assayed as per sections 6.3 of Annex 1.

In general, the microbial filtration efficiency (MFE) is determined for each test article using the following equation:

$$MFE\% = \frac{C - T}{C} \times 100$$

Where: C = Control count.
T = Effluent count of test article

3.1.5 DETECTION LEVEL

Specific percent detection levels for given test runs are calculated from the following equation:

$$DL\% = \frac{C - S}{C} \times 100$$

Where: C = Control count.
S = Sensitivity of the method

3.1.6 FLOW RATE

Testing conditions might be adjusted to simulate different face velocities applicable to various end-use applications. Based on NIOSH recommendations for individual protection testing, the flow rate through the test articles should be maintained at 85.0 LPM (3.0 CFM). The flow rates are determined based on Face Velocity, which is calculated using the following equation:

$$Face\ Velocity = \frac{CFM(ft^3/min)}{Test\ Area\ (ft^2)}$$

In collective protection testing, the face velocity was calculated at approximately 31 ft/min following the above equation, thus the flow rate through the test articles was maintained at 650 CFM (18,400 LPM) for a surface area of 2.0 m^2.

3.1.7 CHALLENGE FILTRATION

According to the intended use, the membranes under test are subjected to various periods of time of continuous challenge filtration. The aerosol challenge procedure for each test article was conducted for consecutive 1-hour intervals when testing in the aerosolization chamber for individual protection. For longevity testing in the HVAC high-speed ventilation system, test articles were exposed to 35-minute periods of microbial aerosolization either once a day, or at the beginning and at the end of each filtration day.

3.1.8 ENVIRONMENTAL CONDITIONS

For both individual protection and collective protection, the temperature and relative humidity conditions within the test apparatus were maintained at 20 ± 5ºC and 50 ± 15%, except when assessing filtration efficiency at different environmental conditions. For such trials, the AFM were tested under the following sets of environmental conditions:

- 20 ± 5ºC and 50 ± 15% RH (Ambient conditions)
- 5 ± 3ºC and 75 ± 15% RH
- 30 ± 3ºC and 30 ± 15% RH
- 30 ± 3ºC and 90 ± 15% RH

3.1.9 SELF-DECONTAMINATION TESTING METHOD

Testing the self-decontamination properties of the Triosynated glass fiber media is performed using a protocol based on the principle of the AATCC Test Method 100-1999[1]. This test method was originally devised as a quantitative procedure for the evaluation of the degree of antibacterial activity of antibacterial finishes on textile materials. This test method was simplified and adapted to viral challenges, namely MS2 coliphage and influenza virus, and various bacterial and fungal challenges: *Staphylcoccus aureus* as a bacterial challenge, *Bacillus atrophaeus* spores as a bacterial spores challenge, and *Aspergillus niger* spores as a fungal spores challenge. *Aspergillus niger* (ATCC 16404) is an airborne mitosporic fungus found worldwide in soil, air and plants and is a common contaminant of heating and ventilating systems which may be pathogenic. *Aspergillus niger* conidia (spores) are 4 to 5 µm in diameter.

Briefly, the test method is as follows. Test articles (1" X 1") are placed in individual sterile 50 mm Petri dishes. A suspension of the chosen microorganism is prepared in a sterile agar slurry (8.5 g/L NaCl, 3 g/L Agar) so as to provide a titer of approximately 10^8 PFU or CFU per ml, respectively. The agar slurry microbial suspension is vortexed immediately prior to inoculation to assure uniform distribution of challenge microorganism. Each swatch is inoculated with 0.1 ml of the microbial suspension. The Petri dishes are incubated at room temperature for the specified contact time(s). Following the specified contact time, each swatch is aseptically transferred into a sterile 50 ml conical tube containing 10 ml of sterile NDS (which contains 0.25% sodium thiosulfate) and is then vortexed to allow complete neutralization of the antimicrobial ingredient and release the microorganisms from the test article. The solution is then collected and serial dilutions are plated on Petri dishes containing the appropriate growth medium using standard microbiological techniques. The degree of antimicrobial activity of a given material for a specific contact time, expressed as % reduction, is calculated as follows.

$$\%Reduction = 100(C - A)/C$$

Where: C = The number of microorganisms recovered from the inoculated untreated control specimen swatches immediately after inoculation (at T=0 contact time)

A = The number of microorganisms recovered from the inoculated treated test specimen swatches incubated for the specified contact time

[1] AATCC Test Method 100-1999 "Antibacterial Finishes on Textile Materials: Assessment of"

3.2 RESULTS

This section describes the microbiological validation testing of the Triosyn Super HEPA (TSH) media composite as detailed in the Statement of Work. The chosen TSH composite is composed of Triosynated metlblown plus Triosynated HEPA glass fiber media. We previously reported that the TSH composite version in which Triosyn was present only on the meltblown layer performed just as well as the doubly Triosynated composite (chosen TSH composite) in microbiological testing, it seems that the extra Triosyn present on the HEPA layer helps the performance of the media against chemical surrogates, therefore all validation testing in microbiology was performed with a composite containing Triosyn on both the meltblown and HEPA layers.

Required validation testing included consistency in Viral Filtration Efficiency (VFE), VFE testing against MS2 at different environmental conditions, consistency of VFE in presence of soil-loading agents, microbial filtration efficiency (MFE) testing against vegetative bacterial and bacterial spore representatives at standard conditions, VFE testing against animal virus at standard conditions, self-decontamination properties, and longevity testing or VFE over time for collective/HVAC applications.

Microbiological aerosol testing was performed using two formats: i) 12.57 cm2 swatches at a flow rate of 4 LPM, or ii) 100 cm2 swatches at a flow rate of 31.8 LPM. The face velocity, defined as the flow rate per unit area, is identical in both cases and corresponds to an elevated flow rate. For example, this face velocity would be consistent with an individual protection device being subjected to a flow rate in the order of 200-300 LPM. As documented in several studies[1,2,3], such peek respiratory airflow rates, that exceed by far the 85 LPM recommended by NIOSH for testing of these devices, are not uncommon during physical exertion typical of military and first responder personnel wearing respirators.

3.2.1 CONSISTENCY IN VFE

VFE of the TSH composite media against MS2 coliphage was assessed in three separate test runs to verify VFE consistency. Flat swatches of 12.57 cm^2 were subjected to air filtration of the bioaerosol at a flow rate of 4.0 LPM under ambient conditions. Results are presented in Table 3.1 and compared in Figure 3.1.

As shown in Table 3.1, the viral penetration through the Triosynated TSH composite varied from 10^2 to 10^3 PFU, relative to the average challenge level of $1X10^8$ PFU to almost $4X10^8$ PFU. This translates to consistent average log reduction values ranging from 5.41 to 5.79 for the three test runs, which represent an average 5.54 ± 0.21 log reduction (Figure 3.1). For comparison, the single available port left was run with a blank composite as an internal control. The blank allowed 10^3 PFU penetration at every sampling point in all three test runs, translating to average log reduction values of 4.64 to 4.77, for an average 4.71 ± 0.07 log reduction. This data demonstrates consistent enhanced VFE performance of the TSH composite media against MS2 coliphage when compared to its blank counterpart.

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[1] Kaufman (2002) *Respiratory Airflow in Working Individuals Wearing Chemical Protection*, http://www.cdc.gov/niosh/npptl/standardsdev/cbrn/apr/meetings/101602/pdfs/niosh_navair16oct02.pdf

[2] Kuklane and Holmér (2002) *Respiratory flow patterns during physical work with respirators*, Department of Ergonomics, National Institute for Working Life, Solna, Sweden http://www.av.se/english/news/report_breathing_mask.pdf

[3] Berndtsson (2003) *Peak Inhalation Air Flow & Minute Volume during a Controlled Test Performed on an Ergometer*, http://www.sea.com.au/docs/papers/gb_ergo_niosh_2003.pdf

TABLE 3.1: VFE CONSISTENCY OF THE TRIOSYNATED TSH COMPARED TO ITS BLANK COUNTERPART AGAINST MS2 COLIPHAGE AT 4 LPM FOR 3 HOURS (M07-0429, M07-0430, M07-0431)

A) RUN #1 (Test ID M07-0429)

Sampling time (h)	TSH composite with Triosyn (n=10) (PFU total)	TSH composite Blank (n=1) (PFU total)	Positive Control (n=1) (PFU total)
1	2.11E+02	1.17E+03	1.40E+08
2	2.55E+02	3.10E+03	5.84E+07
3	3.05E+02	2.02E+03	1.40E+08
Total	7.72E+02	6.29E+03	3.38E+08
Average	2.57E+02	2.10E+03	1.13E+08
Avg. Log red.	5.79	4.73	N / A

*Method Detection Level: 2 PFU

B) RUN #2 (Test ID M07-0430)

Sampling time (h)	TSH composite with Triosyn (n=10) (PFU total)	TSH composite Blank (n=1) (PFU total)	Positive Control (n=1) (PFU total)
1	3.97E+02	2.21E+03	1.04E+08
2	4.68E+02	3.23E+03	1.12E+08
3	1.25E+03	4.34E+03	2.24E+08
Total	2.12E+03	9.78E+03	4.40E+08
Average	7.06E+02	3.26E+03	1.47E+08
Avg. Log red.	5.43	4.64	N / A

*Method Detection Level: 2 PFU

C) RUN #3 (Test ID M07-0431)

Sampling time (h)	TSH composite with Triosyn (n=10) (PFU total)	TSH composite Blank (n=1) (PFU total)	Positive Control (n=1) (PFU total)
1	2.05E+03	5.76E+03	3.28E+08
2	2.03E+03	7.78E+03	4.44E+08
3	2.11E+03	6.14E+03	3.84E+08
Total	6.19E+03	1.97E+04	1.16E+09
Average	2.06E+03	6.56E+03	3.85E+08
Avg. Log red.	5.41	4.77	N / A

*Method Detection Level: 2 PFU

Legend:

TSH composite with Triosyn: 12.57 cm^2 of 20 meltblown media containing 10 g/m2 of Triosyn T50 (10µm) & HEPA grade glass fiber media containing 50 g/m^2 of Triosyn T50 (200-400µm) & 100 g/m^2 carbon media

TSH composite Blank: 12.57 cm^2 of Blank 20 meltblown media & Blank HEPA grade galss fiber media & 100 g/m^2 carbon media

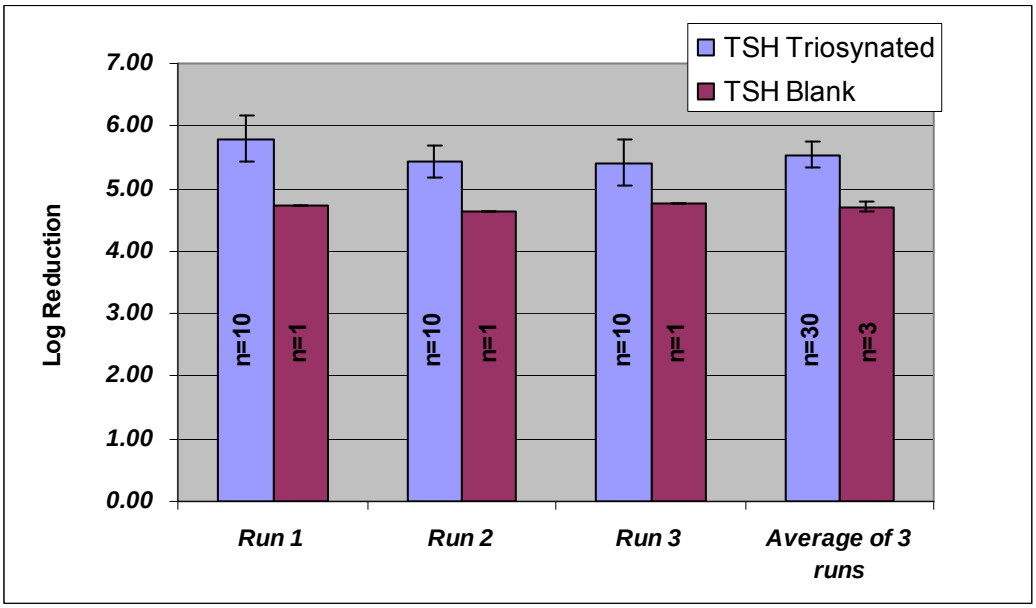


FIGURE 3.1: COMPARING THE VFE OF THE TSH COMPOSITE AGAINST MS2 COLIPHAGE AT 4 LPM FOR 3 HOURS (M07-0429, M07-0430, M07-0431)

3.2.2 VFE TESTING AGAINST MS2 UNDER DIFFERENT ENVIRONMENTAL CONDITIONS

The VFE of the TSH composite media against MS2 coliphage was assessed in different environmental conditions varying in temperature and relative humidity as described in section 3.1.8. Flat swatches of 100 cm^2 were subjected to air filtration of the bioaerosol at a flow rate of 31.8 LPM under specified conditions, which represents the same face velocity as testing conditions used for consistency. As we had reported in the previous report, composites can be evaluated using either the 12.57 cm^2 or 100 cm^2 swatch format at high face velocity (however, as much as possible, smaller swatches were used to conserve media inventory). Results are shown in Table 3.2 and compared in a graph format in Figure 3.2.

As illustrated in Figure 3.2, both the Triosynated and the blank TSH composite media showed fairly stable efficiencies against MS2 coliphage under all tested conditions. Compared to results obtained at ambient conditions (Table 3.2A), the TSH composite yielded slightly higher VFE values in warm and humid conditions (Table 3.2B): the average log reduction of the Triosyn containing composite went from 5.65 log to 6.15 log. The lowest VFE exhibited by the TSH composite media with and without Triosyn was observed at the coldest condition tested. Overall, these results are very stable and show less than approximately 0.5 log variation for both the Triosynated and blank TSH composite media. The added Triosyn advantage is consistent under all conditions tested.

TABLE 3.2: VFE OF THE TSH COMPOSITE WITH AND WITHOUT TRIOSYN UNDER DIFFERENT ENVIRONMENTAL CONDITIONS AGAINST MS2 COLIPHAGE AT 31.8 LPM FOR 3 HOURS (M07-0468, M07-0476, M07-0438, M07-0439, M07-0441, M07-0442, M07-0446, M07-0447)

A) AMBIENT: 20°C ± 3C°; 50% ± 15% R.H. (Tests IDs M07-0468 & M07-0476)

Sampling time (h)	TSH composite with Triosyn (n=6) (PFU total)	TSH composite Blank (n=4) (PFU total)	Positive Control (n=2) (PFU total)
1	1.01E+03	3.96E+04	5.65E+08
2	9.47E+02	3.84E+04	3.84E+08
3	1.47E+03	6.07E+04	4.40E+08
Total	3.43E+03	1.39E+05	1.39E+09
Average	1.14E+03	4.62E+04	4.63E+08
Avg. Log red.	5.65	4.05	N / A

*Method Detection Level: 2 PFU

B) WARM & HUMID: 30°C ± 3C°; 90% ± 15% R.H. (Tests IDs M07-0438 & M07-0439)

Sampling time (h)	TSH composite with Triosyn (n=6) (PFU total)	TSH composite Blank (n=4) (PFU total)	Positive Control (n=2) (PFU total)
1	3.40E+02	1.45E+04	3.91E+08
2	2.37E+02	2.68E+04	5.04E+08
3	1.15E+03	4.45E+04	8.10E+08
Total	1.72E+03	8.57E+04	1.70E+09
Average	5.74E+02	2.86E+04	5.68E+08
Avg. Log red.	6.15	4.31	N / A

*Method Detection Level: 2 PFU

C) WARM & DRY: 30°C ± 3C°; 30% ± 15% R.H. (Tests IDs M07-0441 & M07-0442)

Sampling time (h)	TSH composite with Triosyn (n=6) (PFU total)	TSH composite Blank (n=4) (PFU total)	Positive Control (n=2) (PFU total)
1	1.45E+03	1.26E+04	1.28E+08
2	8.58E+02	8.56E+03	1.08E+08
3	9.36E+02	1.95E+04	3.17E+08
Total	3.24E+03	4.07E+04	5.52E+08
Average	1.08E+03	1.36E+04	1.84E+08
Avg. Log red.	5.39	4.10	N / A

*Method Detection Level: 2 PFU

D) COLD: 5°C ± 3C°; 75% ± 15% R.H. (Tests IDs M07-0446 & M07-0447)

Sampling time (h)	TSH composite with Triosyn (n=6) (PFU total)	TSH composite Blank (n=4) (PFU total)	Positive Control (n=2) (PFU total)
1	3.92E+03	1.01E+05	9.15E+08
2	5.23E+03	1.27E+05	7.35E+08
3	8.95E+03	1.71E+05	1.79E+09
Total	1.81E+04	3.99E+05	3.44E+09
Average	6.03E+03	1.33E+05	1.15E+09
Avg. Log red.	5.29	3.93	N / A

*Method Detection Level: 2 PFU

Legend:

TSH composite with Triosyn: 100 cm^2 of 20 meltblown media containing 10 g/m2 of Triosyn T50 (10µm) & HEPA grade glass fiber media containing 50 g/m^2 of Triosyn T50 (200-400µm) & 100 g/m^2 carbon media

TSH composite Blank: 100 cm^2 of Blank 20 meltblown media & Blank HEPA grade galss fiber media & 100 g/m^2 carbon media

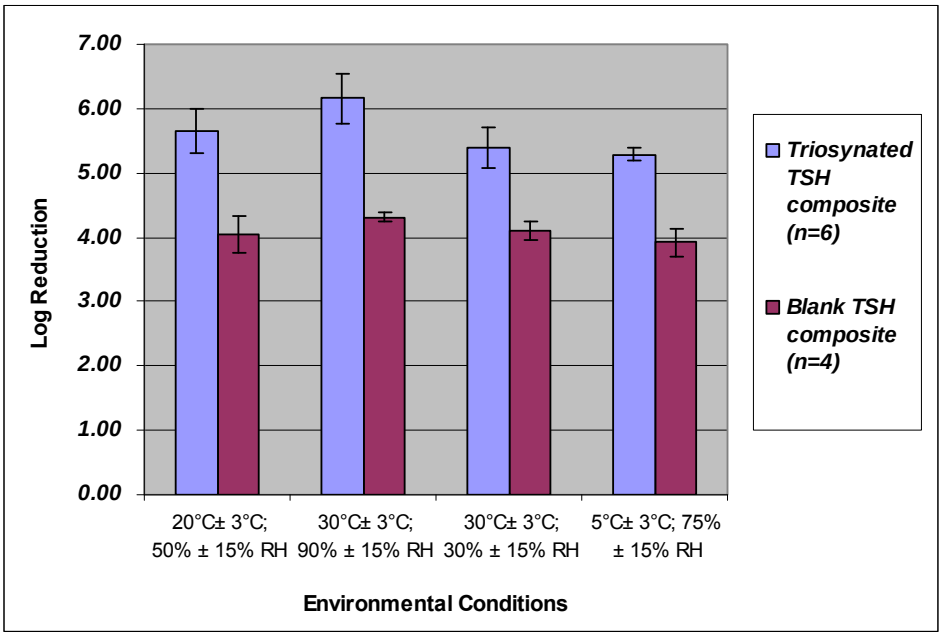


FIGURE 3.2: COMPARING THE VFE OF THE TSH COMPOSITE UNDER DIFFERENT ENVIRONMENTAL CONDITIONS AGAINST MS2 COLIPHAGE AT 31.8 LPM FOR 3 HOURS (M07-0468, M07-0476, M07-0438, M07-0439, M07-0441, M07-0442, M07-0446, M07-0447)

3.2.3 CONSISTENCY OF VFE IN PRESENCE OF SOIL-LOADING AGENTS

The VFE of the Triosynated TSH composite media against MS2 coliphage was evaluated in presence of such soil loading agents as DOP, smoke and dust. Please refer to the Engineering section for detailed loading procedures.

Flat swatches of 100 cm^2 were loaded to 29 mg of DOP and subjected to air filtration of the bioaerosol at a flow rate of 31.8 LPM under ambient conditions. Results are presented in Table 3.3

TABLE 3.3: COMPARING VFE OF THE TRIOSYNATED TSH COMPOSITE MEDIA WITH AND WITHOUT DOP LOADING AGAINST MS2 COLIPHAGE AT 31.8 LPM FOR 3 HOURS (M07-0448, M07-0449)

Sampling time (h)	TSH composite with Triosyn		Positive Control (n=2) (PFU total)
	DOP Loaded (n=12) (PFU total)	Non Soiled (n=6) (PFU total)	
1	1.28E+03	8.68E+02	4.89E+08
2	1.81E+03	1.69E+03	9.95E+08
3	1.45E+03	8.13E+02	3.14E+08
Total	4.54E+03	3.37E+03	1.80E+09
Average	1.51E+03	1.12E+03	5.99E+08
Avg. Log red.	5.90	5.85	N / A

*Method Detection Level: 2 PFU

Legend:

TSH composite with Triosyn: 100 cm^2 of 20 meltblown media containing 10 g/m2 of Triosyn T50 (10µm) & HEPA grade glass fiber media containing 50 g/m^2 of Triosyn T50 (200-400µm) & 100 g/m^2 carbon media

DOP Loaded: 100 cm2 of TSH composite with Triosyn were loaded to 29 mg of DOP.

As shown in Table 3.3, soiling of the Triosynated TSH composite media with DOP particulates did not affect its performance. Both the DOP-loaded and the non soiled samples reduced the average $6X10^8$ PFU MS2 coliphage challenge to $1X10^3$ PFU average viral penetration, which translates to 5.90 and 5.85 log reduction, respectively.

For smoke soiling assessment, 10" X 10" flat samples were loaded with cigarette smoke, then punched into 12.57 cm^2 swatches and subjected to air filtration of the bioaerosol at a flow rate of 4.0 LPM under ambient conditions. Results are presented in Table 3.4.

TABLE 3.4: COMPARING THE VFE OF THE TRIOSYNATED TSH COMPOSITE MEDIA WITH AND WITHOUT SMOKE LOADING AGAINST MS2 COLIPHAGE AT 4.0 LPM FOR 3 HOURS (M07-0470, M07-0471)

Sampling time (h)	TSH composite with Triosyn		Positive Control (n=2) (PFU total)
	Smoke Loaded (n=12) (PFU total)	Non Soiled (n=6) (PFU total)	
1	2.53E+03	2.16E+03	3.87E+07
2	1.91E+03	1.33E+03	1.15E+08
3	2.16E+03	1.87E+03	6.38E+07
Total	6.60E+03	5.35E+03	2.17E+08
Average	2.20E+03	1.78E+03	7.25E+07
Avg. Log red.	4.53	4.64	N / A

*Method Detection Level: 1.83 PFU

Legend:

TSH composite with Triosyn: 12.57 cm^2 of 20 meltblown media containing 10 g/m2 of Triosyn T50 (10µm) & HEPA grade glass fiber media containing 50 g/m^2 of Triosyn T50 (200-400µm) & 100 g/m^2 carbon media

SMOKE Loaded: 12.57 cm2 of TSH composite with Triosyn were loaded with Smoke.

Results shown in Table 3.4 are very similar for both the smoke-loaded and the non soiled TSH composite with Triosyn. Viral penetration levels at all sampling points were almost identical with averages of $2.20X10^3$ PFU compared to $1.78X10^3$ PFU after three hours of continuous filtration. This resulted in average log reduction of 4.53 for the smoke loaded composite and 4.64 for the non soiled media. As seen in Table 3.4, the average log reduction values observed for both loaded and non-loaded samples were lower than expected and no conclusive explanation can be proposed at this time.

Four different dust loading levels of the Triosynated TSH composite were investigated: 10" X 10" flat samples were loaded with dust until pressure drop readings reached the initial pressure drop of the media plus 25%, 50%, 75% and 100% and submitted to the same testing conditions as smoke loading described above. Results of these tests are summarized in Table 3.5 and compared in Figure 3.3.

TABLE 3.5: COMPARING THE VFE OF THE TRIOSYNATED TSH COMPOSITE MEDIA WITH AND WITHOUT DUST LOADING AGAINST MS2 COLIPHAGE AT 4.0 LPM FOR 3 HOURS (M07-0452, M07-0453, M07-0459, M07-0460, M07-0462, M07-0463, M07-0466, M07-0467)

A) Intial Δp + 25% Δp (Tests IDs M07-0452 & M07-0453)

Sampling time (h)	TSH composite with Triosyn		Positive Control (n=2) (PFU total)
	Dust Loaded (n=12) (PFU total)	Non Soiled (n=6) (PFU total)	
1	4.40E+01	1.16E+02	3.79E+07
2	5.12E+01	1.62E+02	3.09E+07
3	1.98E+02	4.10E+02	7.69E+07
Total	2.94E+02	6.88E+02	1.46E+08
Average	9.78E+01	2.29E+02	4.85E+07
Avg. Log red.	5.80	5.39	N / A

*Method Detection Level: 1.83 PFU

B) Intial Δp + 50% Δp (Tests IDs M07-0459 & M07-0460)

Sampling time (h)	TSH composite with Triosyn		Positive Control (n=2) (PFU total)
	Dust Loaded (n=12) (PFU total)	Non Soiled (n=6) (PFU total)	
1	4.50E+02	1.28E+03	1.75E+08
2	7.45E+02	2.19E+03	3.26E+08
3	8.65E+02	2.78E+03	3.73E+08
Total	2.06E+03	6.25E+03	8.74E+08
Average	6.87E+02	2.08E+03	2.91E+08
Avg. Log red.	5.66	5.25	N / A

*Method Detection Level: 1.83 PFU

C) Intial Δp + 75% Δp (Tests IDs M07-0462 & M07-0463)

Sampling time (h)	TSH composite with Triosyn		Positive Control (n=2) (PFU total)
	Dust Loaded (n=12) (PFU total)	Non Soiled (n=6) (PFU total)	
1	3.68E+02	1.25E+03	1.39E+08
2	5.21E+02	1.25E+03	2.63E+08
3	6.52E+02	1.23E+03	2.68E+08
Total	1.54E+03	3.73E+03	6.70E+08
Average	5.14E+02	1.24E+03	2.23E+08
Avg. Log red.	5.71	5.28	N / A

*Method Detection Level: 1.83 PFU

D) Intial Δp + 100% Δp (Tests IDs M07-0466 & M07-0467)

Sampling time (h)	TSH composite with Triosyn		Positive Control (n=2) (PFU total)
	Dust Loaded (n=12) (PFU total)	Non Soiled (n=6) (PFU total)	
1	3.87E+02	5.98E+02	1.24E+08
2	9.42E+02	9.34E+02	2.29E+08
3	6.65E+02	2.08E+03	4.34E+08
Total	1.99E+03	3.61E+03	7.86E+08
Average	6.65E+02	1.20E+03	2.62E+08
Avg. Log red.	5.57	5.39	N / A

*Method Detection Level: 1.83 PFU

Legend:

TSH composite with Triosyn: 12.57 cm^2 of 20 meltblown media containing 10 g/m2 of Triosyn T50 (10µm) & HEPA grade glass fiber media containing 50 g/m^2 of Triosyn T50 (200-400µm) & 100 g/m^2 carbon media

DUST Loaded: 12.57 cm2 of TSH composite with Triosyn were loaded with Dust until 25, 50, 75 & 100% Δp was obtained.

The VFE results for all levels of dust loading were similar for the soiled and non soiled composite (Figure 3.3) suggesting that dust loading does not significantly affect the microbial filtration efficiency of the Triosynated TSH composite media. Average log reduction of the dust loaded samples varied from 5.57 to 5.80 while the non soiled samples average log reductions showed even less fluctuation (5.25 to 5.39 log). The dust loaded to 25% Δp composite (Table 3.5A) showed the lowest penetration levels, but these tests also had the lowest MS2 challenge with an average of 10^7 PFU compared to the other dust loading levels which displayed an average challenge of 10^8 PFU (see Tables 3.5B, 3.5C, 3.5D). Since an increased pressure drop usually increases filtration efficiency, the slightly higher VFE of the dust loaded TSH composite with Triosyn (at all loading levels) is expected.

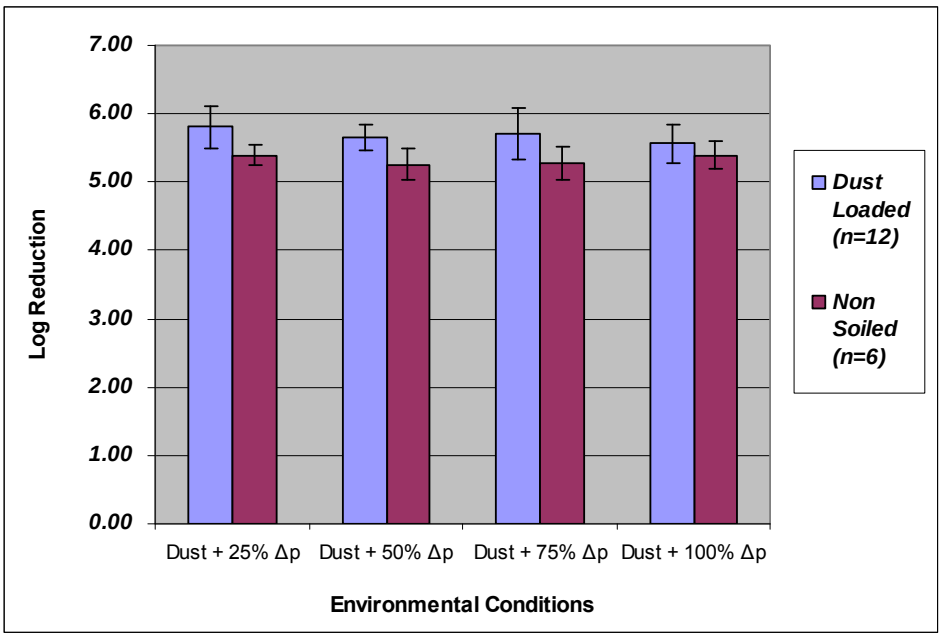


FIGURE 3.3: COMPARING THE VFE OF THE TRIOSYNATED TSH COMPOSITE WITH AND WITHOUT DUST LOADING AT DIFFERENT LOADING LEVELS AGAINST MS2 COLIPHAGE AT 4.0 LPM FOR 3 HOURS (M07-0452, M07-0453, M07-0459, M07-0460, M07-0462, M07-0463, M07-0466, M07-0467)

3.2.4 MFE TESTING AGAINST BACTERIAL AND BACTERIAL SPORE REPRESENTATIVES AT STANDARD CONDITIONS

Microbial Filtration Efficiency (MFE) of the TSH composite media with and without Triosyn was evaluated against *Staphylococcus aureus* and *Bacillus atrophaeus* (BG) spores. Flat swatches of 100 cm^2 were subjected to air filtration of the bioaerosol at a flow rate of 31.8 LPM under ambient conditions. Results are presented in Table 3.6.

TABLE 3.6: MICROBIAL FILTRATION EFFICIENCY (MFE) OF THE TSH COMPOSITE MEDIA WITH AND WITHOUT TRIOSYN AT 31.8 LPM FOR 3 HOURS (M07-0440, M07-0450)

A) *Staphylococcus aureus* (Test ID M07-0440)

Sampling time (h)	TSH composite with Triosyn (n=6) (CFU total)	TSH composite Blank (n=3) (CFU total)	Positive Control (n=1) (CFU total)
1	<2.00E+00	<2.00E+00	3.20E+07
2	<2.00E+00	<2.00E+00	3.40E+07
3	<2.00E+00	<2.00E+00	2.05E+07
Total	<2.00E+00	<2.00E+00	8.65E+07
Average	<2.00E+00	<2.00E+00	2.88E+07
Avg. Log red.	>7.43	>7.42	N / A

*Method Detection Level: 2 CFU

B) *Bacillus atrophaeus* (BG) spores (Test ID M07-0450)

Sampling time (h)	TSH composite with Triosyn (n=6) (CFU total)	TSH composite Blank (n=3) (CFU total)	Positive Control (n=1) (CFU total)
1	<2.00E+00	<2.00E+00	1.75E+06
2	<2.00E+00	<2.00E+00	7.50E+05
3	<2.00E+00	<2.00E+00	7.50E+05
Total	<2.00E+00	<2.00E+00	3.25E+06
Average	<2.00E+00	<2.00E+00	1.08E+06
Avg. Log red.	>6.00	>6.00	N / A

*Method Detection Level: 2 CFU

NOTE: *Calculations were made using the assumption that BDL values corresponded to half the value of the detection limit.*

Legend:

TSH composite with Triosyn: 100 cm^2 of 20 meltblown media containing 10 g/m2 of Triosyn T50 (10µm) & HEPA grade glass fiber media containing 50 g/m^2 of Triosyn T50 (200-400µm) & 100 g/m^2 carbon media

TSH composite Blank: 100 cm^2 of Blank 20 meltblown media & Blank HEPA grade galss fiber media & 100 g/m^2 carbon media

As shown in Table 3.6, the TSH composite media, with or without Triosyn, reduced both the vegetative bacterial and bacterial spore challenges to below detectable levels of penetration at each sampling point, translating to an excess 7.4 log reduction against *Staphylococcus aureus* (Table 3.6A) and an excess 6.0 log reduction against *Bacillus atrophaeus* spores (Table 3.6B). The lower MFE values displayed against BG spores were limited by the smaller challenge size averaging 10^6 CFU, as opposed to the 10^7 CFU average challenge size obtained with *S. aureus*. That no penetration was detected with both vegetative bacteria and bacterial spores is not surprising given the relative large size of these microbes and that a composite with high particulate filtration capacity coupled with electrostatic charges was used.

3.2.5 VFE TESTING AGAINST AN ANIMAL VIRUS REPRESENTATIVE AT STANDARD CONDITIONS

The VFE of the TSH composite with and without Triosyn was evaluated against Influenza virus. Flat swatches of 12.57 cm^2 were subjected to air filtration of the bioaerosol at a flow rate of 4.0 LPM under ambient conditions. Results are presented in Table 3.7.

Against the animal virus model, the TSH composite media yielded identical results with or without addition of Triosyn, reducing the influenza A challenge to below detectable levels of penetration at each sampling point, which translates to an excess 4.75 log reduction. The inferior VFE values displayed by the composite against influenza virus are due to the limitations of this virus model: (i) difficulty in achieving high titers so as to allow challenge levels similar to MS2 coliphage, and (ii) a higher detection level that MS2 coliphage.

TABLE 3.7: VFE OF THE TSH COMPOSITE MEDIA WITH AND WITHOUT TRIOSYN AGAINST INFLUENZA VIRUS AT 4.0 LPM FOR 3 HOURS (V07-0030, V07-0032)

Sampling time (h)	TSH composite with Triosyn (n=6) (PFU total)	TSH composite Blank (n=6) (PFU total)	Positive Control (n=2) (PFU total)
1	<2.22E+01	<2.22E+01	1.90E+05
2	<2.22E+01	<2.22E+01	4.80E+05
3	<2.22E+01	<2.22E+01	9.19E+06
Total	<2.22E+01	<2.22E+01	9.86E+06
Average	<2.22E+01	<2.22E+01	3.29E+06
Avg. Log red.	>4.81	>4.75	N / A

*Method Detection Level: 22.2 PFU

NOTE: *Calculations were made using the assumption that BDL values corresponded to half the value of the detection limit.*

Legend:

TSH composite with Triosyn: 12.57 cm^2 of 20 meltblown media containing 10 g/m2 of Triosyn T50 (10µm) & HEPA grade glass fiber media containing 50 g/m^2 of Triosyn T50 (200-400µm) & 100 g/m^2 carbon media

TSH composite Blank: 12.57 cm^2 of Blank 20 meltblown media & Blank HEPA grade galss fiber media & 100 g/m^2 carbon media

3.2.6 SELF-DECONTAMINATION PROPERTIES

The ability of the TSH composite to devitalize microorganisms was evaluated against viral, bacterial, bacterial spores, and fungal spores representatives. Triosynated and blank samples of the composite media were tested according to the self-decontamination procedure described in section 3.1.9 for contact periods extending to 24 hours. Results are presented in Tables 3.8 and 3.9.

TABLE 3.8: EVALUATION OF THE SELF-DECONTAMINATION ABILITY OF THE TSH COMPOSITE MEDIA WITH AND WITHOUT TRIOSYN AGASINT BACTERIAL, BACTERIAL SPORES AND FUNGAL SPORES REPRESENTATIVES FOR VARIOUS CONTACT PERIODS (M07-0455, M07-0465, M07-0433, M07-0472, M07-0451, M07-0464)

A) *Staphylococcus aureus* (Tests IDs M07-0455, M07-0465)

Contact time (min)	TSH Composite with Triosyn (n=6)		TSH Composite Blank (n=6)	
	Recovered (CFU total)	Reduction (%)	Recovered (CFU total)	Reduction (%)
0	2.41E+05	64.31%	6.74E+05	N / A
15	3.20E+03	99.53%	1.42E+05	79.00%
30	1.94E+01	99.997%	2.93E+05	56.49%
60	BDL*	>99.998%	8.88E+04	86.82%
24 hours	BDL*	>99.998%	BDL*	>99.996%

*BDL = Below Detection Limit = <25 CFU for Blank samples; <16.7 CFU for samples with Triosyn

B) *Bacillus atrophaeus* (BG) spores (Tests IDs M07-0433, M07-0472)

Contact time (min)	TSH Composite with Triosyn (n=6)		TSH Composite Blank (n=6)	
	Recovered (CFU total)	Reduction (%)	Recovered (CFU total)	Reduction (%)
0	7.89E+06	0.00%	5.03E+06	N / A
24 hours	7.57E+05	84.96%	8.38E+05	83.35%

*BDL = Below Detection Limit = <50 CFU

C) *Aspergillus niger* spores (Tests IDs M07-0451, M07-0464)

Contact time (min)	TSH Composite with Triosyn (n=6)		TSH Composite Blank (n=6)	
	Recovered (CFU total)	Reduction (%)	Recovered (CFU total)	Reduction (%)
0	3.02E+05	8.38%	3.30E+05	N / A
24 hours	BDL*	>99.98%	7.12E+04	78.43%

*BDL = Below Detection Limit = <50 CFU

Legend:

TSH composite with Triosyn: 1" X 1" square of: 20 meltblown media containing 10g/m^2 of Triosyn T50 (10µm) & HEPA grade glass fiber media containing 50 g/m^2 of Triosyn T50 (200-400µm)

TSH composite Blank: 1" X 1" square of: Blank 20 meltblown media & Blank HEPA grade glass fiber media

The addition of Triosyn to the TSH composite media enhanced its self-decontamination properties against vegetative bacteria and fungal spores. The Triosynated composite was able to reduce the 10^5 CFU initial challenge to below detectable levels of *Staphylococcus aureus* after only 60 minutes (Table 3.8A), while 24 hours was sufficient for the *Aspergillus niger* spores challenge to be completely devitalized (Table 3.8C). In both cases, 10^4 CFU were still present on the blank TSH composite at said contact times. The BDL value observed after 24 hours for the blank composite against vegetative bacteria is imputable to the natural decay of *S. aureus*. Bacterial spores are known to be more resistant to antimicrobial and disinfectants, and *Bacillus atrophaeus* spores resistance to iodine explains the Triosyn containing TSH composite media weak devitalization of BG spores (Table 3.8B). After 24 hours of contact, the 10^5 CFU challenge was reduced to 10^5 CFU by both the Triosynated composite and its blank counterpart.

In all tests performed to assess self-decontamination properties of the TSH composite media, the HEPA grade glass fiber layer, with or without Triosyn, disintegrated into a pulp state when recovered in the neutralizing buffer. Although this did not affect the previously mentioned microorganisms, it seems to have interfered with the recuperation of MS2 coliphage, thus yielding inconclusive results (data not shown, complete microbiological results are included in Annex 8). Given that microbes being filtered through the TSH composite in a final device would first encounter the meltblown layer, it was decided to inoculate the MS2 coliphage challenge only on the meltblown layer in an attempt to circumvent the technical problems. The results obtained in such a fashion may under-represent the actual antiviral performance. We assessed the ability of this membrane, with and without Triosyn, at devitalizing the viral representative; results of this test are presented in Table 3.9.

TABLE 3.9: EVALUATION OF THE SELF-DECONTAMINATION ABILITY OF THE MELTBLOWN LAYER OF THE TSH COMPOSITE MEDIA WITH AND WITHOUT ADDITION OF TRIOSYN AGAINST MS2 COLIPHAGE FOR VARIOUS CONTACT PERIODS (M07-0483, M07-0495)

Contact time (min)	20 meltblown with Triosyn (n=6)		Blank 20 meltblown (n=6)	
	Recovered (PFU total)	Reduction (%)	Recovered (PFU total)	Reduction (%)
0	6.56E+05	79.29%	3.17E+06	N / A
15	2.75E+01	99.9991%	9.77E+04	96.92%
30	6.67E+00	99.9998%	2.62E+03	99.92%
60	1.05E+01	99.9997%	4.59E+03	99.86%
24 hours	BDL*	>99.9999%	BDL*	>99.9997%

*BDL = Below Detection Limit = <10 PFU for Blank samples; <3.33 PFU for samples with Triosyn

Legend:
20 meltblown with Triosyn: 1" X 1" square of: 20 meltblown media containing 10g/m^2 of Triosyn T50 (10µm)
Blank 20 meltblown: 1" X 1" square of: Blank 20 meltblown media

The Triosynated meltblown media consistently outperformed the blank membrane at all contact periods tested, reducing the 10^5 PFU MS2 coliphage challenge to 10^1 PFU after only 15 minutes of contact. The BDL value observed after 24 hours for the blank membrane is attributable to the natural die-off of the virus under the test conditions used.

3.2.7 LONGEVITY TESTING: VFE OVER TIME AT TYPICAL FACE VELOCITIES FOR COLLECTIVE / HVAC APPLICATIONS

Performance of the Triosynated glass fiber HEPA, alone or together with a Triosynated meltblown layer (the latter being know as the TSH composite media), was investigated under longevity conditions. Four 7.5" x 7.5" pleated filters were prepared and tested in independent ducts, allowing for the simultaneous evaluation of 3 different filter configurations against aerosolized MS2 coliphage. The primary goal of this experiment was to examine the microbial and toxicological performance of the filters under longevity conditions (please refer to Toxicology section of this report for toxicological performance). This test was performed at 20 CFM which corresponds to a face velocity typical of HVAC systems.

Testing was terminated after 538 days; results are summarized in Table 3.10 below and illustrated in Figure 3.4.

Two of the four filters were composed of Triosynated 20 meltblown together with Triosyn Super HEPA media (Filter 1), one filter contained only the Triosyn Super HEPA media (Filter 2), and the last filter was composed of blank 20 meltblown together with blank HEPA media (Filter 3) which served as the control. Each of the four filters was subjected to a challenge size of approximately 10^8 total PFU per sampling. The blank control (Filter 3) allowed an average penetration of approximately 10^5 total PFU per sampling, representing a reduction of approximately 3 log. The filter composed of Triosyn Super HEPA media alone (Filter 2) allowed an average penetration of approximately 10^3 total PFU per sampling, representing a reduction of approximately 5 log. The two filters composed of Triosynated 20 meltblown together with Triosyn Super HEPA (Filter 1) also allowed an average penetration of 10^3 total PFU per sampling, representing a reduction of approximately 5 log. Therefore, regarding the filter composed of 20 meltblown together with blank HEPA media (Filter 3), the Triosynated filter (Filter 1) provides approximately 2 log better reduction of the viral challenge than the non-Triosynated filter (Filter 3) even after an extended period of constant filtration. It is important to mention that this performance was consistently maintained over the course of the entire testing period.

TABLE 3.10: AVERAGE PERFORMANCE OF 7.5" X 7.5" PROTOTYPE FILTERS CONTAINING HEPA GRADE GLASS FIBER MEDIA WITH AND WITHOUT TRIOSYN AGAINST MS2 COLIPHAGE AT 20 CFM AFTER 538 CONTINUOUS DAYS OF FILTRATION (M05-0649)

	Filter 1 (n=2)		***Filter 2 (n=1)***		***Filter 3 (n=1)***	
	20 meltblown Triosynated HEPA Triosynated		**Without 20 meltblown HEPA Triosynated**		**20 meltblown Blank HEPA Blank**	
	Triosyn Filter (PFU total)	**Positive Control** (PFU total)	**Triosyn Filter** (PFU total)	**Positive Control** (PFU total)	**Blank Filter** (PFU total)	**Positive Control** (PFU total)
Average Penetration:	3.22E+03	1.38E+08	5.71E+03	1.60E+08	2.10E+05	1.26E+08
Average Log Reduction:	5.02 ± 0.70		4.64 ± 0.66		3.33 ± 0.72	

Legend:

Filter 1: 0,5 m^2 Pleated Filter: Flat 50 g/m^2 carbon media & [Pleated 20 meltblown media containing 10g/m^2 of Triosyn T50 (10µm) & Glass Fiber media containing 50 g/m^2 of Triosyn T50 (200-400µm)] & 2-ply Flat 100 g/m^2 carbon media

Filter 2: 0,5 m^2 Pleated Filter: Flat 50 g/m^2 carbon media & [Pleated Glass Fiber media containing 50 g/m^2 of Triosyn T50 (200-400µm)] & 2-ply Flat 100 g/m^2 carbon media

Filter 3: 0,5 m^2 Pleated Filter: Flat 50 g/m^2 carbon media & (Pleated Blank 20 meltblown media & Blank Glass Fiber media) & 2-ply Flat 100 g/m^2 carbon media

The data summarized in Table 3.10 is also graphically illustrated in Figures 3.4A and 3.4B below. The raw data expressed as log reduction of the MS2 coliphage challenge is depicted in Figure 3.4A. Each data point is plotted in the graph to give a visual representation of the trend in longevity performance curves obtained with each of the three filter types. The trends become clearer in Figure 3.4B in which the best-fit curves are shown. This graph indicates that the added benefit of Triosyn is nearly 2 logs even after nearly 18 months (538 days) of continuous filtration (Filter 1 compared to Filter 3).

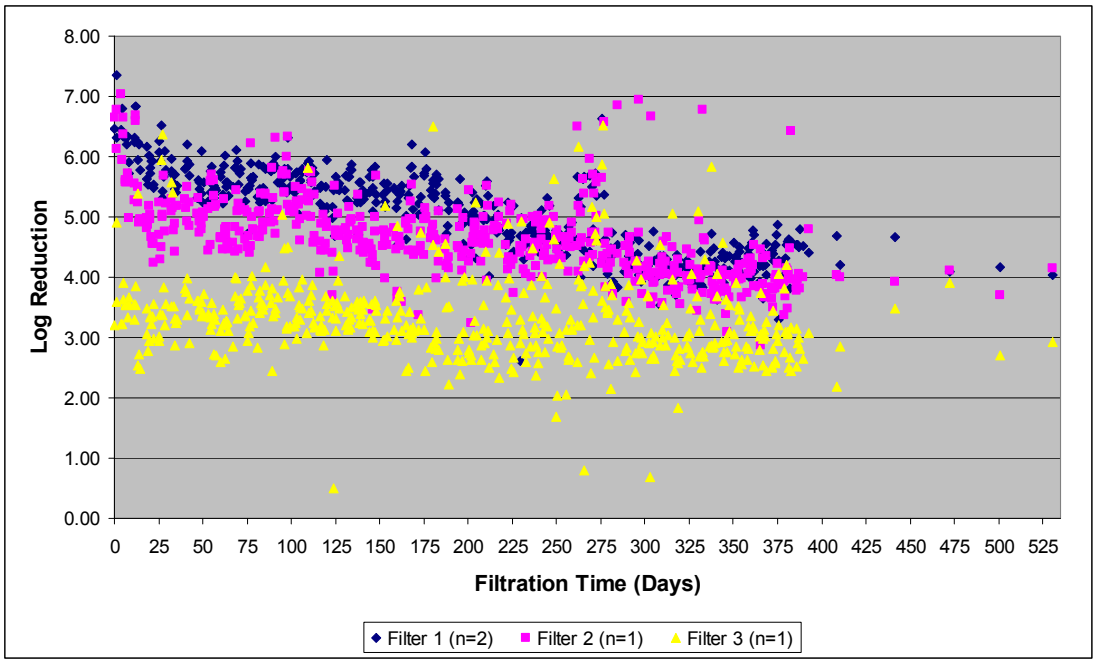


FIGURE 3.4-A: LONGEVITY STUDY RAW DATA: VIRAL LOG REDUCTION OF PROTOTYPE COLLECTIVE PROTECTION FILTERS CONTAINING TRIOSYN SUPER HEPA MEMBRANES

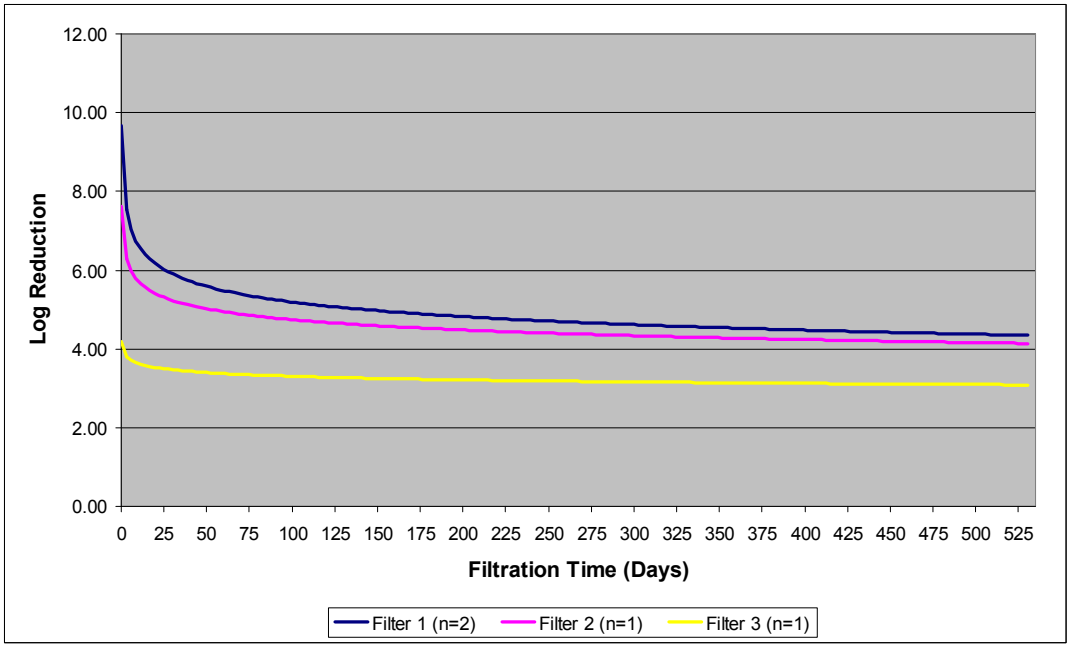


FIGURE 3.4-B: LONGEVITY STUDY TREND LINES: VIRAL LOG REDUCTION OF PROTOTYPE COLLECTIVE PROTECTION FILTERS CONTAINING TRIOSYN SUPER HEPA MEMBRANES

4. PROJECT DEVELOPMENT: CHEMISTRY / TOXICOLOGY

Air Filtration Membranes under development were subjected to chemical and toxicological testing in order to broaden the investigated technology of associating an iodinated polymer to air filtration media to include the characterization of the iodine being liberated. Using a High Pressure Liquid Chromatography (HPLC) instrument with a pulsed electrochemical detector, the chemical content in the effluent was evaluated by measuring iodide and determining the iodine content following the OSHA standard protocol #ID-212. The limit of detection with the electrochemical detector for iodine was determined to be 1.6 x 10^{-3} mg/m^3 iodine (0.0010 ppm I^-). The ultimate goal is to compare the concentrations detected using these methods to existing federal standards in order to establish the safety of the application under development.

Apart from performing toxicological testing to characterize the levels of iodine released from the different Triosynated materials, chemical surrogate analysis was also performed to determine the chemical protection capability of the air filtration membranes under development. This involved the analysis of breakdown chemicals on the Triosynated Super Hepa media and carbon for canister prototypes.

4.1. METHODS

4.1.1 PRINCIPLE

A rigorous testing procedure of the Air Filtration Membrane (AFM) is performed to determine the amount of iodine that is liberated from various Air Filtration Media and devices under development. AFMs are tested at a specified flow rate which is dependant on the surface area of the membrane. Testing conditions might be adjusted to simulate different environmental conditions and a few different face velocities applicable to various end-use applications. As mentioned, the air testing set-up and procedure is based on the OSHA #ID-212 standard protocol[1].

Flury and Zernik[2] reported that humans may work undisturbed at iodine concentrations of 0.1ppm. Based on the reported no-effect, a concentration in humans for ocular and respiratory tract irritation is set at 0.1ppm (1.036 mg/m^3). A TLV-Ceiling limit of 0.1ppm is recommended by the American Conference of Governmental Industrial Hygienist. This limit should minimize the potential for ocular irritation or other adverse health effects attributable to occupational exposure to the non-radioactive forms of iodine.

The TLV for iodine has varied in history as follows:

1948-1955: TLV-TWA, 1ppm

1956-1962: TLV-TWA, 0.1ppm

1963-present: TLV-Ceiling, 0.1ppm

[1] Occupational Safety and Health Administration (OSHA). 1994. *Iodine in Workplace Atmospheres ID#212*
[2] Flury, F. and Zernik, F., Schadliche Gase. Berlin Julius Springer, 1931.

4.1.2 ANALYSIS METHOD

A High Pressure Liquid Chromatograph with a pulsed electrochemical detector containing a non-disposable silver working electrode and silver/silver chloride reference electrode was used to detect iodide from the samples. The iodine concentration was then calculated as described in Annex 5.4.

The method and program used to detect iodide was recently modified in order to reduce the detection limit. It has been reduced to 0.0010 ppm iodide (1.6×10^{-3} mg/m^3 Iodine). This detection limit is not reflected in all of the data presented.

The HPLC method used was developed by the Dionex Corporation[1] a number of years ago and validated by Triosyn Research. The eluent is composed of 62.5 mM sodium hydroxide (4 pressurized eluent bottles) previously vacuum filtered on 0.2 μm nylon filters. The high purity water is degassed prior to preparing the basic solution. It is important not to shake in any way after the solutions have been prepared. The samples are analyzed at ambient temperature at a flow rate of 1.5 mL/min with a run time of 5 minutes. An IonPac AS11 Guard column is used in line with an IonPac AS11 Column. The injection volume is 100 μL and the peak retention time is approximately 2.4 minutes for iodide. The sample analysis is based on the injection of potassium iodide standards using a quadratic equation and the peak areas to obtain the standard curve.

The standards that are regularly made are 0.0015, 0.0050, 0.0100, 0.0300, 0.0500, 0.0750, 0.1000, 1.000 and 1.250 ppm potassium iodide in the trapping media (1.5 mM $NaHCO_3/Na_2CO_3$). These are made in 100mL volumetric flasks, from a 1 L 100 ppm potassium iodide stock solution in high purity water. It is helpful to make the 3 lowest standards in a 1.00 L volume for better reproducibility. A standard containing no iodide must also be prepared. Thus, the trapping media alone is considered as a 0 ppm standard. The standards are stable at room temperature for 29 days with minimal losses.

The need to have such a low detection limit is driven by the low levels of iodine measured during toxicological tests. Due to the low limit, the HPLC instrument must be continuously monitored for any loss of sensitivity and kept in its optimal condition. The column and the working electrode figure prominently in this procedure.

Columns are swapped on a monthly basis. The column replacement helps to eliminate peak broadening. When a column is changed, it is important to start a new sequence with 3 standard curves as well as repeat injections of each standard (2 vials of each standard injected 3 times each). This is a means to monitor stability and reproducibility. Columns that are not in use are stored in 100 mM sodium hydroxide and allowed to regenerate until needed. When a column that has been regenerated no longer provides satisfactory results, it should be disposed of. The general lifetime per column is roughly 6 months when working at its optimal capacity. When the sensitivity of the system drops below the detection limit, this is an indication that the working electrode is in need of polishing. Baseline noise is sometimes also indicative of the need to polish the electrode. The electrode is polished following the basic Dionex procedure using a fine polishing powder and pads provided by Dionex. To polish the electrode, it is necessary to dismantle the cell and remove the working electrode. On the polishing pad a paste is made using the fine polishing powder and some high purity water. In a “figure 8” motion the electrode is polished until satisfied that no discoloration remains on the silver electrode. It is rinsed with water, patted dry. The process is repeated on a dry pad with no powder. The electrode is re-installed and allowed to equilibrate 8-12 hours before injecting any samples.

[1]Dionex Document No. 065040-02 Disposable Electrodes, section 9: Iodide, Thiosulfate, and Thiocyanate using a silver electrode 25-27.

As noted above this procedure has been successful in the determination of very low concentrations of iodine and is relatively easy to maintain. These means can be met by proper maintenance and a keen sense of the life-span of the consumable parts with prompt replacement as necessary.

4.1.3 FLOW RATE

The flow rate through the test article varied depending on the objective of the specific tests. Using the surface area of the test article, the flow rates were determined based on Face Velocity, which is calculated using the following equation:

$$\text{Face Velocity} = \frac{\text{CFM } (ft^3)/\text{min}}{\text{Test Area}}$$

4.1.4 CHALLENGE FILTRATION

According to the intended use, swatches of air filtration materials were subjected to continuous challenge filtration for various periods of time. Sampling was done with small impingers that were filled with 10mL solution of 1.5 mM sodium carbonate and sodium bicarbonate, also termed trapping media. The recommended bubbling period was for 15 minutes.

The filters used in the collective protection testing were subjected to two challenge filtrations per day. In this case, sampling was also performed with small impingers that were filled with 10mL solution of the trapping media.

4.1.5 CHALLENGE PROCEDURE AND SETUP FOR AIR FILTRATION TESTING

Iodine Validation of Toxicology Set-up

The toxicology set-up, along with the vacuum system and flow meters, must be checked on a yearly basis to validate all ports of the air set up. The procedure utilizes a cartridge filled with a known amount of iodine beads which is subjected to a flow rate of 4.3 LPM for four hours. In principle, the iodine validation also follows the OSHA ID-212 standard protocol where the iodine concentration is measured using a carbonate/bicarbonate trapping solution. Using the iodine weight from the air stream concentration at 0.5LPM and calculating the weight of iodine that is in the rest of the flow, the weight of iodine lost from the beads over time is determined and compared to what was initially put into the system. If the amounts balance out, it is then confirmed that the air set up is working properly. Details of the challenge procedure and set-up for iodine validation are described in Annex 5, section 11.1.

The challenge procedure and set-up for collective protection devices is detailed in Annex 5, section 11.4.

The equations used for calculating the amount of iodine released from the Triosynated air filtration membranes are outlined in Annex 5, section 11.5.

4.1.6 VALIDATION TESTING OF TRIOSYN SUPER HEPA

As reported previously, in early June, Triosyn Super HEPA media was produced at the Lydall Facility with the goal of making a media with a polyester binder to enhance its pleatability. In most recent months a final Triosyn material was decided upon for various end use applications. The final media stack is composed of 20-XP Meltblown media containing 10gsm of Triosyn, a HEPA produced at Lydall in October 2005 with 50gsm Triosyn present with particle size from 200-400um, and a carbon backing composed of 100gsm KJ carbon. The interest is to make a canister. or other individual protection applications, using this stack thereby imparting an additional microbial protection.

More specifically, 100cm^2 swatches of the above stack will be tested for 3 hour air filtration tests at various environmental conditions. The iodine content in the effluent will be determined and results analyzed upon exposure to different environmental conditions with and without the presence of the carbon backer.

TABLE 4.1: ENVIRONMENTAL CONDITIONS TO BE TESTED

Temperature (°C ; ± 3°C)	Humidity (% ± 15%)
5	75
20	50
30	30
30	85

The effect of soil loading agents on the complete stack will also be investigated under ambient environmental conditions. The stacks will be loaded with DOP, dust or smoke and then the air filtration tests will be performed on the loaded 100cm^2 media swatches with the carbon backer. The dust loaded samples are loaded to obtain pressure drops that are 25, 50, 75 and 100% more than a non-loaded sample.

TABLE 4.2: SOIL LOADING AGENTS TO BE LOADED ONTO THE FINAL TRIOSYN MEDIA

Soil Loading Agent	Concentration
DOP	23mg per swatch
Dust	Δp + 25
	Δp + 50
	Δp + 75
	Δp + 100
Smoke	Smoke from 1 cigarette per swatch

These efforts will demonstrate if environmental changes or soiling affect the iodine released by the media in any way.

4.1.7 ALTERNATIVE U.S. CARBON SUPPLIERS

Triosyn Corp is presently seeking alternative suppliers for approximately 100g/m^2 carbon for possible future applications in the production of Triosyn respirators. Once a carbon supplier is located and contacted, samples of 100g/m^2 carbon (coconut and/or coal base) produced by the manufacturers are sent to Triosyn Corp for Quality Control testing. Each supplier is sorted by technology and technique used in their carbon production, as well as their performance.

Triosyn Corp requests that each supplier produces a carbon media of 100g/m^2 in carbon concentration, containing carbon granules of 30x60 coconut mesh size or similar. Also, the carbon supplier must also be ISO 9001-2000 certified or presently be in the process of becoming certified.

The carbon media produced by all carbon suppliers is ultimately tested for total performance at Triosyn Corp, where a series of in-house QC tests are performed to verify the quality of the new carbon roll. The QC tests performed on the carbon samples by the Engineering department include pressure drop, weight and thickness measurements and the QC test performed by the Toxicology department is toxicology air testing for carbon adsorption capacity over a period of use for the facemasks. They also must be tested under the most extreme conditions (high humidity). The specifications for each test are illustrated below in Table 4.3.

TABLE 4.3: SPECIFICATIONS FOR QC TESTING OF 100GSM CARBON

QC Test Responsible	QC Test	Number of Test Samples	Sample Surface Area	Specifications
Engineering	Pressure Drop	n=1	100cm^2	Acceptable Range: 0.8 - 2.8 mm H_2O
	Weight	n=3	12.57cm^2	Acceptable Range: 0.2787 - 0.4415 g
	Thickness	n=3	12.57cm^2	Acceptable Range: 1.23 – 1.37mm
Toxicology	Air Testing	n=3	100cm^2	Acceptable Range: ≤ 750µg Iodine for 8 hours

Additional QC tests performed on the carbon samples include inspecting the malleability and texture of the carbon layer to examine the flexibility of the carbon, as well as verifying the distribution of carbon granules throughout the media layer to see if the dispersion is uniform.

Significantly, the pressure drop test and toxicology air test are the two essential tests that ultimately determine the fate of the carbon sample. The pressure drop is defined as the pressure of air built up in the carbon media, where a 100cm^2 carbon sample is challenged with an air flow of 85LPM for this analysis. For an acceptable pressure drop, the carbon should fall within the range of 0.8-2.8mm H_2O, as shown in Table 4.3.

Furthermore, the toxicological air testing is performed by stacking the new carbon sample with a Triosyn media sandwich (35-ZPN blank/20-XP with Triosyn/35-ZPN blank), similar to the stacking found in a Triosyn facemask. Importantly, the toxicology air test verifies the carbon adsorption capacity for Iodine when placed with a fresh Triosynated layer. The effective surface area of the test sample is 100cm^2, where air passes through the stack for 8 hours at a flow rate of 42.7LPM. Sample collections are made every 15 minutes and the trapping solution is 1.5mM sodium carbonate/bicarbonate. Sample collections are injected into the HPLC to measure the Iodide content; the Iodine concentration (in

mg/m^3) is then calculated and is used to determine the dietary intake (in mg) for 8 hours. For an acceptable dietary intake result, the air testing result should not exceed 750µg of Iodine for 8 hours, as shown in Table 4.3.

If criteria are met for both pressure drop and toxicology air testing for a specific carbon, then this sample will be considered for future use in other applications.

During this period, various carbon media have been received from AQF and Lantor manufacturers. Quality control testing results of these carbons are presented and discussed in the section 4.2.6 below.

4.1.8 CHEMICAL SURROGATE TESTING

Chemical testing of media samples (carbon and Triosynated composites) is primarily performed to evaluate their capability to break down specific agents thus offering chemical protection against these agents. Since testing with real chemical warfare agents is restricted, surrogate chemicals are used as acceptable alternatives. These surrogate chemicals have similar physical properties as the real agent, but are not as toxic. For example, relevant chemical surrogates used in lieu of Sarin (GB) include dimethyl methylphosphonate (DMMP) and Demeton-O.

Chemical surrogate testing is performed according to test parameters outlined in the military standard MIL-PFR-51560C. This standard details the minimum physical and chemical testing requirements that canister prototypes have to meet prior to their approval for use.

4.1.8.1 CHEMICAL SURROGATE TESTING SET UP

Analysis of chemical vapour challenges is performed using the MINICAM gas chromatography (GC) set up. Initial steps consist of manually injecting calibration standards at different concentrations into the MINICAM GC to produce a calibration curve. This calibration curve is used to read any results that are generated by the samples being tested.

To set up the system for vapour generation, a 100mL glass syringe (fitted with a luer lock) is filled with the chemical surrogate and locked in place on the infusion pump. A 21” gauge needle is fitted onto the luer lock and the tip inserted into a silicone plug into one of the inlets of the glass vapour cell (housed in a heating mantle) containing Pyrex boiling beads to ensure uniformity of the heating and generation of the agent vapour. The vapour cell is then connected to a static mixer/manifold used to produce a uniform vapour for the tested samples. The manifold has 5 exit ports. Four ports are for Teflon lines to supply samples with the generated vapours, while the last exit port is for a bypass flow line use whenever the vapour flow is not subjected to the samples. The flow rate for the bypass flow line is equal to the sum of the flow rates of the samples. All sample and bypass flow rates are measured by a digital mass flow meter prior to testing. Post test measurements are also performed to confirm the maintenance of the flow rate.

Each sample holder inlet is connected by Teflon tubing from the static mixer/manifold. The sample holder outlet has Teflon tubing leading to a T-connector. The side outlet of the T-connector has a 1/8” line that leads off to the MINICAM system for analysis. Sample flow rate is at 100 LPM for analysis. The other outlet of the T-connector leads to a carbon filter cartridge to remove any surrogate chemicals in the outgoing air stream.

The vacuum pump is turned on to start the air flow through the system (bypass mode). At this point, sample filter holders are put into place and all flows (samples and bypass) are measured and adjusted, if necessary. Once the flow rates have been measured, the heating mantle is activated to warm the vapour cell. Once the boiling beads have heated approximately 20ºC past the boiling point of the surrogate chemical, the surrogate agent injection is turned on so that a vapour can be produced. A 1/8" Teflon line from the static mixer/manifold is connected to the Low Volume Sampler (LVS) to measure the vapour concentration generated. When the appropriate vapour concentration is reached, the bypass flow mode is switched to the sample flow mode to initiate sample testing. Data capturing is done by the MINICAM GC with results reported. Figure 1 depicts the glove box set up for surrogate testing.

Once the test is completed (when breakthrough is reached), sample flow mode is switched to bypass mode to stop the vapour flow through the samples. The vacuum pump is turned off which in turn deactivates the agent injection and heating mantle. Venting of the glove box is done to decontaminate the testing area of any chemicals that may still be present in the box.

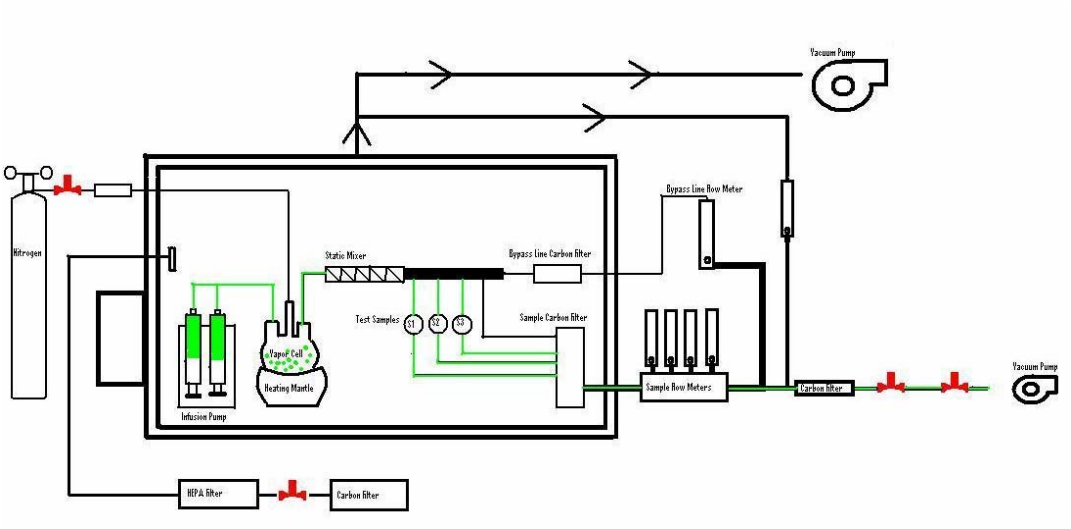


FIGURE 4.1: SURROGATE LAB GLOVE BOX SET UP

4.2 RESULTS

4.2.1 IODINE VALIDATION OF TOXICOLOGY SET-UP

The criterion indicative of a well-functioning and consistent air filtration testing set-up is represented by a minimum iodine percent recovery of 85%. Thus, it is important to validate the air testing system periodically to verify if it meets this criterion.

During the iodine validation process that took place this year, some technical difficulties, such as a broken digital flow meter, as well as large amounts of air filtration testing for other purposes prevented the validation from occurring in a timely manner. This resulted in delays; however, all ports have subsequently been validated.

The ports that had been validated in the first quarter of 2007 were re-tested once more such that validations will not be necessary until June of 2008.

The updated results are displayed in Table 4.4. All ports passed the minimum 85% recovery criterion, indicating that the toxicology set-up is functioning in a reliable and consistent manner.

TABLE 4.4: RESULTS OF TEST FOR VALIDATION OF TOXICOLOGY LABORATORY

Port Number	Initial Amount Iodine Solid (g)	Amount Iodine & Iodate (g) (HPLC Analysis)	Weight Lost (g) (Initial - Titrated)	% Recovery
1	4.51	3.14	3.34	93.9
1 re-test	4.51	2.35	2.53	93.0
2	4.50	3.06	3.56	85.9
3	4.51	2.88	3.39	85.0
4	4.54	2.91	3.28	88.7
4 re-test	4.50	3.2	3.3	96.9
5	4.50	3.20	3.44	92.9
6	4.55	2.96	3.26	90.7
6 re-test	4.53	3.09	3.43	90.0
7	4.52	2.69	2.63	100
8	4.52	2.49	2.54	97.9
9	4.50	2.65	2.62	100
10	4.50	2.48	2.42	100
11	4.49	2.34	2.53	92.6
12	4.52	2.52	2.60	96.7
13	4.50	2.45	2.53	97.0
Average:	4.51	2.78	2.96	93.8

Criteria % Recovery: ≥ 85%

4.2.2 COLLECTIVE PROTECTION

An HVAC/ collective protection test was performed from November 2005 to May 2006. The test was performed using 7.5" X 7.5" pleated filters set up in a 4-chamber HVAC system. The primary goal of this experiment was to examine the microbial and toxicological performance of the filters under longevity conditions (please refer to Microbiology section of this report for microbial efficiency results). These experiments were performed at a flow rate of 20 CFM, which corresponds to a face velocity of 3.7 ft/min (for an 7.5" X 7.5" filter) or 566 LPM. This flow rate is typically encountered in HVAC systems.

The longevity trial was completed after 538 continuous days of filtration with iodine release measurements determined for all samples collected. The air flow was passed through the samples 7 days per week for the duration of the longevity test, however samplings were taken 5 days per week, twice daily from Monday through Friday initially. With time, the samplings were taken less frequently as no changes were seen in the data. The frequency of testing was changed to once daily, 3 times a week on day 396, and subsequently changed to once per month starting on day 445.

Results are summarized in figure 4.2 below. Two of the four filters were composed of 20 meltblown with 10 g/m^2 of Triosyn together with Triosyn Super HEPA media with 50 g/m^2 of Triosyn (Filter 1: average results, n=2), and one filter contained only the Triosyn Super HEPA media with 50 g/m^2 of Triosyn (Filter 2: n=1). The last filter contained the same components as the Filter 1, with no Triosyn embedded in the media (Filter 3). The Filter 3 was not sampled by the Chemistry department; it is used as a control for the Microbiology testing.

As seen by the data presented in figure 4.1, the average iodine levels were either below the instrument's detection limit (BDL) or slightly above, throughout the entire testing period of 538 days. Both configurations tested demonstrated very similar results. In conclusion, the data indicates that the Triosyn Super HEPA proved safe for use in HVAC applications based on its low toxicology profile under longevity conditions.

It is important to note that the HPLC Instrumentation methods were changed during the course of this trial, thereby reducing the instruments detection limit. The detection limit was initially 0.0105 ppm I^- (1.7E-02 mg/m^3) for the first 133 days of testing. It was then reduced to 0.005 ppm I^- (7.2E-03 mg/m^3) and was finally reduced at 285 days to 0.0010 ppm I^- (1.6E-03 mg/m^3) (please refer to section 4.1.2 for details).

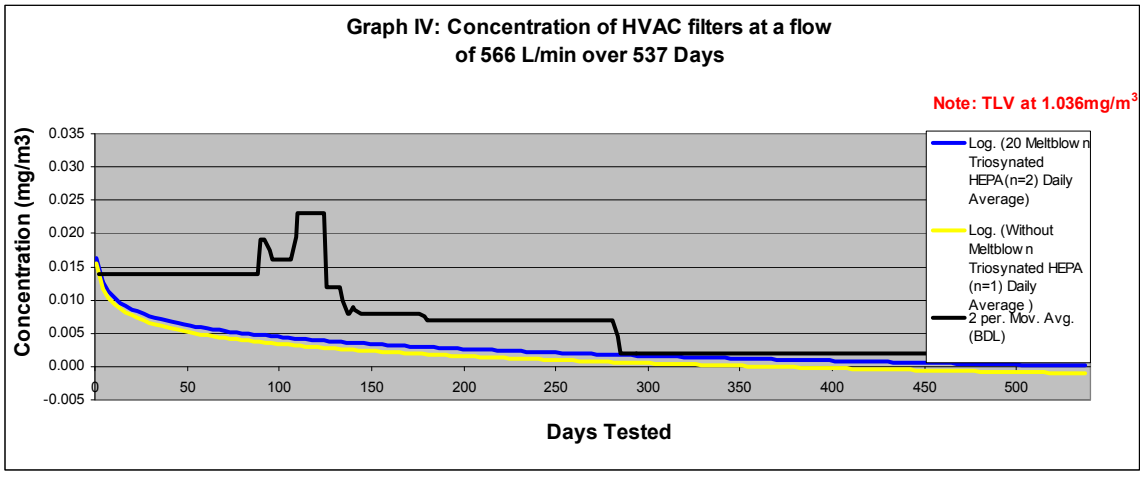


FIGURE 4.2: AMOUNT OF IODINE RELEASED FROM TWO CONFIGURATIONS OF TRIOSYN SUPER HEPA OVER A PERIOD OF 573 DAYS AT AMBIENT CONDITIONS

After undergoing a testing period of 538 days, the four HVAC filters were dismantled for further analysis in microbiology and toxicology. Percent recovery analysis was performed using the thiosulfate method on the three sample filters (Ports 1-3), and read off a prepared standard curve to determine the Triosyn concentration remaining on the Triosynated P-100 HEPA layer from each filter. The use of samples with known concentrations in the standard curve is essential for quantification of unknowns.

Swatch sizes of 47mm (17.35cm^2) were cut from the test filters. In order to account for a possible variability in Triosyn's dispersion (i.e. concentration) across the media, 34 samples were cut across from the HVAC filter (17 samples across the top and 17 samples across the bottom). Results from the percent recovery analysis are presented in Table 4.5.

TABLE 4.5: DETERMINATION OF TRIOSYN CONCENTRATION (MG/M3) IN HVAC TEST SAMPLES

Sample	Sample Area	Average Triosyn Concentration (g/m^2)	Overall Average Triosyn Concentration (g/m^2)
Control (Day 0)	n/ap	n/ap	56.17
Port 1	Top	47.79	43.67
	Bottom	39.55	
Port 2	Top	57.52	55.53
	Bottom	53.53	
Port 3	Top	48.5	48.89
	Bottom	49.28	

Results obtained from the HVAC percent recovery analysis show that the Triosyn concentration from the tested samples ranged from 48.89g/m^2 to 55.53g/m^2 (average: 49.36g/m^2). The initial concentration of Triosyn in the media being 56.17g/m^2, we see that, over the course of 538 days of air testing, a maximum decrease of 12% in the Triosyn concentration was observed. These results indicate that the Triosyn was not significantly depleted from the test articles and, therefore, suggest that the biocidal potential of the HVAC test filters is maintained for further use.

4.2.3 VALIDATION TESTING OF THE SELECTED CONFIGURATION OF THE TRIOSYN SUPER HEPA MATERIAL

Validation testing was performed on the final media stack of Triosyn Super HEPA (TSH) media with polyester produced at the Lydall Facility. These tests served to push the media to its limit by checking its activity under extreme environmental conditions as well as with soiling agents applied before the air filtration tests.

The tests at different environmental conditions and the DOP loading were performed on stacks of 100cm^2 20-XP Meltblown media containing 10gsm Triosyn T50 and HEPA glass fiber with 50gsm Triosyn (200-400um) (Lydall production October 2005) and a carbon backing of 100gsm from KJ carbon all at a flow of 31.8 LPM. This flow corresponds to a flow of 222 LPM on the end product (in-

house canister) with a total surface area of 700cm^2. The tests with the dust and smoke soiling agents were performed on 12.57cm^2 swatches and the flow was at 4 LPM.

4.2.3.1 IODINE CONTENT IN THE EFFLUENT AT DIFFERENT ENVIRONMENTAL CONDITIONS

The different environmental conditions runs were performed with and without a 100gsm KJ carbon backer to compare the levels of iodine released from the media. The first condition tested was at 5°C ± 3°C and 75% RH ± 15%RH. It was tested first with no carbon, and then the test was repeated with the presence of the carbon. As observed in tables 4.6 and 4.7, the presence of carbon brings concentrations averaging at 1.057 mg/m^3 with no carbon down to 0.0304 mg/m^3.

TABLE 4.6: AMOUNT OF IODINE LIBERATED FROM 100CM2 SWATCHES (N=6) OF 20XP MELTBLOWN MEDIA WITH 10GSM TRIOSYN T50 AND HEPA WITH 50GSM TRIOSYN (200-400UM) WITHOUT CARBON OVER A PERIOD OF 3 HOURS AT 5°C ± 3°C AND RELATIVE HUMIDITY OF 75% ± 15%.

Sampling Time (min)	Iodine Concentration (mg/m^3) N=6	Sampling Time (min)	Iodine Concentration (mg/m^3) N=6
15	1.1252	105	1.0818
30	1.3015	120	1.0121
45	1.2967	135	0.9197
60	1.1846	150	0.8663
75	1.0943	165	0.8324
90	1.0392	180	0.9281
Average concentration: (mg/m^3)		1.0568	

BDL = Concentration Iodide less than 0.001 ppm (equal to 1.6E-03 mg/m^3 iodine)

TABLE 4.7: AMOUNT OF IODINE LIBERATED FROM 100CM2 SWATCHES (N=6) OF 20XP MELTBLOWN MEDIA WITH 10GSM TRIOSYN T50 AND HEPA WITH 50GSM TRIOSYN (200-400UM) WITH 100GSM KJ CARBON BACKER OVER A PERIOD OF 3 HOURS AT 5°C ± 3°C AND RELATIVE HUMIDITY OF 75% ± 15%.

Sampling Time (min)	Iodine Concentration (mg/m^3) N=6	Sampling Time (min)	Iodine Concentration (mg/m^3) N=6
15	0.0204	105	0.0305
30	0.0299	120	0.0330
45	0.0308	135	0.0311
60	0.0336	150	0.0316
75	0.0330	165	0.0319
90	0.0247	180	0.0343
Average concentration: (mg/m^3)		0.0304	

BDL = Concentration Iodide less than 0.001 ppm (equal to 1.6E-03 mg/m^3 iodine)

The next environmental condition tested was 20°C ± 3°C and 50% RH ± 15%RH on samples with and without the carbon backer. The results are presented below in tables 4.8 and 4.9.

TABLE 4.8: AMOUNT OF IODINE LIBERATED FROM 100CM2 SWATCHES (N=6) OF 20XP MELTBLOWN MEDIA WITH 10GSM TRIOSYN T50 AND HEPA WITH 50GSM TRIOSYN (200-400UM) WITHOUT CARBON OVER A PERIOD OF 3 HOURS AT 20°C ± 3°C AND RELATIVE HUMIDITY OF 50% ± 15%.

Sampling Time (min)	Iodine Concentration (mg/m^3) N=6	Sampling Time (min)	Iodine Concentration (mg/m^3) N=6
15	1.5864	105	1.3290
30	1.8306	120	1.3140
45	1.6099	135	1.2785
60	1.5009	150	1.2499
75	1.4459	165	1.2215
90	1.3777	180	1.3206
Average concentration: (mg/m^3)		1.4221	

BDL = Concentration Iodide less than 0.001 ppm (equal to 1.6E-03 mg/m^3 iodine)

TABLE 4.9: AMOUNT OF IODINE LIBERATED FROM 100CM2 SWATCHES (N=6) OF 20XP MELTBLOWN MEDIA WITH 10GSM TRIOSYNT50 AND HEPA WITH 50GSM TRIOSYN (200-400UM) WITH 100GSM KJ CARBON BACKER OVER A PERIOD OF 3 HOURS AT 20°C ± 3°C AND RELATIVE HUMIDITY OF 50% ± 15%.

Sampling Time (min)	Iodine Concentration (mg/m^3) N=6	Sampling Time (min)	Iodine Concentration (mg/m^3) N=6
15	0.0262	105	0.0410
30	0.0372	120	0.0412
45	0.0413	135	0.0392
60	0.0464	150	0.0376
75	0.0401	165	0.0406
90	0.0396	180	0.0427
Average concentration: (mg/m^3)		0.0394	

BDL = Concentration Iodide less than 0.001 ppm (equal to 1.6E-03 mg/m^3 iodine)

Next, tests were performed at 30°C ± 3°C and 30% RH± 15%RH with and without the carbon backer. The results presented in Table 4.10 suggest that higher temperatures increase the iodine release, as shown by the iodine concentration observed at 2.415 mg/m^3 for samples with no carbon, when compared to concentrations measured at ambient or lower temperature conditions (see Tables 4.6 and 4.8). This poses a greater strain on the carbon media although the results obtained in the same test with carbon (Table 4.11) show that it is capable of adsorbing much of this iodine, keeping the average concentration at 0.0480 mg/m^3.

TABLE 4.10: AMOUNT OF IODINE LIBERATED FROM 100CM2 SWATCHES (N=6) OF 20XP MELTBLOWN MEDIA WITH 10GSM TRIOSYN T50 AND HEPA WITH 50GSM TRIOSYN (200-400UM) WITHOUT CARBON OVER A PERIOD OF 3 HOURS AT 30°C ± 3°C AND RELATIVE HUMIDITY OF 30% ± 15%.

Sampling Time (min)	Iodine Concentration (mg/m^3) N=6	Sampling Time (min)	Iodine Concentration (mg/m^3) N=6
15	2.9101	105	2.4320
30	2.7673	120	2.3000
45	2.6176	135	2.1782
60	2.6164	150	2.0546
75	2.5285	165	1.9450
90	2.6237	180	2.0018
Average concentration: (mg/m^3)		2.4146	

BDL = Concentration Iodide less than 0.001 ppm (equal to 1.6E-03 mg/m^3 iodine)

TABLE 4.11: AMOUNT OF IODINE LIBERATED FROM 100CM2 SWATCHES (N=6) OF 20XP MELTBLOWN MEDIA WITH 10GSM TRIOSYN T50 AND HEPA WITH 50GSM TRIOSYN (200-400UM) WITH 100GSM KJ CARBON BACKER OVER A PERIOD OF 3 HOURS AT 30°C ± 3°C AND RELATIVE HUMIDITY OF 30% ± 15%.

Sampling Time (min)	Iodine Concentration (mg/m^3) N=6	Sampling Time (min)	Iodine Concentration (mg/m^3) N=6
15	0.0276	105	0.0494
30	0.0451	120	0.0518
45	0.0543	135	0.0480
60	0.0553	150	0.0479
75	0.0524	165	0.0449
90	0.0518	180	0.0479
Average concentration: (mg/m^3)		0.0480	

BDL = Concentration Iodide less than 0.001 ppm (equal to 1.6E-03 mg/m^3 iodine)

The last environmental condition to be tested was 30°C and 85% RH. This was expected to be the harshest of all conditions tested since it combines high temperature and humidity, both factors susceptible to increase iodine release. Please refer to Tables 4.12 and 4.13 for the results. As seen in those tables, the carbon was still effective at reducing the iodine concentrations to an acceptable level of 0.0385mg/m^3 although initial values were above the TLV with an average iodine concentration of 1.9701 mg/m^3.

TABLE 4.12: AMOUNT OF IODINE LIBERATED FROM 100CM2 SWATCHES (N=6) OF 20XP MELTBLOWN MEDIA WITH 10GSM TRIOSYN T50 AND HEPA WITH 50GSM TRIOSYN (200-400UM) WITHOUT CARBON AT A FLOW OF 31.8LPM OVER A PERIOD OF 3 HOURS AT 30°C ± 3°C AND RELATIVE HUMIDITY OF 85% ± 15%.

Sampling Time (min)	Iodine Concentration (mg/m^3) N=6	Sampling Time (min)	Iodine Concentration (mg/m^3) N=6
15	2.1030	105	1.9448
30	2.1494	120	1.9203
45	2.1544	135	1.8725
60	2.1548	150	1.7844
75	2.0492	165	1.6965
90	2.0639	180	1.7481
Average concentration: (mg/m^3)		1.9701	

BDL = Concentration Iodide less than 0.001 ppm (equal to 1.6E-03 mg/m^3 iodine)

TABLE 4.13: AMOUNT OF IODINE LIBERATED FROM 100CM2 SWATCHES (N=6) OF 20XP MELTBLOWN MEDIA WITH 10GSM TRIOSYN T50 AND HEPA WITH 50GSM TRIOSYN (200-400UM) WITH 100GSM KJ CARBON BACKER OVER A PERIOD OF 3 HOURS AT 30°C ± 3°C AND RELATIVE HUMIDITY OF 85% ± 15%.

Sampling Time (min)	Iodine Concentration (mg/m^3) N=6	Sampling Time (min)	Iodine Concentration (mg/m^3) N=6
15	0.0331	105	0.0358
30	0.0385	120	0.0441
45	0.0332	135	0.0400
60	0.0362	150	0.0412
75	0.0357	165	0.0428
90	0.0357	180	0.0450
Average concentration: (mg/m^3)		0.0385	

BDL = Concentration Iodide less than 0.001 ppm (equal to 1.6E-03 mg/m^3 iodine)

After reviewing all the data obtained at different environmental conditions, the performance of the samples tested without the carbon backer was deemed satisfactory. Given that no carbon was present, the expectation was for the iodine concentration to be elevated, i.e. above the TLV for most test articles. The data demonstrated iodine release above the TLV (1.036 mg/m^3) for the duration of the tests, however it was noted that the trend of release was initially always very high with a gradual drop in iodine concentrations over time.

When comparing the data from Tables 4.6, 4.8 and 4.10, we observe a correlation between the increase in temperature (5°C; 20°C; 30°C) and higher iodine concentrations (1.0568mg/m^3; 1.4221mg/m^3; 2.4146 and 1.9701mg/m^3), suggesting that higher temperatures increase the rate of iodine release.

Based on the results obtained in Tables 4.10 and 4.12, higher relative humidity did not seem to be a factor activating iodine release since, at the same temperature condition (30°C), the average iodine concentration measured from test articles subjected to 85% RH was lower than the average concentration observed for samples tested at 30% RH (1.9701mg/m^3 vs 2.4146mg/m^3).

Below the TLV values were consistently obtained for all tests performed with the carbon backer, regardless of the environmental conditions to which the samples were exposed. This confirms that the 100gsm KJ carbon is very efficient at absorbing iodine at extreme as well as ambient environmental conditions. Table 4.14 displays a summary of the tests presented above.

TABLE 4.14: AVERAGE IODINE CONCENTRATION (MG/M3) RELEASED FROM 100CM2 SWATCHES OF (N=6) 20XP MELTBLOWN MEDIA WITH 10GSM TRIOSYN T50 AND HEPA WITH 50GSM TRIOSYN (200-400UM) WITH AND WITHOUT A 100GSM KJ CARBON BACKER OVER A PERIOD OF 3 HOURS AT DIFFERENT ENVIRONMENTAL CONDITIONS.

	Temperature (°C ; ± 3°C)	Humidity (% ± 15%)	Samples with Carbon: Average Iodine Concentration (mg/m^3) N=6	Samples with No Carbon: Average Iodine Concentration (mg/m^3) N=6
Condition #1	5	75	0.0304	1.057
Condition #2	20	50	0.0394	1.422
Condition #3	30	30	0.0480	2.415
Condition #4	30	85	0.0385	1.97

4.2.3.2 IODINE CONTENT IN THE EFFLUENT IN THE PRESENCE OF SOIL LOADING AGENTS

The next series of tests performed was on previously soiled samples of the final media stack. Please refer to the engineering section for a detailed description of soiling methods. For the DOP loaded tests, a total of 23ug of DOP was applied to each sample prior to the air filtration test. Twelve of the previously loaded samples were tested as well as 6 samples of the non-loaded to determine if the soiled samples exhibited less capacity to adsorb iodine. The results are presented in Tables 4.15 and 4.16 below.

TABLE 4.15: AMOUNT OF IODINE LIBERATED FROM DOP-LOADED 20XP MELTBLOWN MEDIA WITH 10GSM TRIOSYN T50 AND HEPA WITH 50GSM TRIOSYN (200-400UM) AND 100GSM KJ CARBON BACKER OVER A PERIOD OF 3 HOURS AT AMBIENT TEMPERATURE AND HUMIDITY.

Sampling Time (min)	Iodine Concentration (mg/m^3) N=12	Sampling Time (min)	Iodine Concentration (mg/m^3) N=12
15	0.0192	105	0.0433
30	0.0319	120	0.0397
45	0.0363	135	0.0469
60	0.0369	150	0.0434
75	0.0392	165	0.0409
90	0.0426	180	0.0481
Average concentration: (mg/m^3)		0.0390	

BDL = Concentration Iodide less than 0.001 ppm (equal to 1.6E-03 mg/m^3 iodine)

TABLE 4.16: AMOUNT OF IODINE LIBERATED FROM NON-SOILED 20XP MELTBLOWN MEDIA WITH 10GSM TRIOSYN T50 AND HEPA WITH 50GSM TRIOSYN (200-400UM) AND 100GSM KJ CARBON BACKER OVER A PERIOD OF 3 HOURS AT AMBIENT TEMPERATURE AND HUMIDITY.

Sampling Time (min)	Iodine Concentration (mg/m^3) N=6	Sampling Time (min)	Iodine Concentration (mg/m^3) N=6
15	0.0187	105	0.0363
30	0.0273	120	0.0337
45	0.0320	135	0.0365
60	0.0314	150	0.0378
75	0.0293	165	0.0338
90	0.0407	180	0.0395
Average concentration: (mg/m^3)		0.0331	

BDL = Concentration Iodide less than 0.001 ppm (equal to 1.6E-03 mg/m^3 iodine)

These tests confirm that DOP does not significantly affect the iodine release of the final media stack since the average concentration of loaded samples was 0.0390 mg/m^3 compared to 0.0331mg/m^3 for the non-loaded.

Samples of the final media stack dust loaded at varying concentrations were also air filtration tested. The concentrations of dust applied to the media were as follows: 25%, 50% 75% and 100%. These percentages represent the change in pressure drop after application of dust. The samples tested were of 12.57cm^2 size and the flow was set at 4LPM as mentioned previously. Tables 4.17 and 4.18 compare the 25% dust loaded samples with unsoiled samples tested in parallel.

TABLE 4.17: AMOUNT OF IODINE LIBERATED FROM 25% DUST-LOADED 20XP MELTBLOWN MEDIA WITH 10GSM TRIOSYN T50 AND HEPA WITH 50GSM TRIOSYN (200-400UM) AND 100GSM KJ CARBON BACKER OVER A PERIOD OF 3 HOURS AT AMBIENT TEMPERATURE AND HUMIDITY.

Sampling Time (min)	Iodine Concentration (mg/m^3) N=12	Sampling Time (min)	Iodine Concentration (mg/m^3) N=12
15	0.0528	105	0.0921
30	0.0837	120	0.0848
45	0.0937	135	0.0849
60	0.0897	150	0.0870
75	0.0926	165	0.0841
90	0.0956	180	0.0753
Average concentration: (mg/m^3)		0.0847	

BDL = Concentration Iodide less than 0.001 ppm (equal to 1.6E-03 mg/m^3 iodine)

TABLE 4.18: AMOUNT OF IODINE LIBERATED FROM NON-SOILED 20XP MELTBLOWN MEDIA WITH 10GSM TRIOSYN T50 AND HEPA WITH 50GSM TRIOSYN (200-400UM) AND 100GSM KJ CARBON BACKER OVER A PERIOD OF 3 HOURS AT AMBIENT TEMPERATURE AND HUMIDITY.

Sampling Time (min)	Iodine Concentration (mg/m^3) N=6	Sampling Time (min)	Iodine Concentration (mg/m^3) N=6
15	0.0434	105	0.0652
30	0.0559	120	0.0619
45	0.0598	135	0.0579
60	0.0577	150	0.0530
75	0.0618	165	0.0520
90	0.0634	180	0.0537
Average concentration: (mg/m^3)		0.0571	

BDL = Concentration Iodide less than 0.001 ppm (equal to 1.6E-03 mg/m^3 iodine)

Consequently, these results demonstrate that the soiling agent: 25% dust particles added to the samples prior to the air filtration test, does not inhibit the media stack's capacity to adsorb iodine. The average concentration of iodine released was 0.0847 mg/m^3 compared to the non-loaded at 0.0571mg/m^3. These average concentrations are based on N=12 of the loaded swatches and N=6 of the non-loaded swatches.

As shown in Tables 4.19 and 4.20, when testing the 50% dust loaded samples, similar iodine concentrations were also measured for both soiled and unsoiled test articles. The loaded samples had an average concentration of 0.0618mg/m^3 compared to 0.0456mg/m^3 for the non-loaded.

TABLE 4.19: AMOUNT OF IODINE LIBERATED FROM 50% DUST-LOADED 20XP MELTBLOWN MEDIA WITH 10GSM TRIOSYN T50 AND HEPA WITH 50GSM TRIOSYN (200-400UM) AND 100GSM KJ CARBON BACKER OVER A PERIOD OF 3 HOURS AT AMBIENT TEMPERATURE AND HUMIDITY.

Sampling Time (min)	Iodine Concentration (mg/m^3) N=12	Sampling Time (min)	Iodine Concentration (mg/m^3) N=12
15	0.0180	105	0.0604
30	0.0479	120	0.0561
45	0.1137	135	0.0620
60	0.0708	150	0.0602
75	0.0716	165	0.0586
90	0.0580	180	0.0640
Average concentration: (mg/m^3)		0.0618	

BDL = Concentration Iodide less than 0.001 ppm (equal to 1.6E-03 mg/m^3 iodine)

TABLE 4.20: AMOUNT OF IODINE LIBERATED FROM NON-SOILED 20XP MELTBLOWN MEDIA WITH 10GSM TRIOSYN T50 AND HEPA WITH 50GSM TRIOSYN (200-400UM) AND 100GSM KJ CARBON BACKER OVER A PERIOD OF 3 HOURS AT AMBIENT TEMPERATURE AND HUMIDITY.

Sampling Time (min)	Iodine Concentration (mg/m^3) N=6	Sampling Time (min)	Iodine Concentration (mg/m^3) N=6
15	0.0169	105	0.0536
30	0.0359	120	0.0477
45	0.0395	135	0.0513
60	0.0413	150	0.0487
75	0.0492	165	0.0520
90	0.0543	180	0.0573
Average concentration: (mg/m^3)		0.0456	

BDL = Concentration Iodide less than 0.001 ppm (equal to 1.6E-03 mg/m^3 iodine)

The samples were next loaded with 75% dust and compared to non-loaded samples. Results are presented in Tables 4.21 and 4.22.

TABLE 4.21: AMOUNT OF IODINE LIBERATED FROM 12.57CM2 SWATCHES 75% DUST-LOADED 20XP MELTBLOWN MEDIA WITH 10GSM TRIOSYN T50 AND HEPA WITH 50GSM TRIOSYN (200-400UM) AND 100GSM KJ CARBON BACKER OVER A PERIOD OF 3 HOURS AT AMBIENT TEMPERATURE AND HUMIDITY.

Sampling Time (min)	Iodine Concentration (mg/m^3) N=12	Sampling Time (min)	Iodine Concentration (mg/m^3) N=12
15	0.0369	105	0.0774
30	0.0740	120	0.0581
45	0.0682	135	0.0626
60	0.0741	150	0.0592
75	0.0747	165	0.0540
90	0.0760	180	0.0603
Average concentration: (mg/m^3)		0.0646	

BDL = Concentration Iodide less than 0.001 ppm (equal to 1.6E-03 mg/m^3 iodine)

TABLE 4.22: AMOUNT OF IODINE LIBERATED FROM NON-SOILED 20XP MELTBLOWN MEDIA WITH 10GSM TRIOSYN T50 AND HEPA WITH 50GSM TRIOSYN (200-400UM) AND 100GSM KJ CARBON BACKER OVER A PERIOD OF 3 HOURS AT AMBIENT TEMPERATURE AND HUMIDITY.

Sampling Time (min)	Iodine Concentration (mg/m^3) N=6	Sampling Time (min)	Iodine Concentration (mg/m^3) N=6
15	0.0167	105	0.0473
30	0.0341	120	0.0461
45	0.0398	135	0.0512
60	0.0446	150	0.0517
75	0.0435	165	0.0500
90	0.0468	180	0.0543
Average concentration: (mg/m^3)		0.0438	

BDL = Concentration Iodide less than 0.001 ppm (equal to 1.6E-03 mg/m^3 iodine)

Results indicated once again a similar average concentration of iodine released for the loaded samples at 0.0646mg/m^3. The non-loaded samples contained an average of 0.0438mg/m^3.

The next samples that were air filtration tested contained soiling agent: 100% dust loaded compared to the non-loaded samples. Results are tabulated in Tables 4.23 and 4.24.

TABLE 4.23: AMOUNT OF IODINE LIBERATED FROM 100% DUST-LOADED 20XP MELTBLOWN MEDIA WITH 10GSM TRIOSYN T50 AND HEPA WITH 50GSM TRIOSYN (200-400UM) AND 100GSM KJ CARBON BACKER OVER A PERIOD OF 3 HOURS AT AMBIENT TEMPERATURE AND HUMIDITY.

Sampling Time (min)	Iodine Concentration (mg/m^3) N=12	Sampling Time (min)	Iodine Concentration (mg/m^3) N=12
15	0.0163	105	0.0330
30	0.0212	120	0.0340
45	0.0266	135	0.0326
60	0.0303	150	0.0337
75	0.0349	165	0.0326
90	0.0316	180	0.0361
Average concentration: (mg/m^3)		0.0302	

BDL = Concentration Iodide less than 0.001 ppm (equal to 1.6E-03 mg/m^3 iodine)

TABLE 4.24: AMOUNT OF IODINE LIBERATED FROM NON-SOILED 20XP MELTBLOWN MEDIA WITH 10GSM TRIOSYN T50 AND HEPA WITH 50GSM TRIOSYN (200-400UM) AND 100GSM KJ CARBON BACKER OVER A PERIOD OF 3 HOURS AT AMBIENT TEMPERATURE AND HUMIDITY.

Sampling Time (min)	Iodine Concentration (mg/m^3) N=6	Sampling Time (min)	Iodine Concentration (mg/m^3) N=6
15	0.0263	105	0.0524
30	0.0306	120	0.0516
45	0.0364	135	0.0502
60	0.0431	150	0.0472
75	0.0445	165	0.0464
90	0.0488	180	0.0534
Average concentration: (mg/m^3)		0.0442	

It is important to note that for N=6 of the dust loaded and for N=3 of the non-loaded samples, a flow of 0.5LPM was initially passed through the samples for a total duration of 60 minutes prior to starting the test due to the occurrence of simultaneous testing of these samples in Microbiology. This unusual procedure did not seem to affect the results in any way since the results obtained from the other ports, tested as per standard procedure, revealed a similar outcome.

The results demonstrated similar results comparing the loaded (0.0302 mg/m^3) to the non-loaded (0.0442mg/m^3) samples.

The final series of tests performed was on smoke loaded samples. The smoke was generated using one cigarette burned to completion per swatch. The results are presented in Tables 4.25 and 4.26 below.

TABLE 4.25: AMOUNT OF IODINE LIBERATED FROM SMOKE-LOADED (FROM A CIGARRETE) 20XP MELTBLOWN MEDIA WITH 10GSM TRIOSYN T50 AND HEPA WITH 50GSM TRIOSYN (200-400UM) AND 100GSM KJ CARBON BACKER OVER A PERIOD OF 3 HOURS AT AMBIENT TEMPERATURE AND HUMIDITY.

Sampling Time (min)	Iodine Concentration (mg/m^3) N=12	Sampling Time (min)	Iodine Concentration (mg/m^3) N=12
15	0.0102	105	0.0247
30	0.0147	120	0.0260
45	0.0179	135	0.0256
60	0.0197	150	0.0267
75	0.0201	165	0.0248
90	0.0232	180	0.0264
Average concentration: (mg/m^3)		0.0217	

TABLE 4.26: AMOUNT OF IODINE LIBERATED FROM NON-SOILED 20XP MELTBLOWN MEDIA WITH 10GSM TRIOSYN T50 AND HEPA WITH 50GSM TRIOSYN (200-400UM) AND 100GSM KJ CARBON BACKER OVER A PERIOD OF 3 HOURS AT AMBIENT TEMPERATURE AND HUMIDITY.

Sampling Time (min)	Iodine Concentration (mg/m^3) N=6	Sampling Time (min)	Iodine Concentration (mg/m^3) N=6
15	0.0086	105	0.0181
30	0.0115	120	0.0187
45	0.0144	135	0.0187
60	0.0169	150	0.0208
75	0.0173	165	0.0226
90	0.0175	180	0.0277
Average concentration: (mg/m^3)		0.0177	

The results above demonstrate no observable difference between the smoke loaded (average iodine release at 0.0217mg/m^3) and the non-loaded samples (average iodine release at 0.0177mg/m^3).

A summary of all Soil loading agents follows in Table 4.27.

TABLE 4.27: AVERAGE IODINE CONCENTRATION (MG/M3) RELEASED FROM DOP-, DUST-, AND SMOKE-LOADED 20XP MELTBLOWN MEDIA WITH 10GSM TRIOSYN T50 AND HEPA WITH 50GSM TRIOSYN (200-400UM) IN COMPARISON TO NON-LOADED SAMPLES.

Soil Loading Agent	Concentration	Soiled samples: Average Iodine Concentration (mg/m^3) N=12	Non-Soiled Samples: Average Iodine Concentration (mg/m^3) N=6
DOP	23mg/swatch	0.0390	0.0331
Dust	Δp + 25	0.0847	0.0571
	Δp + 50	0.0618	0.0456
	Δp + 75	0.0646	0.0438
	Δp + 100	0.0302	0.0442
Smoke	smoke from one cigarette per swatch	0.0217	0.0177

In conclusion, the contamination of samples using DOP, dust and smoke soil loading agents did not seem to affect the rate of iodine release from the TSH composite media since no significant difference was seen in the average iodine concentration between the loaded and the non-loaded samples. All the test results obtained were well below the TLV ((1.036 mg/m^3).

4.2.4 ALTERNATIVE CARBON SUPPLIERS

As mentioned in previous reports, the primary objective of this research was to identify United States–based carbon suppliers for future applications in the production of Triosyn respirators or other air filtration products. This process was initiated by researching the market to identify carbon suppliers in the US and contacting them to obtain samples for QC testing at Triosyn Research laboratories, as detailed in March and June 2007 progress reports.

Table 4.28 below lists all the US carbon suppliers identified and contacted by Triosyn.

TABLE 4.28: LIST OF US CARBON SUPPLIERS CONTACTED BY TRIOSYN

Company	Contact Name	Phone Number	Status
AQF (BBA Fiberweb)	Andre Tolbert	803.547.3106	Samples do not meet performance criteria.
D-Mark	Ron Richmand	800.343.3610	Samples do not meet performance criteria.
Keystone Filter Division	Chris Donatelli	800.822.1963	Samples meeting program needs not available for testing
Sparks Technology	Scott Walker	888.772.7578	Samples meeting program needs not available for testing
Cameron Great Lakes	Paula Lavesser	800.777.4044	Samples meeting program needs not available for testing
Lewcott Corporation	No Contact Name	800.225.7725	Samples meeting program needs not available for testing
Columbus Industries	No Contact Name	www.colind.com	Samples meeting program needs not available for testing
BGF Greensboro N.C	Carla	800-476-4845	Samples meeting program needs not available for testing
Lydall	Scott Keiller (Joe to contact first)	TBD	Samples do not meet performance criteria.
Enhanced Filter Company	Chuck Geyson/Karl Coburn	845-527-6235	Samples meeting program needs not available for testing
Northern Fiberglass	Brian Duffy	603-926-1910	Samples meeting program needs not available for testing

Given the restricted number of US manufacturers able to supply carbon suitable to program needs, alternative manufacturers from abroad were also considered and their material tested for performance according to Triosyn QC specifications, as detailed in the following sections.

Based on results obtained from research and testing performed during previous periods, only two manufacturers, namely AQF from the U.S. and Lantor from UK, were deemed suitable and retained for further testing. Detailed testing and results are presented in sections 4.2.4.1 and 4.2.4.2.

4.2.4.1 AQF CARBON MANUFACTURER (U.S.)

Back in April 2007, a visit to AQF was made to discuss future production of carbon media for QC testing at Triosyn Research. Carbon samples were produced and tested according to the specifications for QC testing. All carbon rolls (at 110g/m^2 and 200g/m^2) were produced using either a coconut shell or coal based in which carbon concentration varied.

The QC tests performed on all AQF carbon samples include pressure drop, weight, thickness, and malleability by the Engineering department, as well as air testing by the Toxicology department. Toxicology air results were obtained using a 1-ply 35ZPN & 10gsm 20-XP & 1-ply 35ZPN media composite with the various carbon materials to determine the iodine dietary amount. Toxicology air testing was performed at 100cm^2 surface area and at a flow rate of 42.7LPM for a period of 8 hours.
Results for all quality control tests are presented in Table 4.29 below.

As illustrated in Table 4.29, the Engineering results for pressure drop fall within the acceptable established criteria of 0.8 – 2.8mm H_2O. The average weight results for all carbon samples also fall within acceptable range, except for sample #9: 200gsm AQF roll (85CTC), where the weight is greater than the established range. On the other hand, the carbon thickness for the 110g/m^2 and 200g/m^2 AQF concentrations fails criteria, since the values are all greater than 1.37mm. This aspect is an important factor in media selection due the need for weld ability when producing the Triosyn facemasks. This increased thickness of the AQF carbon materials will create difficulty to any sort of manipulation with ultrasonic welding.
Importantly, the Toxicology air test results for the 110g/m^2 AQF carbon samples did not pass criteria; where all calculated dietary intake results exceeded the acceptable range of 750µg for 8 hours of testing. Despite using a 1-ply 35ZPN & 10gsm 20-XP & 1-ply 35ZPN media composite for air testing, all results for the 110g/m^2 AQF carbon samples were still greater than the passing criteria for the test period. As a result, all AQF production samples (110g/m^2 and 200g/m^2) fail the quality control criteria.

TABLE 4.29: QUALITY CONTROL RESULTS FOR AQF CARBON MEDIA (CARBON SUPPLIER)

Sample #	AQF Carbon Sample	Pressure Drop (mm H_2O)	Weight (g)	Average Weight (g)	Thickness (mm)	Average Thickness (mm)	Average Dietary for 8 hours (µg)
1	**110gsm:** 20g Scrims **Coconut**	**2.1**	0.3434	**0.3398**	1.72	**1.71**	**2166**
			0.3322		1.67		
			0.3438		1.74		
2	**110gsm:** #A1071: 40g (top layer) **Coconut**	**2.3**	0.3712	**0.4047**	1.60	**1.54**	**854**
			0.4225		1.55		
			0.4203		1.48		
3	**110gsm:** #1074: 40g (top layer) **Coal**	**2.8**	0.3861	**0.3799**	1.63	**1.63**	**1245**
			0.3833		1.58		
			0.3704		1.68		
4	**110gsm:** #1070: 40g Base/40g Top **Coconut**	**1.8**	0.3523	**0.3540**	1.85	**1.82**	**2741**
			0.3538		1.81		
			0.3560		1.81		
5	**110gsm:** #1073: 40g Base/40g Top **Coal**	**2.1**	0.3524	**0.3479**	1.80	**1.75**	**2363**
			0.3439		1.70		
			0.3475		1.76		
6	**110gsm:** #1072: 20/40gsm **Coal**	**2.4**	0.4043	**0.4154**	1.50	**1.47**	**2184**
			0.4579		1.43		
			0.3839		1.47		
7	**110gsm:** #1069: 20/40gsm **Coconut**	**2.2**	0.3556	**0.3387**	1.65	**1.63**	**2575**
			0.3241		1.58		
			0.3365		1.65		
8	**200gsm:** AQF Roll (60CTC) **Coconut**	**2.2**	0.3556	**0.3387**	1.65	**1.63**	**449**
			0.3241		1.58		
			0.3365		1.65		
9	**200gsm:** AQF Roll (85CTC; #2259) **Coconut**	**na**	0.5539	**0.5722**	1.97	**2.00**	**264**
			0.5991		2.05		
			0.5635		1.99		

Acceptable Ranges:
Pressure drop: 0.8-2.8mm H_2O
Weight: 0.2787-0.4415g
Thickness: 1.23-1.37mm
Dietary Intake: ≤ 750ug

4.2.4.2 LANTOR CARBON MANUFACTURER (UK)

Carbon samples were produced from the Lantor manufacturer with a carbon concentration of 90g/m^2. Several types of carbon media were made with and without acid treatment, and with two different types of material backing (cotton and polypropylene backings). The process of Lantor carbon production is quite unique, where the media is produced by spraying a carbon slurry onto one or two sides of the spun bound media, depending on the concentration. This process is advantageous that has the ability to produce a more uniform and thinner media, while still possessing the desired carbon concentration.

This carbon sample was tested for performance and quality. As with the AQF carbon testing, a 1-ply 35ZPN & 10gsm 20-XP & 1-ply 35ZPN media composite was used in the air testing of the Lantor carbon samples. The quality control tests performed on the Lantor carbon samples included pressure drop, weight, thickness, and malleability by the Engineering department, as well as air testing by the Toxicology department. Results for all quality control tests are presented in Table 4.30.

TABLE 4.30: QUALITY CONTROL RESULTS FOR LANTOR CARBON MEDIA

No.	AQF Carbon Sample	Pressure Drop (mm H_2O)	Weight (g)	Average Weight (g)	Thickness (mm)	Average Thickness (mm)	Average Dietary Intake for 8 hours (µg)
1	**90gsm Lantor Carbon** (#3351/200)	**1.7**	0.3463	**0.3510**	2.96	**3.03**	**144** (ambient conditions) 33 (high humidity)
			0.368		3.25		
			0.3388		2.87		
2	**90gsm Acid Lantor Carbon** (#200338)	**0.18**	0.3638	**0.3792**	2.61	**2.63**	**490**
			0.3661		2.56		
			0.4078		2.73		
3	**90gsm Lantor with 70gsm cotton backer** (#200343)	**1.13**	0.5434	**0.5654**	3.91	**4.09**	**26**
			0.5665		4.17		
			0.5862		4.20		
4	**90gsm Lantor with 40gsm polypropylene backer** (#200344)	**0.81**	0.4868	**0.4894**	3.23	**3.19**	**26**
			0.4929		3.23		
			0.4884		3.12		

Acceptable Ranges:
Pressure drop: 0.8-2.8mm H_2O
Weight: 0.2787-0.4415g
Thickness: 1.23-1.37mm
Dietary Intake: ≤ 750ug

As shown above in Table 4.30, the Engineering results for pressure drop pass criteria for all the 90g/m^2 Lantor carbon samples, where the values did not exceed a pressure drop of 2.8mm H_2O. Importantly, the pressure drop for these samples ranges from 0.12mm H_20 to 1.7mm H_2O. The average weights for the Lantor media that contained the polypropylene and cotton backings were greater the acceptance range (>0.4415g). Also, the average thickness of each sample was also noted to be above the acceptance criteria (>1.37mm). This increased thickness in carbon media can pose problems to the potential of ultrasonic welding of the media when producing the Triosyn facemasks.

For the Toxicology air testing, initial testing of 8 hours at 42.7LPM was performed on the Lantor carbon samples, where ambient room conditions were maintained (ambient room temperature and humidity). The 90g/m^2 Lantor carbon (#3351/200) achieved the lowest dietary intake result compared to the other Lantor carbon, where 144µg of Iodine leached for a period of 8 hours. Due to the low dietary intake obtained at ambient conditions for this carbon sample, it was decided to challenge the Lantor carbon further by increasing the room humidity (>85% room humidity). As a result, an air test was performed in Toxicology, where new media stacks with this 90g/m^2 Lantor carbon (#3351/200) were exposed to high humidity, while maintaining ambient room temperature. Furthermore, this test was ultimately performed to see if the adsorptive capacity of this carbon would diminish when faced with worse conditions, and also to see if the leach of Iodine would increase.
Despite the exposure to higher humidity, the 90g/m^2 Lantor carbon (#3351/200) still achieved an acceptable dietary intake result of 33µg of Iodine for 8 hours, which is well below the tolerable limit of 750µg of Iodine for 8 hours.

Since all quality control requirements were met for the 90g/m^2 Lantor carbon (#3351/200), this sample is now being considered for future use in other applications.

In conclusion, out of the eleven (11) US and two (2) foreign carbon suppliers identified and contacted by Triosyn, Lantor (UK) was the only manufacturer able to provide a carbon material meeting all the quality and performance requirements identified for suitable end-use in combination with TSH material in individual and collective applications.

4.2.5 DETERMINATION OF THE EFFECTS OF IODINE ON ASZM-TEDA CARBON

As outlined in the Statement of Work, one of the objectives of the FY06 research program was to characterize the possible effects of iodine on carbon (Task 61). This research was carried out in two major steps, where step # 1 involved exposing the ASZM-TEDA carbon from C2A1 canisters to pure iodine beads in order to achieve maximal loading of the carbon with iodine; and step # 2 where this iodine-loaded carbon was tested for its effectiveness in absorbing chemical surrogate agents. The ultimate goal of these tests was to determine if iodine, the active component of the Triosyn resin, had any detrimental effect on the ability of the ASZM-TEDA carbon to absorb chemical surrogate agents.

In order to accomplish step # 1, 4 C2A1 canisters (which contained approximately 110g of ASZM-TEDA carbon) were set up on the air testing rig in the Toxicology laboratory. At the inlet of the C2A1 canister, a cartridge containing pure iodine beads (approximately 8 grams) was attached to serve as the source of iodine vapour. As air was passed through the iodine cartridge, it carried iodine vapours into the canister sample. Figure 4.3 depicts the set-up used for iodine loading of the ASZM-TEDA carbon in C2A1 canisters. The detailed protocol along with the progress of loading was described in previous reports (March and June 07 Progress Reports).

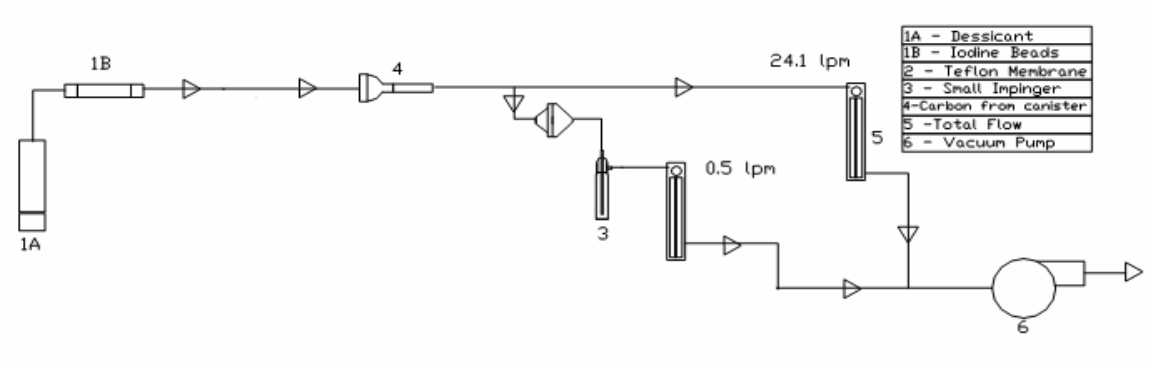


FIGURE 4.3: IODINE LOADING OF C2A1 CANISTER AIR TESTING SETUP

The iodine loading of the ASZM-TEDA carbon in C2A1 canisters was considered completed when the iodine concentration in the effluent air reached the target of 0.5 mg/m^3 iodine. This concentration was selected because it represented about half of the Threshold Limit Value (TLV) of 1.036 mg/m^3. Results of the iodine concentration in the effluent air and amount of iodine used to load the ASZM-TEDA carbon of each canister sample is presented in Table 4.31. Please note that the amount of iodine used to saturate the C2A1 canisters is an exaggerated amount used for testing purposes only. For example, a Triosyn filter media consisting of 20-XP Meltblown media containing 10 gsm of Triosyn with a Triosyn Super HEPA loaded with 50 gsm Triosyn inserted into a canister with a surface area of 810cm^2 only contains 48.6 gsm of Triosyn. Based on a percent of iodine in Triosyn T50 beads of 46.7%, the actual amount of iodine that could potentially interact with the carbon is 22.7g. This amount is 4 times less than the lowest amount used in saturating the canisters, as seen in Table 4.31. Table 4.31 also shows that the target of approximately 0.5 mg/m^3 iodine in the effluent air was reached for samples 2, 3, and 4. As noted, there was a problem with sample #1, where iodine beads spilled into the canister leading to very high measurements of iodine for this sample.

TABLE 4.31: IODINE CONCENTRATION IN THE EFFLUENT AIR AND AMOUNT OF IODINE USED TO LOAD THE ASZM-TEDA CARBON OF FOUR CANISTERS SAMPLES

Sample Canister	Iodine loaded (g)	Effluent Iodine Concentration (mg/m^3)
Sample 1	155	22.704*
Sample 2	93.15	0.4529
Sample 3	181	0.434
Sample 4	181	0.668

* Iodine beads spilled into the canister during the loading procedure which led to this high iodine concentration in the effluent air.

Subsequent to loading of the ASZM-TEDA carbon in C2A1 canisters with iodine, the chemisorption and physisorption properties of the four canister samples were tested against specific chemical agents. Two canisters (Sample 1 and 2) were tested at Triosyn Research's surrogate laboratory to assess the physisorption capacity of the carbon against DMMP, whereas the other 2 samples (Sample 3 and 4) were assayed at a third party laboratory (GEOMET) to assess the chemisorption capacity of the carbon against a blood agent. The initial plan was to test the loaded carbon with cyanogen chloride (CK), as per the MIL-PRF-51560C standard. However, due to a number of unforeseen events, GEOMET was unable to obtain this chemical, and testing needed to be performed with another blood agent, hydrogen cyanide (HCN), instead. More specifically, GEOMET had problems with the CK gas cylinder regulator (it was frozen shut and inoperable), and thus needed obtain another CK cylinder for testing. This option required about 4-5 weeks to deliver due to the amount of time required to prepare the CK plus additional time required to transport the cylinder (must be via ground transportation). By this time, a delay of 3.5 months occurred and GEOMET had not yet received the CK compound. It was then decided by the Chemistry Department to replace CK for HCN. Testing with both DMMP and HCN were performed according to the parameters set out in the MIL-PRF-51560C standard which are outlined in Table 4.32 below.

TABLE 4.32: TEST PARAMETERS FOR CHEMICAL TESTING OF CANISTERS ACCORDING TO MIL-PRF-56560C.

Agent	Flow Rate (LPM)	Minimum Gas Life (minutes)	Vapour Concentration (mg/m^3)	Breakthrough concentration (mg/m^3)	Ct (min mg/m3)
DMMP	50	59	3000±200	0.04	177,000
HCN*	32	30	4000±200	8.0	120,000

* adopted the same parameters as CK

For comparative purposes, testing of each iodine loaded canister was performed along side a fresh C2A1 canister (not exposed to any chemicals) to determine the effect of iodine on the absorbance capacity of the ASZM-TEDA carbon. In the tests with DMMP, we were not able to reach the target vapour concentration of 3000 mg/m^3 (as shown in Table 4.32). Therefore, it was important to test the samples until the breakthrough concentration of 0.04 mg/m^3 was achieved, so that the chemical challenge could be determined. Results are presented in Table 4.33.

TABLE 4.33: DMMP VAPOUR TESTING OF IODINE SATURATED CANISTERS PERFORMED AT THE SURROGATE LABORATORY (TRIOSYN RESEARCH FACILITY)

Test	Sample Canister	Iodine loaded (g)	Effluent Iodine Concentration (mg/m^3)	Test Time (min)	DMMP Vapor Concentration (mg/m^3)	Effluent DMMP Vapor Concentration (mg/m^3)	Ct ($min \cdot mg/m^3$)
1	Control 1	n/ap	n/ap	784	92	0.043	71,918
	Sample 1	155	22.704	959	192	0.041	183,683
2	Control 2	n/ap	n/ap	1267	391	0.013	495,740
	Sample 2	93.15	0.4529	1274	391	0.041	498,479

Note: As per MIL-PFR-51560C, the DMMP breakthrough concentration is set at 0.04mg/m^3

Upon review of the DMMP vapour testing results, it was observed in the first round of testing (control 1 and sample 1) that the iodine loaded carbon was able to meet the MIL-PFR-51560C standard and sustain a greater DMMP chemical challenge than the control sample (183,683 min*mg/m^3 iodine loaded versus 71,918min*mg/m^3 control). It was also noted that the iodine loaded sample had a shift in the peak retention time in the chromatographs, indicating that the iodine present may have caused a chemical change to the DMMP molecule (i.e. possible rearrangement or breakdown, data not shown). The control canister test results were unexpected since the DMMP chemical challenge did not meet the Ct of 177,000min mg/m^3 for this compound. This test was performed with only one control and one iodine loaded carbon and more tests would be required in order further validate these findings.

In the second round of testing, it was noted that the C2A1 control sample (control 2) did not reach the breakthrough limit of 0.04mg/m^3 during the 1267 minutes of testing, whereas the iodine loaded sample (sample 2) reached breakthrough at 1274 minutes. The calculated Cts at the end of testing for the control and loaded test sample were 495,740 and 498,479 min*mg/m^3, respectively (well above the minimum challenge concentration calculated from the test standard of 177,000 $min \cdot mg/m^3$). In conclusion, results from two independent tests suggest that saturating the C2A1's carbon with iodine does not affect its ability to breakdown DMMP.

As shown in Table 4.34, results for HCN vapour testing obtained for control canisters show that these samples (Control 1 and 2) were able to sustain a Ct of 121,080 min*mg/m^3 and 120,000min*mg/m^3, respectively with effluent HCN vapor concentration below the system's limit of detection of 0.036 mg/m^3. As for the results of the iodine loaded C2A1 canisters (Sample 3 and 4), the effluent vapor concentration were 0.256 mg/m^3 and 0.209 mg/m^3, respectively. These results are well below the breakthrough concentration of 8.0mg/m^3 for HCN. The Ct values for the 2 loaded samples were 120,000 min*mg/m^3 or slightly higher.

TABLE 4.34: HCN VAPOUR TESTING OF IODINE SATURATED CANISTERS AT GEOMET.

Test	Sample Canister	Iodine loaded (g)	Effluent Iodine Concentration (mg/m^3)	Test Time (min)	DMMP Vapor Concentration (mg/m^3)	Effluent DMMP Vapor Concentration (mg/m^3)	Ct (min·mg/m^3)
1	Control 1	n/ap	n/ap	30	4036	ND	121,080
	Sample 3	181	0.434		4036	0.256	121,080
2	Control 2	n/ap	n/ap		4000	ND	120,000
	Sample 4	181	0.668		NR	0.209	120,000

Note: As per MIL-PFR-51560C, the CK breakthrough concentration is set at 8mg/m^3
NR: not recorded
ND: non detect; results were below the limit of detection of 0.036mg/m^3

Based on chemical agent testing of the iodine saturated ASZM-TEDA carbon of C2A1 canisters, it is concluded that an over exaggerated exposure of this carbon to iodine did not adversely affect its chemisorption (HCN) and/or physisorption (DMMP) capabilities. Therefore, these findings suggest that integration of the Triosyn Super HEPA media into an IP application, such as a canister containing the ASZM-TEDA carbon, would not compromise the function of this carbon in regards to its chemical adsorption capacity.

4.2.5 ASZM-TEDA CARBON INTEGRITY IN THE PRESENCE OF IODINE

With the possibility of incorporating a Triosyn Filter Media into a canister application, it was important to determine if iodine had any effects on carbon integrity over time. To accomplish this, an accelerated-aging protocol based the ANS/AAM/ISO 11137-1994 standard[1] was used, where multiple prepared holders containing Triosyn beads (top compartment) and ASZM-TEDA carbon (bottom compartment) were aged for 3 weeks at a temperature of 60°C. The duration and temperature for this testing is representative of aging the samples for 18 months at room temperature[2], based on a Q_{10} factor of 2.5.

For the present test, 220 g of Triosyn beads were loaded in the top compartment of a makeshift canister holder and the bottom compartment was filled with 110g ASZM-TEDA carbon. Here, the amount of Triosyn used represented about a 4.5X increase in relation to the actual amount of iodine that could potentially interact with the carbon (22.7g; calculus based on C2A1 canister where the HEPA media is simply replaced by the TSH down-selected configuration).

[1] ANSI/AAMI/ISO 11137-1994 Sterilization of health care products-Requirements for validation and routine control-Radiation sterilization Annex A Device and packaging materials qualification
[2] Based on the calculation of 7 days at 60°C = 6 months at 25°C.
Therefore 3x7 days at 60°C = 18 days at 25°C

At specific time points, samples were removed from storage (room temperature and heated) and taken to the Toxicology laboratory for testing. Testing of the two components (Triosyn and carbon) was performed to monitor and evaluate any changes in the integrity of these components over time. The Triosyn beads were tested for the iodine percent recovery, whereas the ASZM-TEDA carbon was tested for:

1. Bulk density
2. Percent moisture
3. Percent TEDA
4. Metal content
5. Iodine content (found in the carbon).

Table 4.35 summarizes the acceptable ranges for the tests outline above.

TABLE 4.35: ACCEPTABLE RANGES FOR TRIOSYN BEAD AND ASZM-TEDA CARBON

Iodine Recovery (%)	Density* (g/mL)	Moisture** (%)	TEDA+ (%)	Copper+ (Cu) (% w/w)	Molybdenum+ (Mo) (% w/w)	Silver+ (Ag) (% w/w)	Zinc+ (Zn) (% w/w)
45.6-47.8	0.4 – 0.7	3.7 – 4.7	<4	4 - 6	1 – 3	<0.1	4 -6

Note:
*Method as per ASTM D2867-04
** Method as per ASTM D2854-96
+ Method as per MIL-DTL-32101

Results from control and conditioned testing are presented in Tables 4.36 and 4.37 below. Percent recovery results determined for the Triosyn beads kept at room temperature and 60°C (speed-aged samples) were similar and indicated that exposure to high temperature did not have a measurable effect on the amount of iodine released, as determined by the percent recovery method.

As for the parameters determined for the ASZM-TEDA carbon, they all remained within acceptable range or were only slightly out of range. Most importantly, the results indicated that carbon parameters such as bulk density, percent moisture, and metal contents remained stable over time and were not greatly affected by exposure to the high temperature of 60°C. Although the percent recovery analysis showed that there was minimal iodine release from the Triosyn beads, the actual iodine content measured in the ASZM-TEDA carbon compartment increased from 9550 ppm at 6 months to 27650 ppm iodine at 18 months. An opposite trend was identified for the % TEDA content in the aged ASZM-TEDA carbon, where it decreased over time from 0.6% (6 mos.) to 0.1% (18 mos.). This was not observed for the samples kept at room temperature, where the TEDA content did not vary significantly over time. The decrease in the %TEDA content for the speed-aged samples could be directly related to the parallel increase in the iodine content of the carbon, due to a possible chemical reaction between iodine and TEDA. Additional research is required to confirm this hypothesis.

TABLE 4.36: PARAMETERS DETERMINED AFTER SAMPLES OF TRIOSYN AND ASZM-TEDA CARBON WERE STORED TOGETHER FOR 3 WEEKS AT ROOM TEMPERATURE.

Description	Time	Iodine Rec. (%)	Density (g/mL)	Moisture (%)	Iodine (ppm)	TEDA (%)	Cu (% w/w)	Mo (% w/w)	Ag (% w/w)	Zn (% w/w)
Control ASZM-Lot# N04A21CD	1 wk	46.3	0.621	4.459	BDL	1.6%	6.5	3.7	0.075	7.5
Control Canister 1		47.0	0.610	4.678	3585	1.9%	6.5	3.7	0.006	7.0
Control ASZM - Lot# N04A21CD	2 wks	n/ap	0.592	4.459	n/ap	n/ap	n/ap	n/ap	n/ap	n/ap
Control Canister2		47.0	0.567	4.821	5500	1.3%	6.0	3.5	0.050	6.5
Control ASZM - Lot# N04A21CD	3 wks	n/ap	0.646	4.884	n/ap	n/ap	n/ap	n/ap	n/ap	n/ap
Control Canister 3		46.8	0.624	4.060	1320	1.3%	7.0	3.7	0.055	7.0

TABLE 4.37: PARAMETERS DETERMINED AFTER SAMPLES OF TRIOSYN AND ASZM-TEDA CARBON WERE STORED TOGETHER FOR 3 WEEKS AT 60°C

Description	Time	Aged	Iodine Rec.† (%)	Density* (g/mL)	Moisture** (%)	Iodine†† (ppm)	TEDA+ (%)	Cu+ (% w/w)	Mo+ (% w/w)	Ag+ (% w/w)	Zn+ (% w/w)
Canister 1A	1 wk	6 mos.	45.9	0.623	3.322¤	9550	0.6%	6.5	3.5	0.014	7.0
Canister 1B			45.6	0.628	4.584	10150	0.5%	6.5	3.6	0.006	7.0
Canister 2A	2 wks	12 mos.	47.5	0.592	4.119	12750	0.3%	6.0	3.2	0.030	6.0
Canister 2B			46.3	0.592	4.622	18450	0.3%	6.0	3.4	0.008	6.5
Canister 3A	3 wks	18 mos.	47.1	0.651	4.600	10350	0.2%	6.5	3.7	0.055	7.5
Canister 3B			46.9	0.643	4.320	27650	0.1%	6.5	3.6	0.012	7.0

¤Result slightly out of range

In summary, the results presented above suggest that aging of Triosyn T50 beads with ASZM-TEDA carbon does not lead to significant changes in the properties of the carbon. The only important change noted was a decrease in the %TEDA content over time, which could be explained by possible chemical reaction between TEDA and the iodine released from Triosyn.

4.2.6 ANALYSIS OF THE CHEMICAL PROTECTION CAPABILITY OF THE TRIOSYN FILTER MEDIA

Triosyn-containing media was subjected to chemical vapour analysis to determine its capability to breakdown the imposed chemical challenge. In the past, testing of various Triosynated materials demonstrated that, when compared to a blank sample, there was an increase in agent reduction for the Triosynated media. However, there were often doubts regarding Triosyn's ability in breaking-down

certain chemicals. It has been suggested that the 402-OH resin is the main component that would breakdown chemical agents, regardless of any iodine present.

To evaluate the hypothesis that the 402-OH resin is capable to absorb or breakdown chemical vapours, specific polycotton media was produced for testing, including:

a. polycotton media loaded with 150 gsm Triosyn (actual percent recovery measured, yielded a concentration of: 128.16 gsm ± 30 gsm Triosyn)
b. polycotton media loaded with 80 gsm 402-OH resin only. This concentration was calculated based on the amount of resin that is present in the 150gsm Triosyn cotton media.

In addition, Triosynated HEPA media from the August 2005 Lydall production (containing 68.1 gsm Triosyn;) and the down-selected Triosyn Super HEPA composite consisting of 20-XP Meltblown media containing 10gsm of Triosyn with 50gsm Triosyn on the HEPA material (with and without 800 gsm ASZM carbon media) were tested against blank control media to illustrate the added benefit of Triosyn in breaking-down certain chemical agents. Room temperature and speed aged samples of 36 months (4 weeks at 60°C) were tested using DMMP as challenge, according to MIL-PRF-51560C. Some tests were also performed using Demeton-O as a challenge.

Results from comparative testing performed with polycotton media treated with resin only or 150 gsm Triosyn are presented in Table 4.38 and Figure 4.4. As shown in Table 4.38, the Triosynated polycotton media was able to endure a DMMP chemical challenge of 12,296 min·mg/m^3 compared to the 402-OH resin media, which had a Ct value of 4,746 min·mg/m^3. This represents a 61% difference over the resin itself and clearly demonstrates that, although there is some activity with the 402-OH resin, the iodine in the Triosyn has a major impact on the breakdown of chemical surrogate agents.

TABLE 4.38: COMPARISON OF DMMP VAPOUR CHALLENGE ON POLYCOTTON MEDIA LOADED WITH RESIN ONLY AND WITH 150 GSM TRIOSYN

Polycotton media	DMMP vapor concentration (mg/m^3)	Ct (min·mg/m^3)	% Difference from 402-OH
402-OH	181	4,746	n/ap
150gsm Triosyn	270	12,296	61%

Criteria: ≤10% reduction in effluent vapour measurements

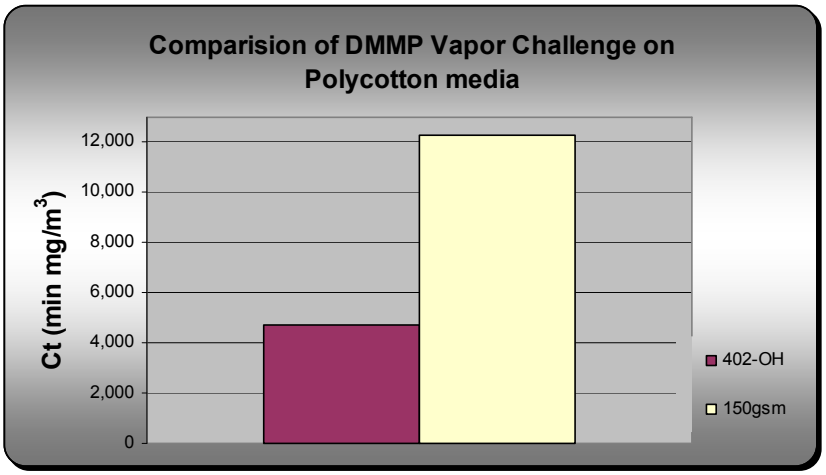


FIGURE 4.4: DMMP VAPOR CHALLENGE ON POLYCOTTON MEDIA

In the second round of testing, Triosynated HEPA materials were tested along with their respective blanks at room temperature and under accelerated aging conditions (4 weeks at 60°C, which is equivalent to 36 weeks at room temperature). Results are presented in Table 4.39 and in Figure 4.5. As seen in previous tests, the samples that contain Triosyn in the filter layer tend to out perform the blank control samples. The Triosyn media stacks kept at room temperature showed a 100% difference over their respective blank counterparts. For the speed-aged samples, it was noticed that the control exhibited some chemical reduction of DMMP, which yielded a % difference of 43% when Triosynated media was compared to the blank. This result was unexpected considering that the other blanks produced no chemical challenge to DMMP.

TABLE 4.39: COMPARISON OF DMMP VAPOUR CHALLENGE ON TRIOSYN FILTER MEDIAS

Media	DMMP vapor concentration (mg/m^3)	Ct ($min \cdot mg/m^3$)	% Difference from Control
Blank HEPA (RT)	180	0	n/ap
68.1gsm HEPA (RT)	182	3,819	100%
Blank HEPA (Heated)	229	4,804	n/ap
68.1gsm HEPA (Heated)	303	8,503	43%
Blank (20XP&HEPA) (RT)	182	0	n/ap
20XP (10gsm Triosyn)&50gsm Triosyn HEPA) (RT)	163	2,110	100%

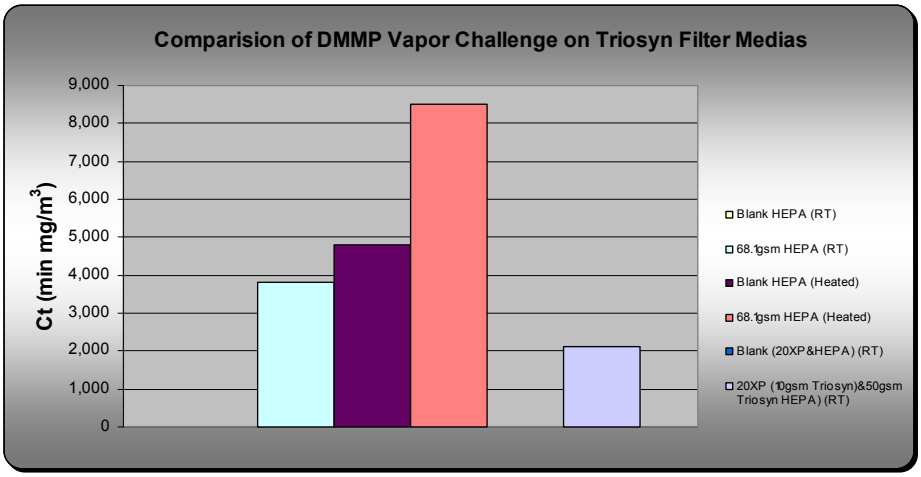


FIGURE 4.5: DMMP VAPOUR CHALLENGE ON TRIOSYN FILTER MEDIAS

The third round of testing involved the same samples tested at round 2 above, but now a layer of 800gsm ASZM-TEDA carbon was added to the Triosyn media stacks. Results presented in Table 4.40 indicated that both at room temperature and under speed aging conditions, the Triosynated material containing 68.1 gsm Triosyn outperformed their respective blanks in terms of breaking-down the DMMP chemical challenge. As for the down-selected Triosyn Super HEPA media stack, results showing the lack of activity for the heated Triosynated samples (Table 4.40) were unexpected and more samples would need to be tested to verify this data.

TABLE 4.40: COMPARISON OF DMMP VAPOUR CHALLENGE ON TRIOSYN FILTER MEDIAS WITH 800GSM CARBON

Media with 800gsm carbon	DMMP vapor concentration (mg/m^3)	Ct ($min \cdot mg/m^3$)	% Difference from Control
Blank HEPA (RT)	329	66,734	n/ap
68.1gsm HEPA (RT)	381	285,358	77%
Blank HEPA (Heated)	349	0	n/ap
68.1gsm HEPA (Heated)	480	77,330	100%
Blank (20XP&HEPA) (RT)	308	0	n/ap
20XP (10gsm Triosyn)&50gsm Triosyn HEPA) (RT)	95.5	129,562	100%
Blank (20XP&HEPA) (heated)	360	0	n/ap
20XP (10gsm Triosyn)&50gsm Triosyn HEPA) (heated)	184	0	0%

The fourth round of testing was performed with demeton-O and included Triosynated HEPA loaded with 68.1 gsm Triosyn and the down-selected Triosyn Super HEPA composite consisting of 20-XP Meltblown media containing 10gsm of Triosyn with 50gsm Triosyn on the HEPA, both tested only at room temperature. Results presented in Table 4.41 and Figure 4.6 show that, although both Triosyn Medias can endure an increased chemical challenge when compared to the controls, the 68.1gsm Triosyn Super HEPA media has a increased capacity to breakdown demeton-O over the down-selected Triosyn Super HEPA composite (36% vs 9% over the control samples).

TABLE 4.41: COMPARISON OF DEMETON-O VAPOUR CHALLENGE ON TRIOSYN FILTER MEDIAS

Media	Demeton-O vapor concentration (mg/m^3)	Ct ($min \cdot mg/m^3$)	% Difference from Control
Blank HEPA (RT)	1.84	158	n/ap
68.1gsm HEPA (RT)	2.16	214	36%
Blank (20XP&HEPA) (RT)	2.25	175	n/ap
20XP (10gsm Triosyn)&50gsm Triosyn HEPA) (RT)	1.66	191	9%

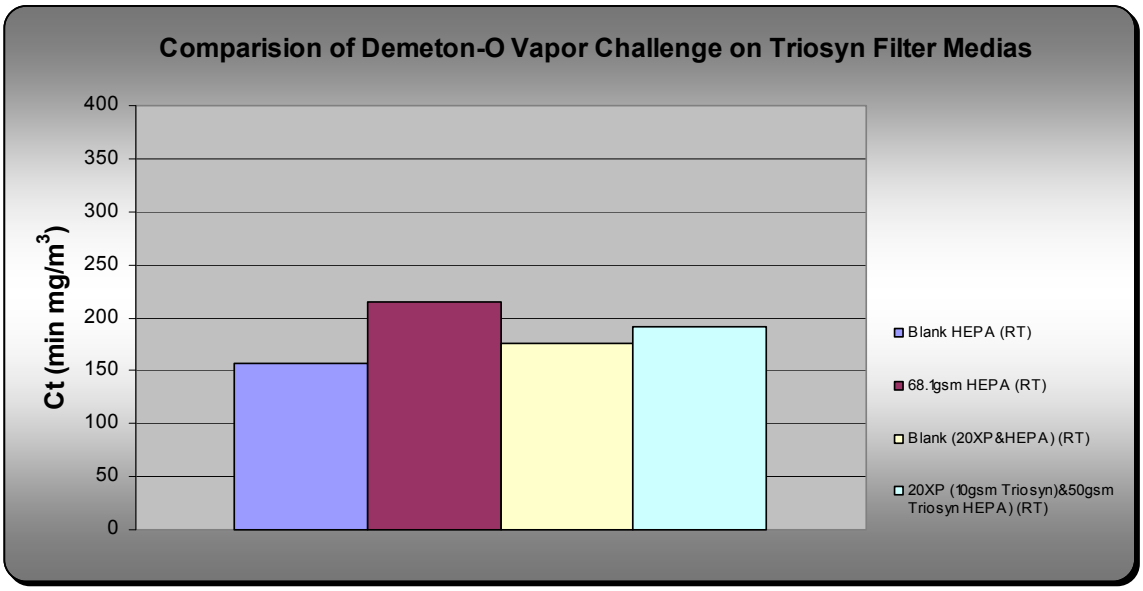


FIGURE 4.6: DMMP VAPOUR CHALLENGE ON TRIOSYN FILTER MEDIAS

In reviewing all the results presented in Tables 4.39 to 4.41, it could be concluded that the addition of Triosyn to any filter media application represents an asset due to Triosyn's demonstrated capability to breakdown chemical surrogate agents such as DMMP and Demeton-O.

4.2.7 DETECTION OF POSSIBLE BY-PRODUCTS OF CHEMICALS EXPOSED TO TRIOSYN POWDER

4.2.7.1 ACQUISITION OF A GC/MS AT TRIOSYN RESEARCH

In order to detect and identify any by-products produced with chemical surrogate agents in contact with Triosyn, it was of great importance to acquire a mass spectrometer (MS). This sort of system is able to detect fragmented species of the chemical in question and identify possible chemical by-products of a reaction. During the last quarter, a gas chromatograph/mass spectrometer (GC/MS) along with a thermal desoption system (for air analysis) was purchased from Griffin Analytical Technologie. As soon as the system was built and approved by Griffin's Quality Assurance Team, two members of the Chemistry Department travelled to West Lafayette, IN for training on the system. This training provided hands on experience on the system and general use of the software provided with the system. Once training was complete (over the course of two days), the GC/MS was shipped to the Mirabel facility for installation.

When the system was set up and ready to use, testing was initiated with the chemicals DMMP and parathion. However, early into testing, numerous problems with the software and hardware appeared and complicated the analysis. Reproducibility of injections was somewhat difficult to maintain since the ion trap filament function was not consistent. Software issues experienced were:

a. program would spontaneously shut down
b. GC/MS system would disconnect from the software
c. generated data is not captured

Hardware issues experienced included:

a. not able to tune (internal calibration) the MS
b. filament would burn out (replaced twice within 1.5 months)
c. Helium leak detected near column
d. experiencing high background noise from blank injections

At first, technical support was provided primarily by phone, but due to the nature of problems experienced, Griffin Analytical Technologies decided to send a technician to the Mirabel facility to help troubleshoot the issues described above. After departure of the technician, problems still arose regarding the filament (somewhat faulty) and the noisy baseline (experiencing high abundance levels of over 1 billion). As per Griffin's instruction, blank injections at a column temperature of 250°C were performed to clean out the system trap. On the third analysis, the baseline detected was decreasing and was below the 1 million abundance level. At this point, an error message came onscreen stating the filament was burnt and needed to be replaced. The front panel was then removed only to discover that there was a flame burning from a cable close to the trap. The power was immediately turned off and the electrical cord removed from the battery power bar. By cutting the power source, the flame went out. The carrier gas was then shut off. Pictures of the damage caused by the small fire were taken and are shown below.

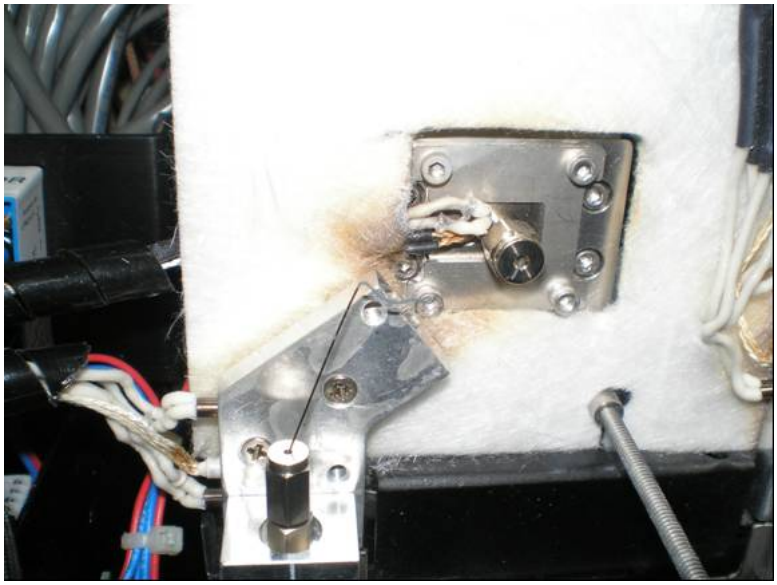


FIGURE 4.7-A: FRONT SHOT OF THE GUARD COLUMN (HALF WAS BURNT)

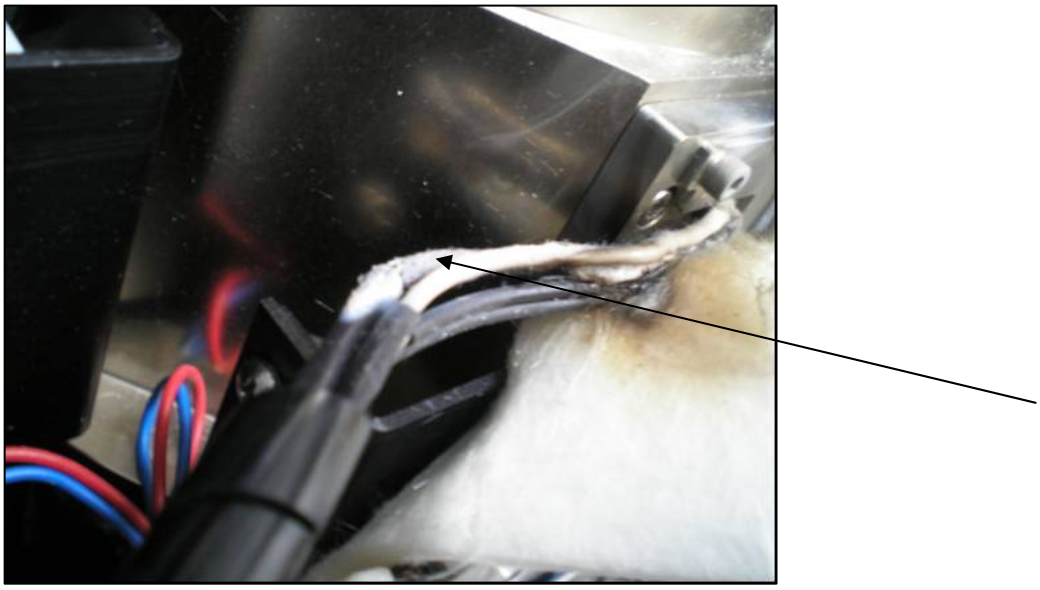


FIGURE 4.7-B: BURNT CABLE WIRE (INDICATED BY THE ARROW)

Griffin Analytical was contacted immediately following this incident and made aware of the current events. Without much discussion, Griffin advised us to send the system back for a full refund.

4.2.7.2 PRELIMINARY TESTING WITH GS/MS SYSTEM

Initial testing on the GC/MS primarily consisted of generating methods for chemical detection of DMMP and parathion (considered a toxic industrial chemical, TIC). Once test methods were well-defined and validated, calibration curves were generated for each chemical to allow for their quantification. Figures 4.8-A and 4.8-B illustrate the two chemicals used (DMMP and parathion).

FIGURE 4.8: MOLECULAR STRUCTURE OF PARATHION AND DMMP

With working methods on hand, it was decided to perform the powder solid/surrogate liquid tests (prepared in methanol) to determine possible by-products produced. Tests consisted of adding 20mL of chemical surrogate agent or TIC solution to 2 grams of powder (Triosyn T50 and 402-OH resin; <50µ). Collections (1mL) of each solution/powder mixture as well as a control sample (no powder) were taken at 60 minutes and 24 hours and filtered prior to injection into the GC/MS. Injected results were then compared to the control sample to determine the percent reduction of the chemical after

interaction with Triosyn powder, and to detect any by-products of this interaction. Results obtained of each chemical are presented in Tables 4.42 and 4.43.

TABLE 4.42: PERCENT REDUCTION OF DMMP FOLLOWING REACTION WITH TRIOSYN T50 POWDER OR RESIN ONLY

Sample	60minutes
	%reduction
Control	-
402-OH	0
T50	57%

Note: 250ng injection made

TABLE 4.43: PERCENT REDUCTION OF PARATHION FOLLOWING REACTION WITH TRIOSYN T50 POWDER OR RESIN ONLY

Sample	60minutes
	%reduction
Control	-
402-OH	22%
T50	28%

Note: 250ng injection made
* injected twice to confirm result

In review of the results for DMMP in contact with T50 powder or resin, it was noted that the 402-OH resin had no effect on the solution, whereas the T50 Triosyn powder was able to reduce the chemical to 57% at 60 minutes. Upon inspection of the spectra generated, no visible peaks (GC) or fragmentation (MS) was noted indicating that no byproducts were formed. It is possible that this lack of peaks was due to the fact that the retention time of the by-products was greater than the method window, therefore no peaks were observed.

As for testing with Parathion, the results showed that the 402-OH resin sample reduced the chemical to 22% after 60 minutes. Triosyn T50 showed a 28% increase in activity compared to the control. Chromatographic analysis detected a compound with a retention time (RT) of 3.3 minutes (parathion RT was 7.7minutes). Based on its spectra analysis at the 60 minute time point, possible compounds (from the software) were found and are listed in Table 4.44.

TABLE 4.44: SPECTRA RESULTS OF POSSIBLE BY-PRODUCTS FROM THE REACTION BETWEEN 402-OH RESIN AND PARATHION

60 minutes
Cyclohexanone, 2-(phenylmethylene)
E-2-Benzlidenecyclohezanone
Sulfadiazine
Benzenamine, 4-phenoxy
Diphenyl sulphide

In the spectral analysis of the parathion solution with the 402-OH resin, diphenyl sulphide was the most likely compound formed. Possible joining and rearrangement of 2 molecules of parathion could form this by-product. This is only a preliminary hypothesis based on information extracted from the MS database software. Much more work would be needed to confirm the configuration in Figure 4.9 which depicts a diphenyl sulfide molecule.

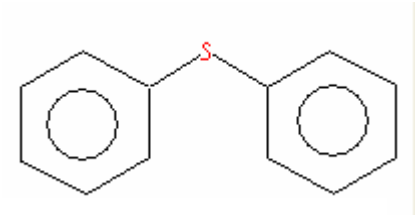


FIGURE 4.9: DIPHENYL SULFIDE

When reviewing the chromatograms obtained from parathion solutions in contact with the T50 powder, it was noted that no peaks were found other than the parathion peak. Thus, even though the quantitative analysis showed that a reduction of parathion occurred, there were no chromatographic peaks or spectra indicating the presence of other species or by-products. As suggested with DMMP, perhaps a byproduct was formed but could not be detected because its retention time was outside of the method window.

In conclusion, results from preliminary GC/MS testing with DMMP and parathion appeared inconclusive. A reduction in the amount of these chemicals was found, but spectral evidence was lacking. Further work is required to refine the test method (for example, increase the time of analysis), in order to fully inspect what is present in the solutions injected. The constant problems and system failures experienced with the GC/MS acquired from Griffin Technologies prevented us from continuing and finalizing the required testing. This work will be concluded when a sound system is obtained at Triosyn Research.

5. REGULATORY PROCESS FOR EPA APPROVAL FOR USE OF TRIOSYN IN HVAC APPLICATIONS

The Triosyn T50 powder has been registered with the U.S. Environmental Protection Agency (EPA) and approved for use in air filters/materials, to the exception of HVAC&R filters, under the treated articles exemption in 40 C.F.R. 152.25(a), which provides an exemption from all requirements of FIFRA (Federal Insecticide, Fungicide and Rodenticide Act) for qualifying articles.

In the light of this exception, in October 2007 a notification was submitted to the U.S. Environmental Protection Agency to add the following indoor, non-food use sites: "*as an additive during the manufacturing process of synthetic and non-woven textile materials used in aquarium filters, vacuum bags and filters, air filters/materials, HVAC&R and other air filters and filter materials, door and floor mats, and outdoor equipment such as awnings, tarpaulins, and portable outdoor shelters. Triosyn® T50 Powder will normally impart protection when added at levels between 12.5% and 45% (wt/wt) of the laminate.*

Not for use in products that come into contact with food. Do not use in or on air ducts, duct fittings, duct liners, fans, supply ducts, return ducts, exhaust ducts, intakes, outlets, louvers, dampers, diffusers, plenums, outdoor air intakes, air handling units, or any other duct work of heating, ventilation, air conditioning, or refrigeration (HVAC&R) systems. **Finished products containing Triosyn® T50 Powder may not make public health claims relating to antimicrobial activity without first obtaining the necessary regulatory approvals."**

The legal basis for this notification to add HVAC&R and other air filters and filter materials to an antimicrobial product was per PR Notice 98-10, PR Notice 2006-A Draft and EPA regulations at 40 CFR 152.46. This notification to amend the current approved label added use sites within an already registered use pattern category for the product (i.e. textile preservatives), and there are no Agency decisions or directives explicitly prohibiting these additions.

Furthermore, no additional data has yet been required for the added non-food since the exposure was not expected to increase, and the dosage, concentration, frequency or method of application are not changed by the notification. Consequently, an approval to amend the label would allow Triosyn® T-50 Powder (EPA Reg. No. 72897-2) to be included as an additive in textile materials to be used in an HVAC&R system. A separate product approval request must be forwarded when claims are made to the final finished product used in the HVAC&R systems, if the claim fall beyond the scope of the treated article exemption as laid down in 40 C.F.R. 152.25(a).

Please refer to Annex 6 for a copy of the documents submitted to the U.S. Environmental Protection Agency (EPA) to support a labelling notification for Triosyn® T-50 Powder (EPA Reg. No. 72897-2), including a cover letter, a copy of the current approved label for the product, a copy of the revised labelling (with changes clearly marked in blue font) and a copy of the new label for approval (clean version).

The final decision by the U.S. Environmental protection Agency (EPA) is expected on this notification to add HVAC&R and other air filters and filter materials to antimicrobial products are expected by the end of first quarter 2008..

6. FIELD EVALUATION OF TRIOSYN ANTIMICROBIAL RESPIRATORS

The Air Force Surgeon General's Modernization Directorate (AF/SGR) has purchased 375,000 T-5000 disposable respirators for evaluation and use. The T-5000 disposable respirator is a commercially-available cup-style filtering facepiece that is NIOSH-approved as a P95 for particulate filtration. The T-5000 incorporates Triosyn antimicrobial resin to offer users increased protection from exposure to disease-causing microorganisms and biological warfare agents.

In order to determine military requirements and ensure compliance of the respirators produced and delivered to the Air Force Surgeon General, Modernization Directorate (AF/SGR), a low rate initial production and initial field demonstration/evaluation were planned to occur during this phase of the program.

As a first step, the military requirements for field evaluation of personnel protective equipment were reviewed and the relevant parameters necessary to assess the general performance of the Triosyn respirators under actual military use were identified and included in a questionnaire and field test plan to be used for data collection. The draft questionnaire and field test plan prepared by Triosyn are attached in Annex 7.

The goal of the proposed effort was to evaluate the T-5000 respirator for use by military field medical personnel by collecting comments from military users wearing the respirator in a real use environment. Their comments would indicate whether the respirator helped these users complete their missions safely. Their responses would also help the manufacturer understand whether certain features could be added or upgraded to improve the comfort, usability, and/or wearability of the respirator for military users.

All available data pertaining to field evaluation can be obtained from the Air Force Research Laboratory Materials and Manufacturing Directorate's Airbase and Environmental Technology Division (AFRL/MLQ).

7 CONCLUSIONS

The deliverables required under the W911NF-05-C-0042 contract are complete with the issuance of this final report.

The major objective of the FY06 research program was to continue the development of the *Triosyn Super HEPA Media* (TSH) and to demonstrate its improved microbial and chemical protection capabilities for IP and CP end-use applications. This material is originated from a manufacturing process where the Triosyn resin is added directly to the glass fiber HEPA mixture to create a filter material which retains HEPA grade performance and provides an enhanced biological protection due to the proven antimicrobial properties of Triosyn.

The advanced development of a HEPA material incorporating Triosyn resin has involved laboratory testing to define the antimicrobial/chemical capability of the material under development. In Engineering, the research was focused on media design and manufacturability. Production runs have been performed, which generated different configurations of the Triosyn HEPA filter material for testing in microbiology and chemistry. Microbiology efforts have focused on testing and validating the antimicrobial performance of the different composites against viral particles, in order to quantify the microbial filtration efficiency of the media under development. Chemistry efforts have been two-fold: (i) to determine the iodine content released from the media into the effluent air so as to ensure that it remains below the acceptable levels as defined by regulatory authorities (ii) to investigate and quantify the efficiency of the Triosyn HEPA media in terms of chemical protection against warfare agents.

A major goal pursued by the Engineering team during FY06 was to produce batches of Triosyn Super HEPA media that displayed the same physical properties and performance as the media manufactured at Lydall in October 2005. Three manufacturing trial runs of different production lots were performed in FY06, which included two runs at Lydall (December 2006 and June 2007), and another performed at an alternative production site (Western Michigan University). The Triosyn Super HEPA produced during these trial runs were subjected to a battery of tests including air resistance (Δp), %penetration (DOP), Viral Filtration Efficiency and iodine release in order to quantify its performance and compare it to previous batches. Results indicated that there was great variation in physical parameters and performance among the different batches, even though the manufacturing process remained essentially the same. Therefore, all validation testing described in this report used blank and Triosynated media produced during the Lydall October 2005 production run, from which the down-selected configuration of Triosyn Super HEPA was originated. This configuration is a two-ply composite, composed of glass fiber HEPA media loaded with 50 g/m^2 200-400 micron Triosyn with a layer of 20 meltblown containing 10 g/m^2 Triosyn.

Engineering efforts were also focused on media pleatability to address previous issues where filter prototypes showed extensive cracking along their creases when pleated. In an attempt to produce stronger media, polyester was used as an additive to improve media flexibility and low heat was applied during pleating. Pleat strength determinations were made during the June 07 production using materials produced with and without the polyester additive. Even though pleat strength increased with the addition of polyester, better pleating characteristics were obtained when both formulations (+/- polyester) were heated during pleating. These results indicated that heating played a key role in improving the pleatability of the TSH under development.

In Microbiology, validation testing of the down-selected configuration of Triosyn Super HEPA was the main focus of the research performed during the last quarter. Below is a summary of the tests performed with their respective findings:

1. Consistency in Viral Filtration Efficiency (VFE): average log reduction of 5.54 ± 0.21 (n=30) for the Triosyn Super HEPA material in comparison to a blank composite which displayed an average log reduction of 4.71 ± 0.07 (n=3). This data validates the consistency in VFE of the TSH media against MS2 coliphage and emphasizes the enhanced performance of the Triosynated material in relation to its blank counterpart.
2. VFE testing at different environmental conditions: results showed that the viral filtration performance of the TSH material remained stable after the media was exposed to various conditions of temperature and relative humidity (Table 3.2).
3. VFE testing in presence of soil-loading agents: pre-loading of the TSH composite with DOP, smoke or dust (at loading levels of 25%, 50%, 75% and 100%) did not significantly affect its viral filtration performance (Tables 3.3, 3.4, and 3.5), as the average log reduction values were similar between soiled and non-soiled materials.
4. Microbial filtration efficiency (MFE) against vegetative bacteria and bacterial spores: the TSH composite media reduced the challenges of *Staphylococcus aureus* and *Bacillus atrophaeus* spores to below detectable levels of penetration at each sampling point, translating to an excess 7.4 log reduction against *Staphylococcus aureus* (Table 3.6A) and an excess 6.0 log reduction against *Bacillus atrophaeus* spores (Table 3.6B).
5. VFE testing against animal virus at standard conditions: when the TSH composite was challenged against Influenza A virus, below detectable levels of penetration were measured in the effluent air, which translates to an excess 4.75 log reduction (Table 3.7).
6. Self-decontamination properties: the ability of the TSH composite to devitalize microorganisms on contact was evaluated against viruses, bacteria, bacterial and fungal spores representatives, and the results showed that contact times as low as 60 minutes were sufficient to reduce the initial challenge of *Staphylococcus aureus* and MS2 coliphage to levels > 99.998%. For *Bacillus atrophaeus* and *Aspergillus niger* spores, after a contact time of 24 hours, initial microbial challenges were reduced to 84.96% and > 99.98%, respectively (Tables 3.8 and 3.9).

In toxicology, validation testing of the down-selected configuration of Triosyn Super HEPA involved measuring the levels of iodine released in the effluent air after the media was exposed to different environmental and soiling conditions. Following exposure to various conditions of temperature and relative humidity, the results indicated that the iodine levels released from TSH media stacked with a carbon backer were consistently low and below the TLV of 1.036 mg/m^3, regardless of the environmental condition tested. In the absence of a carbon backer, the iodine levels were generally above the TLV, which emphasizes the effectiveness of the carbon in absorbing excessive levels of iodine in the effluent air. As expected, the amount of iodine released in the effluent air increased at higher temperatures; however, the same trend was not observed for increased humidity levels.
As per the different soil-loading conditions tested, pre-loading of the TSH composite with DOP, smoke or dust (at loading levels of 25%, 50%, 75% and 100%) did not significantly affect its toxicological profile, as similar iodine release levels were measured for soiled and non-soiled materials.

Validation testing of the down-selected Triosyn Super HEPA composite also involved examining the potential of this material to be used in collective protection end-use applications operating under long-term conditions. A longevity trial was conducted throughout the FY06 program and results indicated that, even after close to 18 months of continuous filtration, the Triosynated filter still provided approximately 2 log better reduction than the non-Triosynated filter when tested against a viral challenge of MS2 coliphage. It is important to mention that this performance was consistently maintained over the course of the entire testing period. In terms of its toxicology performance over time, the iodine levels were shown to be either below the instrument's detection limit (BDL) or slightly above. At the end of this longevity trial it was decided to evaluate the capacity of the filtration media to

kill both viruses and bacteria on contact after being subjected to such lengthy continuous air filtration. To accomplish this, a protocol based on the AATCC 100 Standard was employed and results showed that the Triosynated media retained its ability to self-decontaminate against viral (MS2 coliphage) and bacterial (*Staphylococcus aureus*) challenges even after being subjected to 538 days of continuous air filtration. In Chemistry, iodine content analysis was performed upon completion of the longevity trial and results indicated that there was a maximum decrease of 12% in the Triosyn concentration, in relation to the Triosyn content of the filters at day 0.

Another important goal related to the development of the Triosyn Super HEPA media was to investigate its chemical protection capability against warfare agents. Testing was performed to characterize the performance of the Triosyn Super HEPA material in breaking down chemical surrogates such as: dimethylmethylphosphonate (DMMP) and Demeton-O, using fresh and aged Triosynated media. Results demonstrated that Triosynated HEPA media had an increased breaking-down activity against DMMP and Demeton when compared to blank non-Triosynated materials.
In order to further investigate the reaction between Triosyn and certain chemical agents, a GC/MS system was acquired from Griffin Technologies and installed at Triosyn Research. This equipment was intended to detect and identify any by-products obtained from the reaction between Triosyn and chemical agents and provide a better understanding of the nature of this reaction. Unfortunately, there were numerous technical problems with the GC/MS system received from Griffin Technologies which culminated with a small fire in the system, making it completely unusable. Consequently, only preliminary work was performed with DMMP and parathion (a member of the TIC family), generating inconclusive data. There was evidence that Triosyn powder interacted with these compounds leading to a reduction in their amounts, but no specific by-products of the reaction were identified in the spectral analysis. Further research, along with some methodological changes, would be required in order to obtain more conclusive data.

Additional work in the Chemistry area involved characterizing possible effects of iodine on the ASZM-TEDA carbon. This research was carried out in two major steps, where step # 1 involved exposing the ASZM-TEDA carbon from C2A1 canisters to pure iodine beads in order to achieve maximal loading of the carbon with iodine; and step # 2 where this iodine-loaded carbon was tested for its effectiveness in absorbing chemical surrogate agents. The ultimate goal of these tests was to determine if iodine, the active component of the Triosyn resin, had any detrimental effect on the ability of the ASZM-TEDA carbon to absorb chemical surrogate agents. Results from chemical agent testing of the iodine saturated ASZM-TEDA carbon of C2A1 canisters suggested that an over exaggerated exposure of this carbon to iodine did not adversely affect its chemisorption (HCN) and/or physisorption (DMMP) capabilities. Therefore, it is fair to extrapolate that integration of the Triosyn Super HEPA media into an IP application, such as a canister containing the ASZM-TEDA carbon, would not compromise the function of this carbon in regards to its chemical adsorption capacity.
Work in Chemistry was also performed to determine if iodine had any effects on carbon integrity over time. Triosyn beads were put in contact ASZM-TEDA carbon for 3 weeks under accelerated aging conditions at 60°C, which is equivalent to 18 months at room temperature. Results suggested that aging of Triosyn T50 beads with ASZM-TEDA carbon did not lead to significant changes in the properties of the carbon, as determined by measuring its bulk density, percent moisture and metal content (zinc, copper, molybdenum and silver). The only important changes noted included a decrease in the %TEDA content, which was parallel to an increase in the iodine content of the carbon. These quantitative changes could be explained by a reaction between the iodine released from Triosyn and TEDA.

In conclusion, the objectives set out for the FY06 research program were achieved and resulted in a mature Triosyn Super HEPA filter material. More specifically, a manufacturing process to incorporate Triosyn particles to glass fiber HEPA was developed to produce a material which maintained standard

HEPA performance but also displayed enhanced antimicrobial and chemical protection properties due to the presence of Triosyn. The antimicrobial performance of this media was consistently demonstrated under a variety of testing conditions and following exposure to different microbial challenges. The safety profile of the Triosynated material was also well-defined as measured by the iodine levels released in the effluent air under several exposure conditions. Finally, the chemical protection capability of the TSH was demonstrated following exposure of the media to surrogates of chemical warfare agents and potential incompatibilities originated from adverse interactions between iodine and the ASZM-TEDA carbon were investigated. This advanced TSH filter material is now ready for the next research steps which involve prototype designing for insertion into various individual and collective protection end-use applications.

8 ANNEX 1 MICROBIOLOGICAL METHODS AND MATERIALS

8.1 METHODS FOR PREPARATION OF MATERIALS

8.1.1 MS2 SPECIALIZED MEDIA

Tryptone	10.0 g
Yeast extract	5.0 g
Sodium chloride	10.0 g
Purified water	1.0 L

Dissolve all components in the purified water. Add a stir bar and mix thoroughly. Adjust pH at 7.2 ± 0.2 (at 25°C). Sterilize in the autoclave for 15 minutes at 121°C. Store at 4°C ± 2°C for up to 2 months.

8.1.2 MS2 MEDIA

Tryptone	10.0 g
Yeast extract	1.0 g
Sodium chloride	8.0 g
Glucose	1.0 g
Magnesium chloride 1M	1.0 mL
Thiamine 10.0 mg/mL	1.0 mL
Purified water	1.0 L

Dissolve all components, except thiamine and magnesium chloride, in the purified water. Add a stir bar and mix thoroughly. Adjust pH at 7.2 ± 0.2 (at 25°C). Sterilize in the autoclave for 15 minutes at 121°C. Prepare the thiamine and $MgCl_2$ solutions and filter them through separate 0.22 μm filter apparatus. Under aseptic conditions, add 1mL of the thiamine solution and 1 mL of $MgCl_2$ 1M to the autoclaved solution and mix.

Store at 4°C ± 2°C for up to 2 months. For utilization, add 1.0 g of agar per 100 mL of the mixture. Boil and dispense in sterile centrifuge tube. Keep at 50°C in a water bath.

8.1.3 PHOSPHATE BUFFER SALINE (PBS)

8.1.3.1 STOCK SOLUTION (10X)

Potassium phosphate monobasic	1.8 g
Potassium phosphate dibasic	15.2 g
Sodium chloride	85.0 g
Purified water	1,0 L

Dissolve all components in the purified water. Add a stir bar and mix thoroughly. Adjust pH at 7.2 ± 0.2 (at 25°C). Sterilize in the autoclave for 15 minutes at 121°C.

8.1.3.2 WORK SOLUTION (1X)

Using purified water, dilute the 10X stock solution to 1:10. Adjust pH at 7.2 ± 0.2 (at 25°C). Sterilize in the autoclave for 15 minutes at 121°C. Store at 4°C ± 2°C for up to 2 months.

8.1.3.3 PBS 0,001% ANTIFOAM A

To 1,0 litre of 1X work solution, add 0.01 mL (10 µl) of antifoam A. Adjust the pH to 7.2 ± 0.2. Sterilize in the autoclave for 15 minutes at 121°C. Store at 4°C ± 2°C for up to 2 months.

8.1.4 PLATE COUNT BROTH (MPCB)

The plate count broth is a non-selective general-purpose medium for determining bacterial counts using the membrane filtration procedure.

Yeast Extract	5.0 g
Tryptone	10.0 g
Dextrose	2.0 g
Purified water	1.0 L

Dissolve all components in the purified water. Add a stir bar and mix thoroughly. Adjust pH at 7.0 ± 0.2 (at 25°C). Sterilize in the autoclave for 15 minutes at 121°C. Store at 4°C ± 2°C for up to 2 months.

8.1.5 TRYPTICASE SOYA BROTH (TSB)

The trypticase soya broth is a general medium used for cultivating a variety of fastidious and non-fastidious microorganisms.

Pancreatic digest casein	17.0 g
Soymeal peptone	3.0 g
D(+)- glucose	2.5 g
Sodium chloride	5.0 g
Dipostassium phosphate	2.5 g
Purified water	1.0 L

Dissolve the appropriate amount of dehydrated medium in the water. If necessary, warm slightly to dissolve completely. When solution temperature is at 25°C, adjust pH to 7.3 ±0.2. Sterilize in the autoclave for 15 minutes at 121°C. Store at 4°C ± 2°C for up to 2 months.

8.1.6 TRYPTICASE SOYA AGAR (TSA)

The trypticase soya agar is a general medium used for cultivating a variety of fastidious and non-fastidious microorganisms.

Pancreatic digest casein	17.0 g
Soymeal peptone	3.0 g
D(+)- glucose	2.5 g
Sodium chloride	5.0 g
Dipostassium phosphate	2.5 g
Agar	15.0 g
Purified water	1.0 L

Dissolve the appropriate amount of dehydrated medium in the water. If necessary, warm slightly to dissolve completely. When solution temperature is at 25°C, adjust pH to 7.3 ±0.2. Sterilize in the autoclave for 15 minutes at 121°C. Dispense in Petri dishes. Store at 4°C ± 2°C for up to 2 weeks.

8.1.7 SPORULATION AGAR

Nutrient Broth	8.0 g
Plate Count Agar	22.5 g
Agar	1.0 g
Manganese sulfate	0.3 g
Purified water	1.0 L

Dissolve the appropriate amount of dehydrated medium in the water. If necessary, warm slightly to dissolve completely. When solution temperature is at 25°C, adjust pH to 6.6 ±0.2. Sterilize in the autoclave for 15 minutes at 121°C. Dispense in Petri dishes. Store at 4°C ± 2°C for up to 2 weeks.

8.1.8 POTATO DEXTROSE AGAR (PDA)

Potato dextrose agar is a general purpose medium used for cultivating yeasts and molds.

Potatoes infusion	200 g
Dextrose	20 g
Agar	15 g
Purified water	1.0 L

Dissolve the appropriate amount of dehydrated medium in the water. If necessary, heat to boiling to dissolve completely. Sterilize in the autoclave for 15 minutes at 121°C. When solution has cooled down, adjust the pH to 3.5 ± 0.1 with the amount of sterile 10% tartaric acid specified on the label. Dispense in Petri dishes. Store at 4°C ± 2°C for up to 2 weeks.

8.1.9 Complete Growth Medium (Influenza)

Complete growth medium is a general cell culture medium intended for mammalian cells seeding and culturing.

Dulbecco's Modified Eagles Medium (DMEM) High Glucose (L-glutamine and L-glucose) with sodium and pyruvate
Fetal Bovine Serum (FBS)
Penicillin/Streptomycin

Supplement DMEM with 10% heat inactivated (45 min at 56°C) FBS and 1% Penicillin/Streptomycin.

8.1.10 Infection Medium (Influenza)

Infection medium is a specific medium used for infection of MDCK cells with influenza virus.

DMEM High Glucose (L-glutamine and L-glucose) with sodium and pyruvate
Bovine Serum Albumin (BSA)
Penicillin/Streptomycin

Supplement DMEM with 0.3% BSA and 1% Penicillin/Streptomycin.

8.1.11 Overlay Agar (Influenza)

Seaplaque low melting point agar
Purified water
2X Infection Medium (Influenza)
TPCK-trypsin (tosylphenylalanylchloromethane treated trypsin)

Prepare and autoclave 2% seaplaque agar in purified water, then place in 37-42°C water bath for at least 20 min (if using previously prepared agar, melt in microwave, but avoid excessive microwaving, just enough to melt, and do not use agar that has been microwaved more than twice).
Prepare the 2X Infection medium by supplementing DMEM with twice the normal final concentration of BSA (0.6%) and Penicillin/Streptomycin (2%). Warm to 37-42°C in water bath.
Mix equal volumes of 2X Infection medium and seaplaque agar: final concentration of the mixture should be 1% seaplaque agar, 1X Infection medium. Add TPCK-trypsin to a final concentration of 1µg/ml.

8.2 PREPARATION OF TEST MICROORGANISMS

8.2.1 PREPARATION OF STOCK SUSPENSION OF MS2 COLIPHAGE

8.2.1.1 REAGENTS AND MATERIALS

- *Escherichia coli* ATCC 15597
- MS2 coliphage ATCC 15597-B1
- TSB (trypticase soya broth) as described in section 6.1.5
- MS2 specialized media as described in section 6.1.1
- Lysozyme
- EDTA 0,5 M
- Chloroform
- Stirring plate
- Incubator at 35°C

8.2.1.2 METHODS

1. The propagating host of coliphage MS2 is *Escherichia coli* (ATCC 15597), which is rehydrated in 10 mL of trypticase soya broth (TSB), followed by overnight incubation at 35°C ± 0.5 °C. 50 mL of the specialized MS2 media is spiked with this fresh strain and incubated overnight at 35°C ± 0.5 °C.

2. In a fernbach, the 50 mL culture is added to 500 mL of the same specialized MS2 media to which 2 mL of 1M $CaCl_2$ were added.

3. The fernbach is incubated at 35°C ± 0.5 °C with shaking for 3 hours.

4. 1.5 mL of coliphage MS2 is added to this log phase culture broth and placed in the 35°C incubator with constant shaking for an overnight incubation.

5. 0.5 mL of lysozyme per liter of media is added and incubated with shaking for 30 minutes. 1.0 mL of 0.5M EDTA and 1 mL of chloroform are added in the fernbach, which is then incubated for an additional 30 min.

6. The suspension is centrifuged for 60 min. at 800 RPM. The supernatant is then transferred and results in a titer of 10^{10}-10^{11} plaque forming units per mL (PFU/mL). The suspension is stored at 4.0 ± 2.0 °C until required.

8.2.2 PREPARATION OF FRESH SUSPENSION OF *STAPHYLOCOCCUS AUREUS* BACTERIA

8.2.2.1 REAGENT AND MATERIALS

- *Staphylococcus aureus* ATCC 6538
- TSB (trypticase soya broth) as described in section 6.1.5
- PBS (work solution) as described in section 6.1.3.2
- Stirring plate
- Incubator at 37ºC

8.2.2.2 PROCEDURE

1. *Staphylococcus aureus* ATCC 6538 is inoculated in 250 mL of trypticase soya broth (TSB) from an 18-24h culture on trypticase soya agar (TSA).

2. Under moderate agitation, the *Staphylococcus aureus* suspension is incubated overnight at 37ºC ± 0.5°C.

3. The bacterial culture is then centrifuged at 1100 RPM for 20 minutes.

4. The supernatant is removed and the suspension washed using 100 mL of phosphate buffer saline (PBS).

5. Repeat step 3 and finally wash the suspension using 100 mL of sterile ultra purified water (in order to avoid foaming in the suspension).

6. Vortex.

7. Prepare a fresh suspension daily.

8.2.3 PREPARATION OF STOCK SUSPENSION OF *BACILLUS ATROPHAEUS* SPORES

8.2.3.1 REAGENTS AND MATERIALS

- *Bacillus atrophaeus* ATCC 9372
- TSB (trypticase soya broth) as described in section 6.1.5
- Sporulation media as described in section 6.1.7
- Stirring plate
- Incubator at 37ºC

8.2.3.2 METHODS

1. Spores of *Bacillus atrophaeus* (ATCC 9372) are produced by rehydration in 10mL of trypticase soya broth (TSB) and incubation at 35°C ± 0.5°C for five days. 0.1mL of this suspension (containing vegetative cells) is transferred and spread on a specialized sporulating medium.

2. These cultures are incubated at 35°C ± 0.5°C for five days, after which the cells are collected in sterile water. The resulting suspension is heated at 80°C ± 2.0°C for 30 minutes in order to select only spores.

3. Titer of the stock suspension should be within the range of 10^9 CFU/mL. The suspension is stored at 4.0°C ± 2.0°C until required.

8.2.4 PREPARATION OF STOCK SUSPENSION OF *ASPERGILLUS NIGER* SPORES

8.2.4.1 REAGENTS AND MATERIALS

- *Aspergillus niger* ATCC 16404
- PDA (potato dextrose agar) as described in section 6.1.8
- Sterile 0.5% saline solution with 0.05% of Triton X-100
- Glass beads
- Sterile glass wool
- Incubator at 25ºC

8.2.4.2 METHODS

1. At least 10 PDA plates are inoculated with *Aspergillus niger* (ATCC 16404) and incubated at 25°C ± 0.5°C for seven to ten days.

2. 10 ml of a sterile 0.5% saline solution with 0.05% of Triton X-100 is added to each plate, and the surface of the culture gently scraped with a platinum wire to liberate the conidial spores. The liquid is then slightly agitated and gently decanted in a flask containing a few glass beads.

3. The mold suspension is vigorously shaken to break up any clumps of spores and filtered through a thin layer of sterile glass wool.

4. Titer of the stock suspension should be within the range of 10^8 CFU/ml. The suspension is stored at 4.0°C ± 2.0°C for up to 4 weeks.

8.2.5 PREPARATION OF STOCK SUSPENSION OF INFLUENZA VIRUS

8.2.5.1 REAGENTS AND MATERIALS

- MDCK cell line ATCC CRL-34
- Influenza A/PR/8/34 virus – tissue culture adapted H1N1 ATCC VR-1469
- Complete Growth Medium as described in section 6.1.9
- Infection Medium as described in section 6.1.10
- Phosphate Buffer Saline (PBS) 1X without calcium and magnesium
- Trypsin-EDTA (0.25% trypsin, 2.21mM EDTA)
- TPCK-trypsin (tosylphenylalanylchloromethane treated trypsin)
- 175-cm^2 flasks
- 6-well plates
- Haemocytometer with cover glass
- Cryopreservation vials (2mL)
- 50mL conical centrifuge tubes
- 12-channel multi-pipette
- CO_2 tank and regulator
- 37°C incubator with 5% CO_2
- -80°C freezer or liquid nitrogen storage tank
- Inverted microscope
- Centrifuge

8.2.5.2 METHOD FOR SEEDING MDCK CELLS

1. Aspirate culture medium from stock culture of MDCK cells.

2. Briefly rinse the cell layer with PBS to remove all traces of serum (which contains Trypsin inhibitor).

3. Add 2.0mL of Trypsin-EDTA solution to flask and return to 37°C incubator for 2 to 5 minutes. Occasionally observe cells under an inverted microscope until cell layer is dispersed.

   Note: to avoid clumping, do not agitate the cells by tapping or shaking the flask while waiting for the cells to detach.

4. Add 6.0 to 8.0mL of Complete Growth medium and resuspend cells by gently pipetting.

5. Count cells using the Haemocytometer, dilute to desired density in Complete Growth medium, and add appropriate aliquots of the cell suspension to new culture vessels. Typically, a density of 2 x 10^5 cells/mL should result in a near-confluent monolayer (desirable for infection) in 1-2 days. Adjust the number of seeded cells as needed.

6. Seed 6-well plate with ~3 x 10^6 cells/plate or 1:4 split for 175-cm2 flask.

   Note: 6-well plates should be plated for test purposes only.

7. Incubate 6-well test plates at 37°C, 5% CO_2.

8.2.5.3 METHOD FOR INFECTION (PROPAGATING INFLUENZA VIRUS IN MDCK CELLS)

1. Aspirate culture medium from 175-cm2 flasks containing semi-confluent (70-90%) monolayers of MDCK cells.

2. Wash the monolayer with Infection medium to remove all traces of serum.

3. Inoculate each flask with 7mL of influenza virus stock (stock titer ~10^7 PFU/mL) diluted 1:1000 in Infection medium. This amount of virus should result in a multiplicity of infection (MOI) which should minimize the formation of defective interfering virus particles.

4. Spread the inoculum evenly over the monolayer by gentle rocking of the flask.

5. Incubate for 60 min at 37°C, 5% CO_2 to allow for virus adsorption with gentle rocking every 15 min.

6. Add an additional 13mL of Infection medium supplemented with TPCK-trypsin to give a final concentration of 1µg/mL. Incubate at 37°C, 5% CO_2.

7. Monitor for CPE using an inverted microscope. Usually, 36-48 hours is sufficient to obtain nearly 100% of cells exhibiting CPE caused viral replication. At this point, the viral preparation is ready to be harvested.

8.2.5.4 METHOD FOR HARVESTING INFLUENZA VIRUS FROM MDCK CELLS

1. Within 36-48 hours post infection, nearly 100% of each virus-inoculated monolayer should show cell rounding/cytopathic effect (CPE).

2. Collect the supernatant of flasks and dispense the cell suspension into 500mL conical tubes (~35mL per tube). Do not fill past the 40mL mark as these tubes may be frozen and contents will expand.

3. Pellet cell debris by centrifugation at 3,000 rpm for 15 minutes at 4°C.

4. Collect the virus-containing supernatant in a new conical tube.

5. Optional: concentrate virus stock by filtering through 0.45µm membrane to remove particulates followed by centrifugation using a Centricon Plus-80, 100 kDa cutoff (Millipore) at approximately 2000 x *g*, 4°C until desired volume is obtained.

6. Dispense appropriate aliquots into cryopreservation vials (or in conical tubes for larger volumes) and store them at -80°C or in liquid nitrogen.

8.2.5.5 METHOD FOR CONCENTRATING INFLUENZA VIRUS BY ULTRACENTRIFUGATION

1. **Materials needed**:
    - Ultracentrifuge
    - Beckman Swinging Bucket Rotor SW 40 (or preferable SW 28)
    - Beckman Ultra-clear Centrifuge Tubes 14X89 mm
    - 25% Sucrose solution

2. Add 7mL crude concentrate to a centrifuge tube.

3. Carefully add 1mL 25% sucrose to the bottom of the centrifuge tube.

4. Add an additional 4mL crude concentrate to centrifuge tube bringing the total volume to 12mL.

5. Repeat for all tubes. Ensure all tubes have equal volumes thus equal weights.

6. Place centrifuge tubes into buckets, than mount buckets on rotors an place in ultracentrifuge.

7. Spin at 12500 RPM for 2 hours. Pellet virus by centrifugation at 27000 *g*).

8. Aspirate supernatant leaving only the pellet and residual medium.

9. Re-suspend in desired medium, typically PBS (one-tenth the original volume), and store at -80°C.

8.3 PROCEDURES FOR ASSAYING TEST MICROORGANISMS

8.3.1 PROCEDURE FOR ASSAYING MS2 COLIPHAGE

8.3.1.1 APPARATUS AND REAGENTS

- MS2 media as described in section 6.1.2
- PBS (work solution) as described in section 6.1.3.2
- Borosilicate tubes
- Sterile 15mL centrifuge tubes
- Serological pipettes
- 100mm disposable petri dishes
- Water bath

8.3.1.2 PROCEDURE

1. Inoculate MS2 media with *Escherichia coli* ATCC 15597 strain or any other suitable *E.coli* strain that may act as an MS2 host, and incubate for approximately four hours at 37°C± 0.5°C with shaking.

2. Add 1% of agar to MS2 media (in liquid state), heat to boiling and dispense into sterile 15mL centrifuge tubes. Place tubes in a water bath and maintain at 50°C ± 5°C.

3. Use new/sterile empty 100mm disposable petri dishes kept at ambient temperature.

4. Add equal volumes (e.g., 1000 µl) of the *E. coli* culture and the MS2 suspension sample diluted in PBS buffer to the liquid MS2 media. Mix the centrifuge tube by double inversion.

5. Fill each petri dish with the solution prepared in step 4 and gently swirl. This ensures complete mixing of the host and coliphage and eliminates dry spots in the petri dishes.

6. Allow overlay media to solidify at room temperature (as this is a soft agar 1%, care should be taken not to disturb the plates with any violent agitations).

7. Incubate plates at 35.0°C± 0.5°C, right side up for an overnight incubation.

8. Positive and negative controls are required at the beginning and end of each trial/sample set. This will provide evidence of host contamination and host susceptibility to the MS2 coliphage. Negative controls are prepared by pouring 1000 µl of host only in an empty/sterile 100mm petri dish and filling with overlay media (see step 5-6). Positive controls are prepared the same manner as negative controls, with the exception that a drop of undiluted sample of MS2 stock (approximately 10µl) is carefully added to the liquid MS2 media. Proceed with steps 5, 6, 7 and 8 as indicated above. Negative controls should be checked for a confluent lawn and lack of viral growth. Positive controls should be checked for lawn confluence and lysis.

9. The Plaque Forming Units (PFU) per mL is equal to the average number of the countable plaques (25-250 PFU) multiplied by the appropriate number to arrive at one (1) milliliter. For example, if the average number of countable plaques is 118 at 10^{-8} dilution and 1000µl of sample was assayed, then the calculation would be 118 x 10^{8} x 1 (1 x 1000 µl = 1mL) for a titer of 1.18 x 10^{10} PFU/mL. *The sensitivity of the method is equivalent to 1 PFU/mL.

8.3.2 PROCEDURE FOR ASSAYING *STAPHYLOCOCCUS AUREUS*

8.3.2.1 APPARATUS AND MATERIALS

TSA plates as described in section 6.1.6.
PBS (work solution) as described in section 6.1.3.2
Glass bacteria spreader
Serological pipettes
Borosilicate tubes

8.3.2.2 PROCEDURE

1. Inoculate TSA plates with 0.2mL of the bacteria suspension diluted in PBS buffer.
2. Spread the inoculum gently on the agar surface with a glass bacteria spreader, until the inoculum is completely absorbed.
3. Incubates plates, right side up, at 35.0°C± 0.5°C for 48h.
4. Record the number of colonies formed on the plates.
5. Calculate the number of bacteria in the suspension.

*The sensitivity of the method is equivalent to 25 CFU/mL.

8.3.3 PROCEDURE FOR ASSAYING *BACILLUS ATROPHAEUS* SPORES

8.3.3.1 APPARATUS AND MATERIALS

TSA plates as described in section 6.1.6.
PBS (work solution) as described in section 6.1.3.2
Glass bacteria spreader
Serological pipettes
Borosilicate tubes

8.3.3.2 PROCEDURE

1. Inoculate TSA plates with 0.2mL of the spore suspension diluted in PBS buffer.
2. Spread the inoculum gently on the agar surface with a glass bacteria spreader, until the inoculum is completely absorbed.
3. Incubates plates, right side up, at 35.0°C± 0.5°C, overnight.
4. Record the number of colonies formed on the plates.

5. Calculate the number of bacterial spores in the suspension.

*The sensitivity of the method is equivalent to 25 CFU/mL.

8.3.4 PROCEDURE FOR ASSAYING *ASPERGILLUS NIGER* SPORES

8.3.4.1 APPARATUS AND MATERIALS

PDA plates as described in section 6.1.8.
PBS (work solution) as described in section 6.1.3.2
Glass bacteria spreader
Serological pipettes
Borosilicate tubes

8.3.4.2 PROCEDURE

1. Inoculate PDA plates with 0.2ml of the spore suspension diluted in PBS buffer.

2. Spread the inoculum gently on the agar surface with a glass bacteria spreader, until the inoculum is completely absorbed.

3. Incubates plates, right side up, at 25.0^{o}C± 0.5^{o}C, for 72h ± 2h.

4. Record the number of colonies formed on the plates.

5. Calculate the number of bacterial spores in the suspension.

*The sensitivity of the method is equivalent to 25 CFU/ml.

8.3.5 PROCEDURE FOR ASSAYING INFLUENZA VIRUS

8.3.5.1 APPARATUS AND MATERIALS

Infection Medium as described in section 6.1.10.
Agar Overlay as described in section 6.1.11
6-well plates
Serological pipettes

8.3.5.2 PROCEDURE

1. Seed 6-well plates 2 days in advance according to the procedure described in section 6.2.5.2.

2. Prepare serial 10-fold dilutions from 10^{-1} to 10^{-5} of influenza virus in infection medium.

3. Wash monolayer in with 1mL of infection medium per well.

4. Remove wash and add 300µL of virus dilution per labeled well. Generally, 10^{-3} to 10^{-5} dilutions are plated in duplicate to fill up one plate.

5. Incubates plates at 37°C, 5% CO_2 for 1 hour with gentle agitation every 10-15 minutes to redistribute the inoculum.

6. During this one-hour incubation period, prepare the agar overlay as described in section 6.1.11 (make enough to dispense 3mL per well)

7. Remove the inoculum from each well by aspiration and gently add 3mL of agar overlay per well.

8. Allow agar to solidify in the biological safety cabinet with lids ajar on plates.

9. Once agar is solidified, invert plates and place in 37°C, 5% CO_2 incubator for 3 to 5 days.

10. Reading the plaque assay results: plaques can be read in plate as is – by varying contrast against a light source they can be seen through bottom of the plate. Typically, this can be done 3 days post infection. Unlike lytic viruses which ultimately lyse the host cell, influenza virus is released from the cell membrane by a budding process to acquire a lipid membrane in the process. Therefore, infected cells are not generally lysed by influenza virus and hence plaques appear as aberrations (white spots) in the cell monolayer rather than as zone of complete clearing.

8.4 METHOD FOR DETERMINATION OF CHALLENGE NUMBER OF TEST MICROORGANISMS

8.4.1 METHOD FOR DETERMINATION OF CHALLENGE NUMBER OF MS2 COLIPHAGE

8.4.1.1 PRINCIPLE

The challenge number of MS2 coliphage is determined by either the collection of the air passing through an empty filter holder in the impingement samplers when tested in the aerosolizing chamber test apparatus, or the collection of the air before the AFM in the impingement samplers when tested in the HVAC high-speed ventilation system. The viral challenge is determined for each run of tests.

8.4.1.2 APPARATUS AND MATERIALS

Aerosolizing chamber test apparatus, described in Annex 2.
MS2 media as described in section 6.1.2.
PBS (work solution) as described in section 6.1.3.2.
PBS 0,001% antifoam A as described in section 6.1.3.3.

8.4.1.3 PROCEDURE

1. The test apparatus is to be designed and run following the description in Annex 2.

2. Collect the viruses in the impingers containing PBS 0.001% antifoam A. The flow rate and the sampling intervals are to remain the same as that for the number of MS2 coliphage passing through the AFM.

3. Perform serial dilution of the collecting buffer in order to obtain 25 PFU to 250 PFU per MS2 agar plate.

4. Assay the resulting suspensions as per section 6.3.1.

5. Calculate and record the concentration of the MS2 coliphage challenge.

6. If the challenge number of coliphage is < 10^4 PFU, the test is not valid.

8.4.2 METHOD FOR DETERMINATION OF CHALLENGE NUMBER OF *STAPHYLOCOCCUS AUREUS*

8.4.2.1 PRINCIPLE

The challenge number of *Staphylococcus aureus* is determined by either the collection of the air passing through an empty filter holder in the impingement samplers when tested in the aerosolizing chamber test apparatus, or the collection of the air before the AFM in the impingement samplers when tested in the HVAC high-speed ventilation system. The bacterial challenge is determined for each run of tests.

8.4.2.2 APPARATUS AND MATERIALS

Aerosolizing chamber test apparatus, described in Annex 2.
TSA plates as described in section 6.1.6.
PBS (work solution) as described in section 6.1.3.2
PBS 0,001% antifoam A as described in section 6.1.3.3

8.4.2.3 PROCEDURE

2. The test apparatus is to be designed and run following the description in Annex 2.

3. Collect the bacteria in the impingers containing PBS 0.001% antifoam A. The flow rate and the sampling intervals are to remain the same as that for the number of *Staphylococcus aureus* passing through the AFM.

4. Perform serial dilution of the collecting buffer in order to obtain 25 CFU to 250 CFU per TSA plate.

5. Assay the resulting suspensions as per section 6.3.2.

6. Calculate and record the concentration of the *Staphylococcus aureus* challenge.

7. If the challenge number of bacteria is < 10^3 CFU, the test is not valid.

8.4.3 METHOD FOR DETERMINATION OF CHALLENGE NUMBER OF *BACILLUS ATROPHAEUS* SPORES

8.4.3.1 PRINCIPLE

The challenge number of *Bacillus atrophaeus* spores is determined by either the collection of the air passing through an empty filter holder in the impingement samplers when tested in the aerosolizing chamber test apparatus, or the collection of the air before the AFM in the impingement samplers when tested in the HVAC high-speed ventilation system. The sporicidal challenge is determined for each run of tests.

8.4.3.2 APPARATUS AND MATERIALS

Aerosolizing chamber test apparatus, described in Annex 2.
TSA plates as described in section 6.1.6.
PBS (work solution) as described in section 6.1.3.2
PBS 0,001% antifoam A as described in section 6.1.3.3

8.4.3.3 PROCEDURE

1. The test apparatus is to be designed and run following the description in Annex2.

2. Collect the bacterial spores in the impingers containing PBS 0.001% antifoam A. The flow rate and the sampling intervals are to remain the same as that for the number of *Bacillus atrophaeus* spores passing through the AFM.

3. Perform serial dilution of the collecting buffer in order to obtain 25 CFU to 250 CFU per TSA plate.

4. Assay the resulting suspensions as per section 6.3.3.

5. Calculate and record the concentration of the *Bacillus atrophaeus* spores challenge.

6. If the challenge number of spores is < 10^3 CFU, the test is not valid.

8.4.4 METHOD FOR DETERMINATION OF CHALLENGE NUMBER OF INFLUENZA VIRUS

8.4.4.1 PRINCIPLE

The challenge number of influenza virus is determined by the collection of the air passing through an empty filter holder in the impingement samplers when tested in the aerosolizing chamber test apparatus. The viral challenge is determined for each run of tests.

8.4.4.2 APPARATUS AND MATERIALS

Aerosolizing chamber test apparatus, described in Annex 2.
Dulbecco's Modified Eagle Medium (DMEM) supplemented with 1% Penicillin / Streptomycin
Infection Medium as described in section 6.1.10.
Agar Overlay as described in section 6.1.11

8.4.4.3 PROCEDURE

1. The test apparatus is to be designed and run following the description in Annex2.

2. Collect the viruses in the impingers containing DMEM 1% Pen/Strep. The flow rate and the sampling intervals are to remain the same as that for the number of influenza virus passing through the AFM.

3. Perform serial dilution of the collecting buffer in order to obtain 25 PFU to 250 PFU per well.

4. Assay the resulting suspensions as per section 6.3.5.

5. Calculate and record the concentration of the influenza virus challenge.

If the challenge number of viruses is < 10^3 PFU, the test is not valid.

8.5 METHOD FOR DETERMINATION OF THE NUMBER OF TEST MICROORGANISMS PASSING THROUGH THE AFM.

8.5.1 METHOD FOR DETERMINATION OF THE NUMBER OF MS2 COLIPHAGE PASSING THROUGH THE AFM.

8.5.1.1 PRINCIPLE

The number of MS2 coliphage passing through the AFM, is determined by the collection of the air passing through the AFMs in the impingement samplers. This number is determined for each AFM tested.

8.5.1.2 APPARATUS AND MATERIALS

Aerosolizing chamber test apparatus, described in Annex 2.
MS2 media as described in section 6.1.2.
PBS (work solution) as described in section 6.1.3.2

PBS 0.001% antifoam A as described in section 6.1.3.3

8.5.1.3 PROCEDURE

1. The test apparatus is to be designed and run following the description in Annex 2.

2. Collect the viruses in the impingers containing PBS 0.001% antifoam A. The flow rate and the sampling intervals are to remain the same as that for the determination of the challenge number of MS2 coliphage.

3. Perform serial dilution of the collecting buffer in order to obtain 25 PFU to 250 PFU per MS2 agar plate.

4. Assay the resulting suspensions as per section 6.3.1.

5. Calculate and record the concentration of MS2 coliphage passing through each AFM under test.

8.5.2 METHOD FOR DETERMINATION OF THE NUMBER OF STAPHYLOCOCCUS AUREUS PASSING THROUGH THE AFM.

8.5.2.1 PRINCIPLE

The number of *Staphylococcus aureus* passing through the AFM, is determined by the collection of the air passing through the AFMs in the impingement samplers. This number is determined for each AFM tested.

8.5.2.2 APPARATUS AND MATERIALS

Aerosolizing chamber test apparatus, described in Annex 2.
TSA plates as described in section 6.1.6.
PBS (work solution) as described in section 6.1.3.2
PBS 0.001% antifoam A as described in section 6.1.3.3
Filtration apparatus
mPCB as described in section 6.1.4

8.5.2.3 PROCEDURE

1. The test apparatus is to be designed and run following the description in Annex 2.

2. Collect the bacteria in the impingers containing PBS 0.001% antifoam A. The flow rate and the sampling intervals are to remain the same as that for the determination of the challenge number of *Staphylococcus aureus.*

3. Assay the resulting suspensions as per section 6.3.2.

4. Filter the remaining collecting buffer following the Filtration Membrane Method in section 6.6.

5. Calculate and record the concentration of *Staphylococcus aureus* passing through each AFM under test.

8.5.3 METHOD FOR DETERMINATION OF THE NUMBER OF *BACILLUS ATROPHAEUS* SPORES PASSING THROUGH THE AFM.

8.5.3.1 PRINCIPLE

The number of *Bacillus atrophaeus* spores passing through the AFM, is determined by the collection of the air passing through the AFMs in the impingement samplers. This number is determined for each AFM tested.

8.5.3.2 APPARATUS AND MATERIALS

Aerosolizing chamber test apparatus, described in Annex 2.
TSA plates as described in section 6.1.6.
PBS (work solution) as described in section 6.1.3.2
PBS 0.001% antifoam A as described in section 6.1.3.3
Filtration apparatus
mPCB as described in section 6.1.4

8.5.3.3 PROCEDURE

1. The test apparatus is to be designed and run following the description in Annex 2.

2. Collect the spores in the impingers containing PBS 0.001% antifoam A. The flow rate and the sampling intervals are to remain the same as that for the determination of the challenge number of *Bacillus atrophaeus.*

3. Assay the resulting suspensions as per section 6.3.3.

4. Filter the remaining collecting buffer following the Filtration Membrane Method in section 6.6.

5. Calculate and record the concentration of *Bacillus atrophaeus* spores passing through each AFM under test.

8.5.4 METHOD FOR DETERMINATION OF THE NUMBER OF INFLUENZA VIRUS PASSING THROUGH THE AFM.

8.5.4.1 PRINCIPLE

The number of influenza viruses passing through the AFM, is determined by the collection of the air passing through the AFMs in the impingement samplers. This number is determined for each AFM tested.

8.5.4.2 APPARATUS AND MATERIALS

Aerosolizing chamber test apparatus, described in Annex 2.
Dulbecco's Modified Eagle Medium (DMEM) supplemented with 1% Penicillin / Streptomycin
Infection Medium as described in section 6.1.10.
Agar Overlay as described in section 6.1.11

8.5.4.3 PROCEDURE

6. The test apparatus is to be designed and run following the description in Annex 2.

7. Collect the viruses in the impingers containing DMEM 1% Pen/Strep. The flow rate and the sampling intervals are to remain the same as that for the determination of the challenge number of influenza virus.

8. Perform serial dilution of the collecting buffer in order to obtain 25 PFU to 250 PFU per well.

9. Assay the resulting suspensions as per section 6.3.5.

10. Calculate and record the concentration of influenza virus passing through each AFM under test.

8.6 METHOD OF FILTRATING MEMBRANE

8.6.1 SCOPE

This method is followed in view of establishing an adequate detection level of the microorganisms versus the volume of solution used after the study period. This method follows the Standard Operational Procedure of the Filtrating Membrane Method used for water analysis.

8.6.2 APPARATUS AND MATERIALS

Filtration apparatus
mPCB as described in section 6.1.4
Filtration membrane 0.45µm
Petri dishes 50mm with absorbent pads

8.6.3 METHOD

1. The filtration apparatus and system should be sterilized.

2. Lay a filtrating membrane on the base of the filtration apparatus. Install the filtration funnel and pour the solution to be tested. Initiate the vacuum system.

3. Remove the filtration funnel, and place the filtration membrane on 2 mL of Plate Count Broth in a 50mm Petri dish containing an absorbent pad.

4. Incubate the petri dishes upside down at 37ºC ± 75% RH for the tested microorganism appropriate incubation period.

*The sensitivity of the method is equivalent to 1 CFU/mL.

9 ANNEX 2 DESIGN AND OPERATION OF AEROSOLIZING CHAMBER TEST APPARATUS

9.1 PRINCIPLE

The AFMs under test are subjected to an airborne microbial challenge using an aerosolizing chamber to simulate a true scenario contaminated air volume. Microorganisms are sprayed into a mixing tunnel using up to four (4) Collision jet nebulizers to form a uniform microorganism/air solution. The solution is injected into the aerosolizing chamber for precise amount of time allowing for several air exchanges. The 50 cfm fan is used to circulate the microorganism/dilution air solution throughout the aerosolizing chamber. The high efficiency particle filter operating at low vacuum maintains constant negative pressure in the aerosolizing chamber. The pressure, temperature and relative humidity of the microorganisms/dilution air solution in the aerosolizing chamber are continuously monitored. The filter holders, including the AFMs to be tested, are connected to the sampling ports. By operating the vacuum pump, the microorganisms/dilution air solution into the aerosolizing chamber is drawn through the AFMs, and then through the impingement samplers. One sampling port draws the solution directly into two (2) impingement samplers in parallel and is used to determine the concentration of the microorganisms in the challenge (positive control). The airflow of the filter holders are individually controlled using flow meters with effluent needle valves. The setup has the capability of testing a maximum of five (5) AFMs and one positive control, with test flows ranging from 50 to 85 LPM.

9.2 TEST APPARATUS

The test apparatus is displayed in figure 6.1.

1. Nebulizer panel, with up to 4 6-jet modified Collision nebulizers

2. 110 V AC utility port

3. Sample filter holders – bank of six encapsulating filter holders

4. Impingement samplers – twelve 500-mL impingers setup in parallel pairs

5. Bank of calibrated flow meters – six calibrated flow meters recommended for vacuum flows, scale 20 to 110 LPM

6. HEPA capsules
   6a. HEPA exhaust capsule – to filter air exiting the chamber
   6b. HEPA surplus air capsule – to filter dilution air entering the chamber.

7. Vacuum Pump, minimum capability of 1500 LPM

8. 3-inch exhaust port, with shut-off valve

9. Pressure relief valve, rated to open at 1/3 psi

10. Thermo-Hygrometer, temperature and relative humidity readings

11. Magnehelic manometer, to measure pressure in the chamber -15 to 15 inches of water

12. Pressure regulator, to control the pressure of the filtered air supply, 0-100 psi

13. UV light – 15 watts

14. Glove ports – with neoprene gloves

15. Electronic timer – setting selection from 5 to 180 minutes, controls the status of the vacuum pump

16. Air mixing tunnel supplying the sample filter holders with a homogeneous microorganism-air solution

17. Pressure-gauge manometers – used to measure air pressure at the inlet of the nebulizer(s)

18. Pre-filter – to protect flow meters from moisture (aka: Moisture trap)

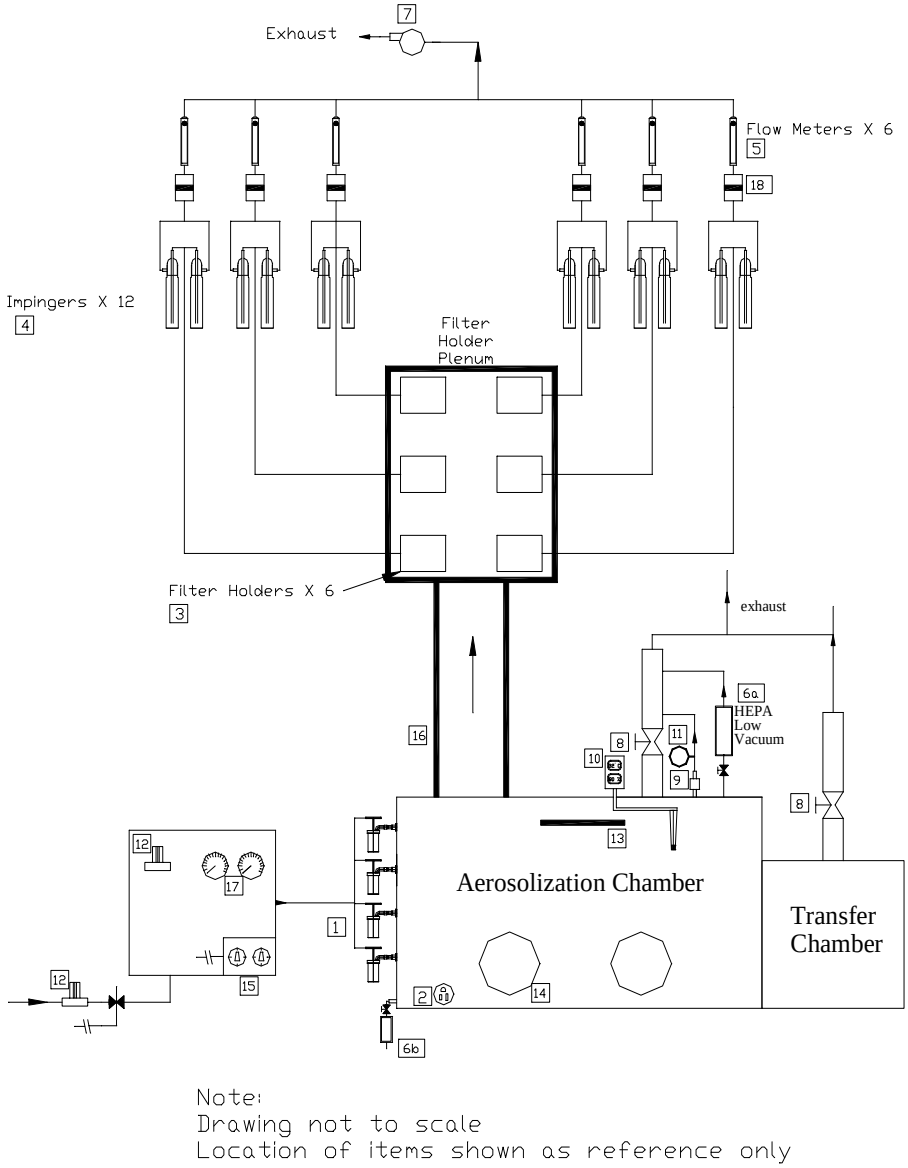


FIGURE 9.1: DIAGRAM OF AEROSOLIZING CHAMBER TEST APPARATUS

9.3 METHOD OF USE

1. Ensure that the temperature in the chamber is between 15 and 25°C.
2. Ensure that all port valves are in the closed position
3. Turn on the circulating fan using the rheostat.
4. Connect the nebulizers containing the appropriate suspension of challenge microorganisms to the nebulizer panel. For HRV14, use 50 mL of a 10^7-10^8 $TCID_{50}$/mL viral preparation (as described in Annex 1) per nebulizer. The number of nebulizers and/or the titer of microorganisms used may be modified based on desired microorganism concentration in the aerosol.
5. Add 100 mL of PBS / 0.001% antifoam A to each AGI-500 impingement sampler and fasten to the filter holders. Alternatively, add 30 mL of DMEM supplemented with antibiotics to each AGI-30 impingement sampler and fasten to the filter holders in a branched fashion such that the flow into the AGI-30 can be set to 12 LPM and the other branch to 73 LPM. The latter branch should be filtered through an additional HEPA filter.
6. Attach filter holders containing test AFMs to the sampling ports on the top of the chamber.
7. When ready to begin the test, open the HEPA surplus air capsule valve, then switch on the vacuum pump by setting the timer to the specified interval to the first sampling point. Adjust the needle valve on the vacuum flowmeters to the required challenge airflow.
8. Open the compressed air to the nebulizers and set to 70 psi.
9. During the test, verify the following readings:
    - Nebulizer pressure
    - Magnehelic pressure reading is below 1 inch of water column
10. At each sampling point, the timer should stop the air supply and the vacuum pump. Remove the impingers for assay, and replace with sterile impingers with the appropriate collection fluid as described in step 5. Record the temperature and relative humidity at each sampling point.
11. Continue the test by setting the timer to the time required to reach the next sampling point. Continue until the AFMs have been tested for the expected lifecycle of the product.
12. At the end of the test period, the timer should stop the vacuum pump and air supply. Close the HEPA surplus air capsule valve.
13. Disconnect the impingement samplers and carry out assays of collection fluid from the impingement samplers, for all test AFMs as well as the positive control as per section 5.5 of Annex 1. If using DMEM as the collection fluid, the starting dilution in the $TCID_{50}$ assay is 10^0 whereas with PBS / 0.001% antifoam A, the starting dilution is 10^{-1}. Record the volume of fluid recovered from each impinger.
14. Record the CPE formed in the 96-well plates at the end of the incubation period.
15. Calculate and record the concentration of HRV14 passing through the AFMs as well as in the challenge air flow as per section 5.5 in Annex 1.
16. The challenge size of microorganisms must be greater than 10^4 CFU, or the test is not valid.
17. Disconnect the Collision nebulizers from the apparatus. Add microorganisms to the nebulizers to conduct additional experiments with the same challenge. Otherwise, sterilize the nebulizers using hot water and chlorine bleach for 30 minutes.

18. Sterilize the chamber using the UV light, and the filter holders and impingers using UV light and ethanol. Please note that the use of microorganisms other than HRV14 may require different sterilization procedures.

10 ANNEX 3 DESIGN AND OPERATION OF DIFFERENTIAL PRESSURE TEST APPARATUS

10.1 APPARATUS

The diagram below illustrates the apparatus that measures the air resistance generated by a NBCW (Nuclear, Biological, and Chemical Warfare) C2 canister in the form of a pressure drop. An air tank supply feeds 20psi of air into system. There is a pressure valve attached to the tank with two pressure gauges. One pressure gauge indicates the internal tank pressure and the other pressure gauge indicates the pressure of air leaving the tank. A tube then leads to a ball-valve which acts as our on/off switch for the air flow. The next step is a flow meter with a control valve to set the flow rate. A volumetric flow meter with digital display is included into the system directly after the flow meter with control valve for fine tuning of the desired flow rate. Upon exiting the volumetric flow meter, the flow is diverged by a Y-connector into two separate tubes. One tube leads to one end of the U-tube manometer filled with de-ionized water, leaving the other end of the U-tube manometer open to atmospheric pressure. The other tube from the Y-connector leads to the NBCW C2 canister holder.

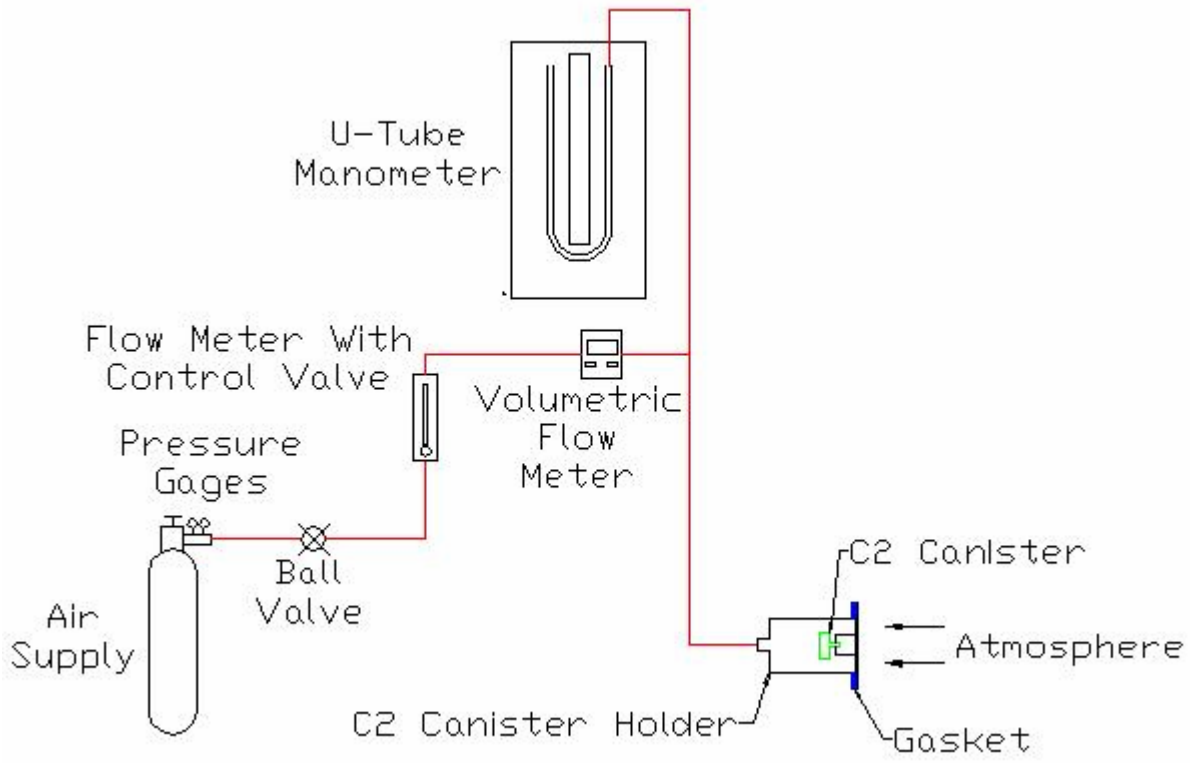


FIGURE 10.1 DIAGRAM OF DIFFERENTIAL PRESSURE APPARATUS

10.2 CALIBRATION

- Before testing the pressure drop across the C2 canister, the pressure drop across the entire system must first be determined.
- First, make certain that all of the tubes are properly inserted into their appropriate fitting so that there are no leaks.
- Ensure that the meniscus on each side of the U-tube manometer is positioned at the 0mm level. The U-tube manometer reading should be made from the same position of the curved meniscus every time a reading is made during calibration and testing (typically the reading is made at the level of the middle of the meniscus, see fig. 2 below).
- Next, turn on the air supply to 20 psi, and make certain there is proper flow through the system.
- The C2 canister holder should not contain a C2 canister at this time.
- Adjust the flow meter to 85 liters per minute (or desired flow rate), and measure the difference of water column between the two meniscuses in the U-tube manometer. This reading gives the pressure drop in mm H_2O. Ideally, the water level should rise on one side of the U-tube and drop by an equal distance on the other side of the U-tube.
- Record this value as the tare pressure drop, ΔP_{tare}.
- Turn off the air supply by the ball valve.

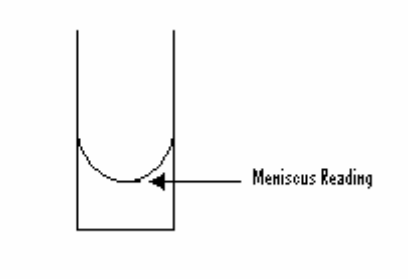


FIGURE 10.2 MENISCUS READING

Reference Canister:

- For future pressure drop testing, a reference canister may be used for calibration to ensure that the system is in good working order and has no leaks.
- Test one canister in particular several times. The pressure drop readings should be consistent as long as no other changes have been made in the system.
- In-between each of these tests, remove the tubing from the fittings and then re-insert them. You may also completely replace the tubing with new tubing. This procedure is performed as a guarantee that the same leak will not occur twice and that if there is a leak it will be detected as there will be a change in the pressure drop reading.
- Essentially, the whole system should be inspected including the connection between the canister and the canister holder.
- If the pressure drop readings are consistent for all tests, then the tested canister may serve as a reference canister for calibration purposes. The pressure drop for the reference canister must be recorded and preferably written directly on the canister itself.

- Thus, for future testing, the pressure drop of this canister may be determined prior to any other testing. If the reading is the correct value, then the system does not contain any leaks and one may then proceed to test more canisters.

10.3 PROCEDURE

- After calibrating the apparatus, place the test C2 canister in the holder.
- Turn on the air supply by the ball valve, and verify the flow rate by reading the flow meter with control valve and the volumetric flow meter. Both instruments should read 85 liters per minute. If there is an incorrect reading, or if there is severe fluctuation, take out the test canister from the holder and recalibrate the system.
- Record the volumetric flow reading.
- After recording the volumetric flow rate, measure the difference in height of the two meniscuses in the U-tube manometer. This reading will give the differential pressure value across the total system, ΔP_{total} (canister and system).
- The actual pressure drop of the canister, $\Delta P_{canister}$, will then be equal to the differential pressure of the total system minus the tare pressure drop as shown in the following equation:

$$\Delta P_{canister} = \Delta P_{total} - \Delta P_{tare}$$

- Turn off the air supply by the ball valve.

11 HVAC TEST SYSTEM

The HVAC test system is designed to allow full size HVAC filters to be tested using a microbial challenge agent.

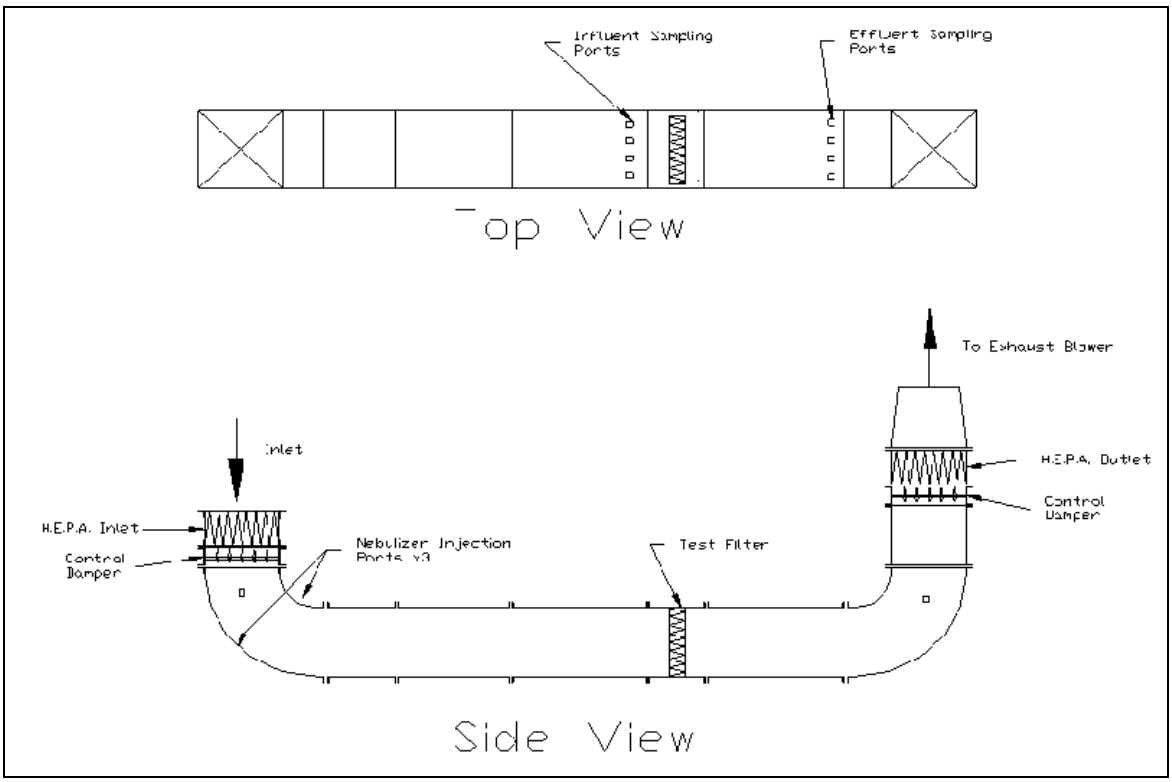


FIGURE 11.1: HVAC TEST SYSTEM DIAGRAM

Air entering the test system passes through a HEPA filter to remove contaminants. A damper is located immediately following the HEPA filter. This damper serves to prevent back flow during decontamination. Following the damper, three nebulizer ports allow connection of three 6-jet modified collision nebulizers. The nebulizers inject challenge microorganisms into the air stream. A long section of duct follows the nebulizers to allow the microorganisms to evenly distribute and to allow a uniform flow to form. Influent sampling ports, visible in the Top View, are located immediately preceding the test filter. These ports sample the microbial concentration entering the filter. The air then passes through the test filter. The effluent sampling ports are set back from the test filter to simulate the extended time to diffusion in a real-life situation. Finally, the air passes through a HEPA filter and continues to the exhaust. A damper, located just before the HEPA filter, may be closed to block the flow. A blower is located in the exhaust line to move air through the system. The blower maintains negative pressure throughout the test system, ensuring that contaminated air does not leak from the apparatus. The system is also equipped with UV and spray decontaminant systems. The HVAC lab houses three independent test systems.

FIGURE 11.2: HVAC HIGH SPEED VENTILATION LABORATORY

12 ANNEX 4: INFLUENZA VIRUS MODEL

This addendum describes the materials required and methods developed for the use of live influenza virus (non-pathogenic strain) in air filtration studies.

12.1 MATERIALS

12.1.1 ORGANISMS

- MDCK cell line (ATCC CRL-34)
- Influenza A/PR/8/34 virus – tissue culture adapted (H1N1; ATCC VR-1469)

12.1.2 BUFFERS AND CULTURE MEDIA

Complete growth medium
Dulbecco's Modified Eagles Medium (DMEM; HyClone, Tekniscience cat # SH30243.02) supplemented with 10% heat inactivated (45 min at 56°C)Fetal Bovine Serum (FBS; HyClone, VWR cat # CA16777-014) and 1% Penicillin/Streptomycin (HyClone, VWR cat # CA16777-164)

Infection medium
DMEM supplemented with 0.3% Bovine Serum Albumin (BSA; Sigma, cat # A8412) and 1% Penicillin/Streptomycin

Phosphate Buffered Saline (PBS)
Phosphate Buffered Saline (1X) without calcium or magnesium (Hyclone, Teckniscience cat # SH30256.01)

Trypsin-EDTA solution
0.25% Trypsin, 2.21 mM EDTA in HBSS (without Ca, Mg, $NaHCO_3$) (Hyclone, Teckniscience cat # SH30042.01)

TPCK-trypsin
tosylphenylalanylchloromethane treated trysin (Sigma, cat # T8802)

Seaplaque
Low melting point agar (Cambrex Bio Science, cat # 50101)

2X DMEM/BSA
DMEM supplemented with twice the normal final concentration of BSA (0.6%) and Penicillin/Streptomycin (2%)

12.1.3 MISCELLANEOUS

- 175-cm^2 flasks
- 96-well plates
- Haemocytometer
- Haemocytometer cover glass
- Cryopreservation vials (2 mL)
- 50 mL conical tubes
- CO_2 tank and regulator
- 37°C incubator with 5% CO_2
- Water bath
- -80°C freezer or liquid nitrogen storage tank
- 12-channel multipipette

12.2 PROCEDURE FOR SEEDING MDCK CELLS

1. Aspirate culture medium from stock culture of MDCK cells.
2. Briefly rinse the cell layer with PBS to remove all traces of serum (which contains trypsin inhibitor).
3. Add 2.0 mL of Trypsin-EDTA solution to flask and return to 37°C incubator for 2 to 5 minutes. Occasionally observe cells under an inverted microscope until cell layer is dispersed.

   Note: To avoid clumping, do not agitate the cells by tapping or shaking the flask while waiting for the cells to detach.
4. Add 6.0 to 8.0 mL of complete growth medium and resuspend cells by gently pipetting.
5. Count cells using a haemocytometer, dilute to desired density in complete growth medium, and add appropriate aliquots of the cell suspension to new culture vessels. Typically, a density of 2 x 10^5 cells/mL should result in a near-confluent monolayer (desirable for infection) in 1-2 days. Adjust number of seeded cells as needed.
6. Seed 6-well plate with ~3 x 10^6 cells/plate or 1:4 split for 175-cm^2 flask. **Note**: 6-well plates should be plated for test purposes only.
7. Incubate 6-well test plates at 37°C, 5%CO_2.

12.3 PROCEDURE FOR PROPAGATING INFLUENZA VIRUS IN MDCK CELLS

1. Aspirate culture medium from 175-cm^2 flasks containing semi-confluent (70-90%) monolayers of MDCK cells.
2. Wash the monolayer with infection medium to remove all traces of serum.
3. Inoculate each flask with 7 mL of influenza virus stock (stock titer ~10^7 PFU/mL) diluted 1:1000 in infection medium. This amount of virus should result in a multiplicity of infection (MOI) which should minimize the formation of defective interfering virus particles.
4. Spread the inoculum evenly over the monolayer by gentle rocking of the flask.
5. Incubate for 1 hr at 37°C, 5%CO_2 to allow for virus adsorption with gentle rocking every 15 min.
6. Add an additional 13 mL of infection medium supplemented with TPCK-trypsin to give a final concentration of 1 □g/mL. Incubate at 37°C, 5%CO_2. TPCK-trypsin is a serine protease type

enzyme which cleaves the influenza virus hemagglutinin protein precursor (HA_0) into its mature products HA_1 and HA_2 thereby increasing the infectious titer of influenza virus produced *in vitro*.

7. Monitor for CPE using an inverted microscope. Usually, 36-48 hours is sufficient to obtain nearly 100% of cells exhibiting CPE caused by viral replication. At this point, the viral preparation is ready to be harvested.

12.4 PROCEDURE FOR HARVESTING INFLUENZA VIRUS FROM MDCK CELLS

1. Within 36-48 hours post infection, nearly 100% of each virus-inoculated monolayer should show cell rounding/cytopathic effect (CPE)
2. Collect the supernatant of flasks and dispense the cell suspension into 50 mL conical tubes (~35 mL per tube). Do not fill past the 40 mL mark as these tubes may be frozen and contents will expand. **Note**: Empty flasks will still contain virus and should be treated as infectious. Leave all empty flasks in hood until they can be decontaminated with a 10% bleach solution and disposed of into a biohazard bag.
3. Pellet cell debris by centrifugation at 3,000 rpm for 15 minutes at 4ºC.
4. Collect the virus-containing supernatant in a new conical tube.
5. Optional: Concentrate virus stock by filtering through 0.45 □m membrane to remove particulates followed by centrifugation using a Centricon Plus-80, 100 kDa cutoff (Millipore) at approximately 2000 x *g*, 4ºC until desired volume is obtained.
6. Dispense appropriate aliquots into cryopreservation vials (or in conical tubes for larger volumes) and store them at -80ºC or in liquid nitrogen.

12.5 PROCEDURE FOR CONCENTRATING INFLUENZA VIRUS BY ULTRACENTRIFUGATION

Materials needed

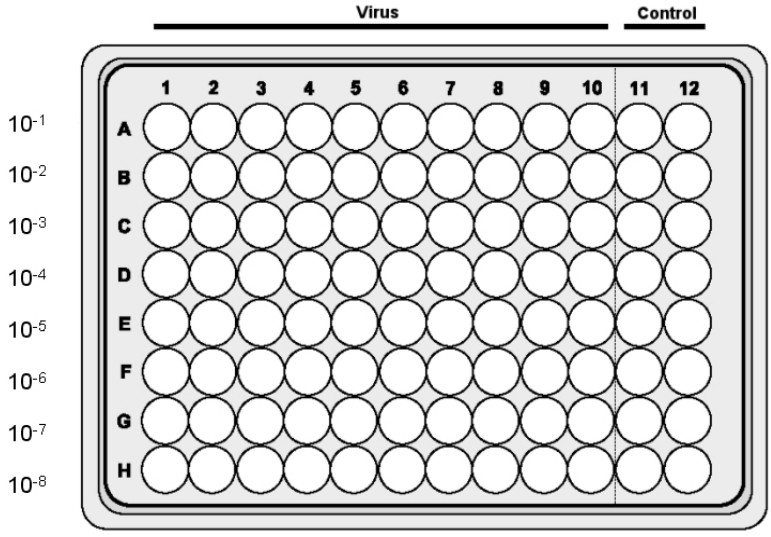
- Ultracentrifuge
- Beckmann Swinging Bucket Rotor SW 40 (or preferably SW 28)
- Beckmann Ultra-clear Centrifuge Tubes 14 x 89 mm (Beckmann # 344059)
- 25% sucrose solution

Method

1. Add 7 mL crude concentrate to a centrifuge tube.
2. Carefully add 1 mL 25% sucrose to the bottom of the centrifuge tube.
3. Add an additional 4 mL crude concentrate to centrifuge tube bringing the total volume to 12 mL.
4. Repeat for all tubes. Ensure all tubes have equal volumes thus equal weights.
5. Place centrifuge tubes into buckets.
6. Mount buckets on rotors and place in ultracentrifuge.
7. Spin at 12500 RPM for 2 hours. (Pellet virus by centrifugation at 27000g).
8. Aspirate supernatant leaving only the pellet and residual medium.
9. Re-suspend in desired medium, typically PBS (one-tenth the original volume), and store at -80°C.

12.6 PROCEDURE FOR TITERING INFLUENZA VIRUS BY TCID50 ASSAY

1. Approximately 24 hours prior to testing, seed 96-well plates with ~10000 MDCK cells/well in 100 µl of complete growth medium (~10^6 cells in 10 mL of medium) and incubate at 37°C, 5% CO_2 to allow for approx. 50% confluent monolayer formation within 24 hours. Each titration assay should include 2 columns as uninfected cell controls (negative controls)
2. After 24 hours, inspect wells to ensure that cells have attached and formed an even monolayer that is about 50% confluent.
3. Remove and discard culture medium from monolayers of MDCK cells. Wash cells with infection medium and replace with 180 µl/well of fresh infection medium ~2-3 hours prior to start of assay.
4. In reference to the diagram of a 96-well plate below, in Column 1-10 of Row A place 20 µl of media/virus and 20 µl culture media (negative control) in to Row A Column 11 & 12 pipette up and down 10x to ensure complete mixture. This will be the 10^{-1} dilution. Note that the number of replicates for a given sample may vary. Typically, four replicates per sample are performed. Also, samples for which a relatively low titer is expected, the range of dilutions needn't be as high as for those for which a relatively high titer is expected.



5. Remove 20 µl from the 10^{-1} row and pipette into Row B Column 1-12 and mix 10x thus creating the 10^{-2} dilution.
6. Repeat this process for as many dilutions as necessary.
7. Within 4-5 days post infection, CPE should be detectable and the $TCID_{50}$ can be calculated using the Karber statistical method as follows:

Titer: $\mathbf{T}=10^{1+d(Sp-.05)}$ (Karber Formula)
where d = log of the dilution (log 10 = 1)
Sp = sum of the proportions

For example, given the following data for a $TCID_{50}$ assay carried out with 100 µl per well,

Dilution	Ratio of infected wells	Proportion of infected wells
10^{-1}	10/10	1

10^{-2}	10/10	1
10^{-3}	10/10	1
10^{-4}	10/10	1
10^{-5}	6/10	0.6
10^{-6}	2/10	0.2
10^{-7}	0/10	0
10^{-8}	0/10	0

d = log 10 = 1

Sp = 1 + 1 + 1 + 1 + 0.6 + 0.2 + 0 + 0 = 4.8

T = $10^{1+1(4.8 - 0.5)}$ = $10^{5.3}$ $TCID_{50}$ (per 100 □l)

T= $10^{6.3}$ $TCID_{50}$/mL or 2.0 x 10^{6} $TCID_{50}$/mL

12.7 PROCEDURE FOR TITERING INFLUENZA VIRUS BY PLAQUE ASSAY

1. Seed 6-well plates 2 days in advance according to the protocol described above.
2. Prepare serial 10-fold dilutions from 10^{-1} to 10^{-5} of influenza virus in infection medium.
3. Wash monolayer in with 1 mL of infection medium per well.
4. Remove wash and add 300 □l of virus dilution per labeled well. Generally, 10^{-3} to 10^{-5} dilutions are plated in duplicate to fill up one plate.
5. Incubate plates at 37°C, 5% CO_2 for 1 hour with gentle agitation every 10-15 min to redistribute the inoculum.
6. During this 1-hour incubation period, prepare the agar overlay (make enough to dispense 3 mL per well):
    a) Place autoclaved 2% Seaplaque low melting point agar in 37-42°C water bath for at least 20 min. If using previously prepared agar, melt in microwave (avoid excessive microwaving, just enough to melt) and do not use agar that has been microwaved more than twice. The agar overlay is the most critical parameter in performing a successful plaque assay.
    b) Warm 2X DMEM/BSA to 37-42°C.
    c) Mix equal volumes of 2X DMEM/BSA and agar (both at 37-42°C; final concentration of the mixture is 1% agar, 1X DMEM/BSA). Add TPCK-trypsin to a final concentration of 1 □g/mL.
7. Remove the inoculum from each well by aspiration and gently add 3 mL of overlay per well.
8. Allow agar to solidify in the biological safety cabinet with lids ajar on plates.
9. Once agar is solidified, invert plates and place in 37°C, 5% CO_2 incubator.

Reading the plaque assay results

Plaques can be read in plate as is-by varying contrast against light source they can be seen through bottom of plate. Typically, this can be done 3 days post infection. Unlike lytic viruses which ultimately lyse the host cell, influenza virus is released from the cell membrane by a budding process to acquire a lipid membrane in the process. Therefore, infected cells are not generally lysed by influenza virus and hence plaques appear as aberrations (white spots) in the cell monolayer rather than as zone of complete clearing.

13 ANNEX 5: TOXICOLOGICAL SET-UPS AND PROCEDURES

13.1 IODINE VALIDATION OF TOXICOLOGY SET-UP

The toxicological set-up validation uses pure iodine beads subjected to continuous challenge filtration. The challenge samplings use AGI 500 impingers filled with 400mL of 1.5 mM sodium carbonate and sodium bicarbonate, also termed the trapping media. A sample is taken every 15 minutes until the end of the four hour testing period.

Steps (1 to 8) on figure 11.1, illustrate the setup used for the Iodine Validation tests of the Toxicology Setup. The procedure is described in detail in SOP CHM-031. The following paragraphs will elaborate on the latter steps.

All the glassware pieces are cleaned with chromic acid; this procedure will eliminate any iodine species that may adhere to the sides of the glassware. This is a very important step, especially when our detection method is sensitive to very small amounts of iodide.

Step 1 is indicative of the desiccant (silica) used to ensure that no humidity from the ambient air may get trapped on the iodine beads. This leads, via RNT tubing, to the Iodine cartridge (step#2) that is composed of 2 ball valves joined by a piece of rigid Teflon tube containing 4.5 g of iodine beads. The valve beneath the iodine must be fitted with a 2-ply piece of glass fiber in order to prevent the beads from falling through. Moving toward the vacuum, using Tygon (Teflon coated internally) tubing one branch of a “T” connector leads to a filter holder (47-5B) with 2-ply 800 gsm KJ carbon.

This carbon traps the excess iodine not being absorbed by the trapping media solution and prevents it from going through the flow meter and into the vacuum pump. This carbon is removed and replaced with a fresh set after 2 hours or when the tubing (RNT) connecting it to the flow meter (step#4) turns colour demonstrating the presence of iodine after the carbon.

From the other branch of the “T” connector, Tygon tubing leads to an AGI-500 impinger (step#5) containing 400 mL of trapping solution. This leads via RNT tubing to a humidity trap (step#6) therein placed to prevent water droplets from forming inside the sampling flow meter (step#7). Both flow meters are connected to a vacuum pump (step#8).

Prior to starting the test, the apparatus should be set up as follows:

Set up each AGI-500 with 400 mL of trapping media. Parafilm/seal all openings on the AGI-500 as well as the connectors attached to the AGI-500. It is important to ensure the AGI-500 has an air tight seal.
Connect side arm to the sample flow meter. Turn on vacuum pump, measure the sampling flow (at the top of the AGI-500) with a digital flow meter. Ensure flow is close to 0.5 LPM. Record the sampling flow. Turn off vacuum pump.
Connect the remaining apparatus for the sample ports being tested. Ensure that all connections are sealed with parafilm. Ensure that the high flow meter is closed. Open ball valves which are connected to the iodine cartridge. Turn on vacuum pump (set for 15 minutes). Slowly increase the total flow to 4.3 LPM while measuring the total flow with a digital flow meter. Note: It is important to slowly increase the total flow to avoid the possibility of a back flow.

Once the vacuum system has stopped, close both valves of the iodine cartridge. Turn off the high flow meter. Disconnect the tubing to the top of the impinger. Collect the solution in a 15 mL sampling tube and discard the remaining sample in a waste container.
Inject sample on the HPLC Instrument using a 20 fold dilution. Refill the AGI-500 with 400 mL of trapping media. Using parafilm, re-seal all connections to ensure an airtight unit once more. Once again, open valves which are connected to the iodine cartridge.
Turn on vacuum pump (set for 15 minutes). At this point, test has restarted. Slowly increase the total flow to 4.3 LPM while measuring the total flow with a digital flow meter. Collections are to be made every 15 minutes for 240 minutes.
Continue the test in the same manner, ensuring that the total flow meters are shut during collections and reopened once the test has recommenced. The ball valves must be shut during collections and prior to restarting the test. Once testing has been completed, measure the sampling flow and record the flow rate.

Over the course of any test the room air must be sampled without any test article attached to provide a means to verify that the surrounding air is not introducing any iodide into the test article thereby causing false positive results. It is important to analyze a baseline control sample (blank) of the trapping media itself, to get a HPLC signal that measures a value of 0ppm for the iodide species.

At the end of the validation, a titration is performed in order to determine the exact mass lost from the iodine beads. A standard titration curve must be made prior to starting the titration, using the following procedure:

1- Using 250 mL Erlenmeyer flasks, 4-5 samples of Iodine beads are obtained ranging between 1.6 – 2.2 grams. 175 mL of 0.1 N sodium thiosulfate solution is added to each flask. Each flask is parafilmed and let stir overnight. Once dissolved, add starch indicator (3-5 drops).
2- Titrate with 0.1 N iodine solution. Produce a table of weight (g) and volume iodine titrated (mL) (include 175 mL/0 g Iodine as a data point). A curve can be produced from this data. Using the curve, determine the linear equation for the best fit straight line. The R^2 value should be 0.99 or better.
3- Once a standard titration curve is obtained, the iodine remaining in the cartridge after the air test can be quantified. Remove the cartridge containing iodine. Remove the top valve connected to cartridge. Empty beads into 250 mL Erlenmeyer flask. Using an analytical balance, record the wet weight of beads. Remove other ball valve connected to cartridge. Rinse cartridge with 175mL 0.1 N Sodium Thiosulfate solution into same flask with beads. Parafilm the flask and let stir overnight. Titrate sample with iodine (back titration).
4- From standard curve, obtain weight of iodine remaining in the sample cartridge. This is done in order to account for any small particles within the tube and valves that were unable to be weighed. It provides a more accurate method to obtain the weight instead of the mass from the balance.
5- The minimum percent recovery (%) required to validate each testing port is 85%.

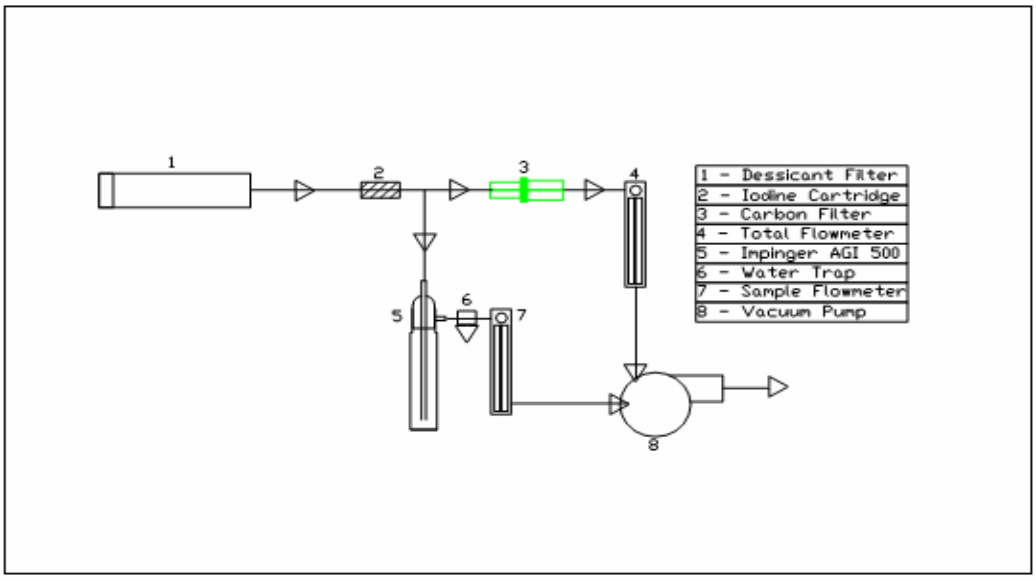


FIGURE 13.1: IODINE VALIDATION OF TOXICOLOGY SETUP

13.2 TOXICOLOGY SET-UP AND AIR TESTING PROCEDURE

Steps (1 to 5) on figure 12.1, illustrate the setup and the testing procedure used for air testing of selected media and devices under development. The following paragraphs will elaborate on the latter steps.

All the glassware pieces are cleaned with chromic acid; this procedure will eliminate any iodine species that may adhere to the sides of the glassware. This is a very important step, especially when our detection method is sensitive to very small amounts of iodide.

Room air (step#0) acts as the control volume. The filter holder (step#1) that contains the test article is setup on figure 4.2 to one of the ports. It is connected to the main flow meter that regulates the total flow rate 10.3LPM or any other that may be required.

From the filter holder in step#1, moving toward the vacuum, one branch of a “T” connector leads to a Teflon filter holder (step#2) positioned between the Triosyn composite membrane and the small impinger (0.5 LPM) that contains 10mL of trapping media (step#3). The Teflon membrane is approved by OSHA, to preclude any iodide containing particulates or any other types of particulates.

The second branch of the “T” connector leads to the flow meter (step#4) controlling the total airflow passing through the test article. In (step#4), the regulator will indicate the total flow that is passing through the Triosyn composite membrane. Both flow meters are connected to a vacuum pump that is set to run for the time needed (step#5). Over the course of any test the room air must be sampled without any test article attached to provide a means to verify that the surrounding air is not introducing any iodide into the test article thereby causing false positive results. It is important to analyze a baseline control sample (blank) of the trapping media itself, to get a HPLC signal that measures a value of 0ppm for the iodide species.

Testing with Iodine following OSHA standard (#ID-212) is performed by ion chromatography. The HPLC detects the iodide species that is present in the different air samples. Using a multi point calibration curve, we could determine the amount of iodide present in all the samples. The concentration of iodine is determined using an equation that was established in the OSHA protocol (ID-212).

The total amount of iodine in units of mg/m^3 is determined from the iodide measure, using calculations outlined in Annex 5.4.

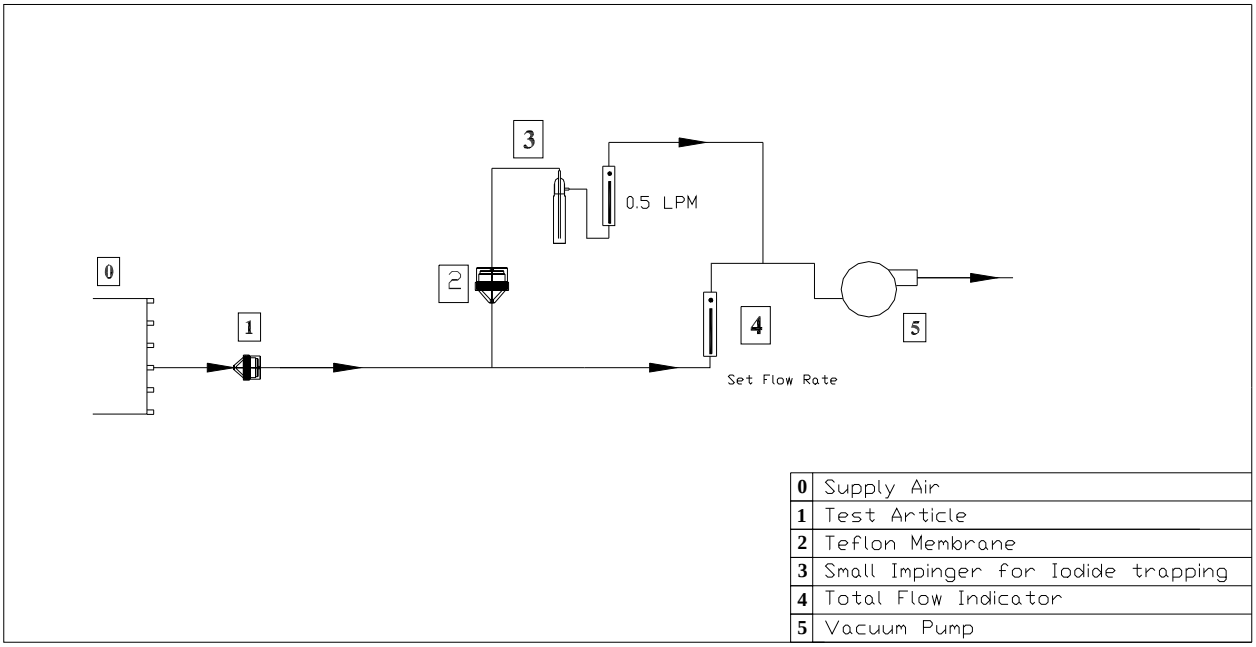


FIGURE 13.2: AIR/TOXICOLOGY SETUP

13.3 VALIDATION OF THE SODIUM CARBONATE/SODIUM BICARBONATE TRAPPING SOLUTION CONCENTRATION

In order to validate the 1.5 mM sodium carbonate/sodium bicarbonate solution, "the total alkalinity (defined as the number of moles of hydrochloric acid (HCl) required to react with the carbonate ($CO3^{-2}$) and bicarbonate ($HCO3^{-}$) is determined"[1]. A sample titration of 1.5 mM sodium carbonate/sodium bicarbonate stock solution is performed using a 1.5 mM HCl solution. Based on the amount of HCl solution titrated, we can accurately determine/validate the concentration of the 1.5 mM sodium carbonate/sodium bicarbonate trapping solution.

In theory, the reaction of HCl (aq) (1.5 mM) with the solution of 1.5 mM Sodium Carbonate/Sodium Bicarbonate (a buffer solution), are carried out in two steps (reactions):

$$\underline{\text{Rxn 1}}: \mathbf{Na_2CO_3 + HCl \rightarrow NaHCO_3 + NaCl}$$
$$\mathbf{CO_3^{2-} + H^+ \rightarrow HCO_3^{-1}} \quad \text{(Net ionic)}$$

At this point, all carbonate CO_3^{2-} from Na_2CO_3 has reacted and we are left with bicarbonate HCO_3^{-1}. For every mol of carbonate reacted, one mol of bicarbonate is produced. Therefore, we are left with 2 moles of bicarbonate at this point (i.e. one mol from Rxn 1, and one mole from the original $NaHCO_3$ present):

$$\underline{\text{Rxn 2}}: \mathbf{2HCO_3^{-1} + 2H^+ \rightarrow 2\ H_2CO_3}$$

Therefore, for the titration rxn**:**

$$\mathbf{2\ moles\ CO_3^{2-} + 1\ mole\ HCO_3^{-1} = Total\ moles\ H^{+\ Titrated}}$$

For a 25.0 mL sample of 1.5 mM sodium carbonate/sodium bicarbonate solution we know that 75.0 mL of 1.5 mM HCl solution is required for the following titration reactions:

$$\mathbf{Na_2CO_3 + HCl \rightarrow NaHCO_3 + NaCl}$$
$$\mathbf{2HCO_3^{-1} + 2H^+ \rightarrow 2\ H_2CO_3}$$

and since: $\mathbf{2\ moles\ CO_3^{2-}\ +\ 1\ mole\ HCO_3^{-} = Total\ moles\ H^+\ Titrated}$

then:
$$2\left(\left[\frac{1.5\ \text{mmol}\ CO_3^{2-}}{\text{L}}\right] \times 25.0 \times 10^{-3}\ \text{L}\right) + \left(\left[\frac{1.5\ \text{mmol}\ HCO_3^{-}}{\text{L}}\right] \times 25.0 \times 10^{-3}\ \text{L}\right)$$
$$= \left[\frac{1.5\ \text{mmol}\ H^+}{\text{L}}\right] \times \text{Vol. HCl (titrated) (L)}$$

$$\text{Volume HCl (titrated)} = 75.0 \times 10^{-3}\ \text{L} = \mathbf{75.0\ mL}$$

In order to perform the titration reaction, a 0.100 M standardized solution of HCl is first be prepared. From this solution, the 1.5 mM HCl solution is then obtained by performing a simple dilution:

[1] CHEM 3111 Lab, Experiment #3 Analysis of a Mixture of Carbonate and Bicarbonate (Harris, D.C., *Quantitative Chemical Analysis, 6th edition,* W.H. Freeman and Company, New York, 2002.

Dry primary standard-grade sodium carbonate for 1 hr at 110°C and cool it in a dessicator. Using 125 mL Erlenmeyer flasks, weigh three samples containing exactly 0.132 g Na_2CO_3 needed to react with exactly 25.00 mL of 0.1 M HCl. Prepare 0.100 M HCl titrant to be standardized by diluting 8.33 mL of concentrated 12N HCl to a total volume of 1L. Use a 1L volumetric flask to dilute acid. Mix solution by inverting approximately 15 times. Let stand 5 minutes. Using a volumetric pipet, add 25.0 mL of high purity water to each flask containing the solid. Add a stir bar to each Erlenmeyer flask. Number/identify each flask.

Rinse burette with HCl titrant three times. Fill burette, record the initial volume. Using a Pasteur pipet and bulb, add 5 drops of indicator to the first flask.
Carefully titrate with HCl until it just turns from blue to green. (Record the volume of the burette.) Boil the solution for approximately 30 seconds to expel $CO_{2\ (g)}$. The solution should return to the initial blue color.
Cool flask in water bath for approximately 3-4 minutes. Carefully titrate HCl (drop wise) until the solution turns green again. Record the final volume. Repeat this previous step for flasks two and three.

Calculate the concentration standardized HCl solution based on the volumes titrated. Using a volumetric flask, prepare the 1.5 mM HCl from the now standardized HCl solution. When adding 0.100 HCl to flask, use glass volumetric pipettes for volumes ≥ 1.0 mL. Use a 1000µL micropipette for volumes that are less than 1.0 mL.

The 1.5 mM Sodium Carbonate/Sodium Bicarbonate trapping solution used during chemical toxicological testing is prepared and kept in 4L amber bottles which are identified and numbered.

From each 4L bottle, pipet 25.0 mL (use a volumetric pipet) into a 125 mL Erlenmeyer flask. Add a stir bar to each flask. Number/identify each flask. Rinse burette with previously prepared 1.5 mM HCl titrant. Fill burette, record the initial volume. Add 5 drops of indicator to the first flask.

Begin titration of the first sample with HCl. When the burette is close to empty, stop titration, record the volume, refill burette and record the new initial volume.
Continue to add HCl from the burette until the solution turns from blue to green. (See Appendix exact color.) Record the volume.

Boil the solution for approximately 30 seconds to expel $CO_{2\ (g).}$ The solution should return to the initial blue color. Cool flask in water bath for approximately 5 minutes. Carefully add HCl (drop wise) until the solution turns green again. Record the final volume of burette. Repeat titrations for remaining samples. Determine the concentration of carbonate in solution (see equation).

$$\textbf{x mmol carbonate} = \frac{([1.5\ \text{mmol}\ H^+/L] \times \text{Vol HCl (L) (titrated)}}{75.0 \times 10^{-3}\ L}$$

REAGENTS/APPARATUS:

- 1.5 mM Sodium Carbonate/Sodium Bicarbonate Solution
  (as per standard operational procedure “Toxicology QC Facemask Testing”)
- 12 N HCl (ACS Grade)
- 0.100 M HCl (prepared from 12N HCl, see procedure)
- 1.5 mM HCl (prepared from standardized 0.100 M HCl solution, see procedure)

- NaOH 50% w/w (Product SS254-1 by Fischer Scientific)
- Bromocresol Green Powder (ACS grade by Fischer Scientific)
- High Purity Water (NERL)
- Bromocresol Green Indicator:
    - Prepare 0.01 M NaOH Solution:
      -Fill approximately half way with high purity water.

      -Add 264 µL concentrated NaOH to 500 mL
      -Fill to mark with water.
    - Prepare bromocresol green indicator:
      -Weigh 0.1 g bromocresol green.
      -Using 250mL volumetric flask, dissolve powder in 14.3 mL 0.01 M NaOH solution.
      -Fill to mark with water.
      -Add stir bar, let stir for 24 hours.
      Note: Indicator is ideally prepared in advance.
      Label expiry date on bottle. See document CHM004 for determining the proper expiry date.

13.4 CHALLENGE PROCEDURE AND SETUP FOR COLLECTIVE PROTECTION

Steps (1 to 5) on figure 13.1 illustrate the setup and the testing procedure used for Triosyn filters tested at flow rates representative of HVAC applications. The following paragraph will elaborate on the latter steps.

All the glassware pieces are cleaned with chromic acid; this procedure will eliminate any iodine species that may adhere to the sides of the glassware. They are then rinsed with a sufficient amount of deionised water and then rinsed three times with the trapping solution. This is a very important step, especially when our detection method is sensitive to very small amounts of iodide.

The set up includes three air ducts that are used to test three air filtration media. It is as follows: two ducts for the testing of the Triosyn filter in duplicate and one duct for the control media that does not contain any Triosyn. Each air duct contains four (4) sampling ports; an average value is taken which will represent the iodine that is liberated from each of media. The air in the room is passed through the media at a given flow rate. It is connected to the main flow meter that regulates the total flow rate required to test a specific sample. From the HVAC Triosyn composite media in step#1, a Teflon filter holder (step#2) is positioned between the “T” connector and the small impinger (0.5 Litres per minute) that contains 10mL of trapping media (step#3). The Teflon membrane with a pore size of 0.45µm is approved by OSHA, to preclude any iodide containing particulates or any other types of particulates. In step#5, the flow meter is connected to a vacuum pump generating the vacuum.

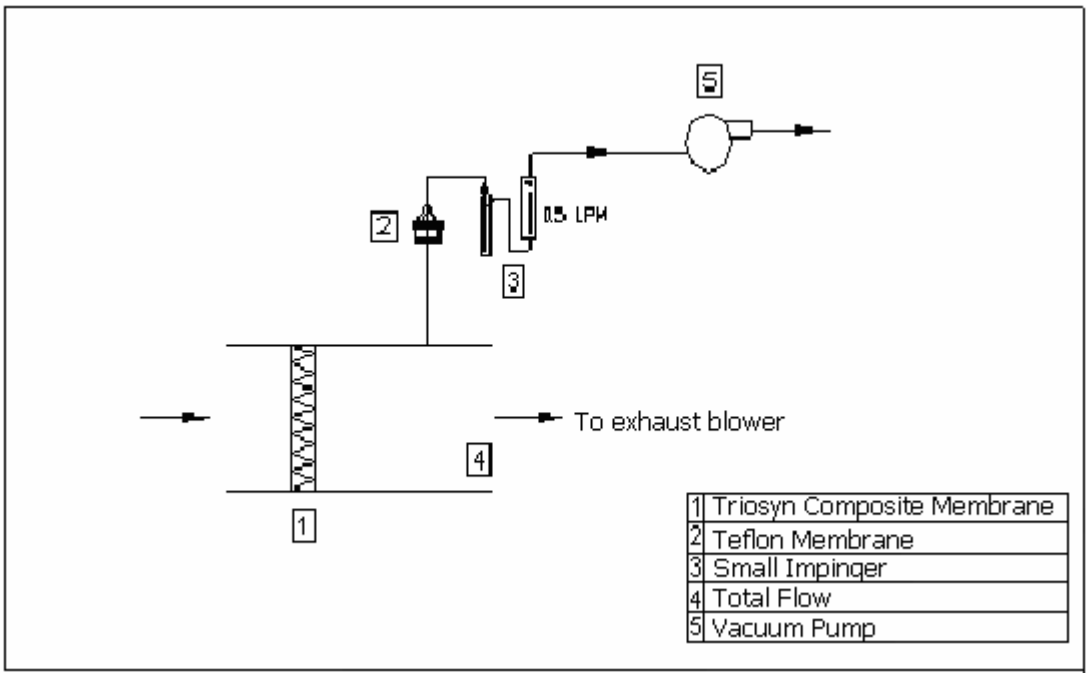


FIGURE 13.3: HVAC SET UP

13.5 CALCULATION OF THE AMOUNT OF IODINE IN AIR TEST SAMPLES

The HPLC instrument with an electrochemical detector is a highly sensitive instrument used to determine very low concentrations of iodide species. It is the only system that could read with great precision, very small amounts of iodide species. The iodine content could be calculated from the iodide measured using the following equations:

$$A = (\mu g/mL\ I^-) \times (Sol\ Vol)\ (Gravimetric\ Factor)$$

$$ppm\ of\ I_2 = \frac{A \times Mol.Vol.}{AV \times Mol.\ Wt.}$$

Where:

A = µg I_2

µg/mL I^- = Amount of iodide determined from the calibration curve

Sol. Vol. = Solution Volume in the small impinger (10 mL)

GF = Gravimetric Factor= 3 I_2/5I^-= 6/5=1.2

Mol. Vol. = Molar Volume (L/Mol) = 24.45 at Standard Temperature and Pressure

AV = Air Volume (L)

Mol. Wt. = Molecular Weight for I_2 = 253.8 g/mol

The total amount of iodine in units of mg/m^3 is determined using the following equation:

$$\textbf{Iodine } (mg/m^3) = \frac{\textbf{Conc. iodide (mg/L) x Trapping media vol. (L) x Gravimetric Factor (1.2)}}{\textbf{Flow Rate (L/min) x Duration of Sampling (Min.) x } m^3\textbf{/1000L}}$$

Where:

Conc. of Iodide (mg/L) = Amount mg/L of Iodide from calibration curve of HPLC

Trapping media vol. (L) = Solution volume in impinger in Litres (0.0010 L in small impinger)

Gravimetric Factor = 1.2 (The stoichiometric factor arising from conversion of iodine to iodide)

$$3\ I_2 + OH^- \rightarrow 3\ H_2O + 5I^- + IO_3^-$$

Gravimetric factor = $3\ I_2 / 5I^- = 6/5 = 1.2$

Flow rate (LPM) = Flow of Air passing through impinger (LPM) (0.5 LPM)

Duration of Sampling (min) = Sampling time in minutes

m^3/1000L = converts Litres to m^3

ANNEX 6: DOCUMENTS SUBMITTED TO THE U.S EPA FOR APPROVAL OF TRIOSYN FOR USE IN HVAC APPLICATIONS

The subsequent pages contain the correspondence and documents sent to the U.S. Environmental Protection Agency to support the labelling amendment for Triosyn® T-50 Powder (EPA Reg. No. 72897-2), including:

i. a cover letter,
ii. a copy of the current approved label for T50 Powder
iii. a copy of the revised labelling (with changes clearly marked in blue font)
iv. a copy of the new label for approval (clean version).

27 September, 2007

Ms. Emily Mitchell (PM#32)
Document Processing Desk (NOTIF)
Office of Pesticide Programs (7504P)
U.S. Environmental Protection Agency
Room S4900, One Potomac Yard
2777 South Crystal Drive
Arlington, Virginia 22202-4501

SUBJECT: NOTIFICATION TO ADD HVAC&R AND OTHER AIR FILTERS AND FILTER MATERIALS TO AN ANTIMICROBIAL PRODUCT PER PR NOTICE 98-10 AND PR NOTICE 2006-A DRAFT

Dear Ms. Mitchell,

Please find enclosed the following documents to support a labeling notification for Triosyn® T-50 Powder (EPA Reg. No. 72897-2), a registered indoor, nonfood use antimicrobial pesticide:

1. Cover letter
2. Application Form (EPA Form No. 8570-1);
3. Appendix 1 – One (1) copy of the current approved label for the product;
4. Appendix 2 – Previous communication with EPA with regard to this amendment; and
5. Appendix 3 – Five (5) copies of the revised labeling (with changes clearly marked in blue font).
6. Appendix 4 – Five (5) copies of the new label for approval (clean version)

This labeling notification is being made to add the following indoor, nonfood use sites: "*as an additive during the manufacturing process of synthetic and non-woven textile materials used in aquarium filters, vacuum bags and filters, air filters/materials,* ***HVAC&R and other air filters and filter materials****, door and floor mats, and outdoor equipment such as awnings, tarpaulins, and portable outdoor shelters. Triosyn® T50 Powder will normally impart protection when added at levels between 12.5% and 45% (wt/wt) of the laminate.*

Not for use in products that come into contact with food. ***Do not use in or on air ducts, duct fittings, duct liners, fans, supply ducts, return ducts, exhaust ducts, intakes, outlets, louvers, dampers, diffusers, plenums, outdoor air intakes, air handling units, or any other duct work of heating, ventilation, air conditioning, or refrigeration (HVAC&R) systems.*** *Finished products containing Triosyn® T50 Powder may not make public health claims relating to antimicrobial activity without first obtaining the necessary regulatory approvals.*"

Triosyn Corp.
Headquarters
1191 South Brownell Road
Williston, VT 05495
USA
Tel: (866) 865-5084
Fax: (802) 658-2681
info@triosyn.com

Notification to add HVAC&R and other air filters and filter materials to an antimicrobial product per PR Notice 98-10 and PR Notice 2006-A Draft. This notification is consistent with the provisions of PR Notice 98-10, PR Notice 2006-A Draft and EPA regulations at 40 CFR 152.46, and no other changes have been made to the labeling or the confidential statement of formula of this product. I understand that it is a violation of 18 U.S.C. Sec. 1001 to willfully make any false statement to EPA. I further understand that if this notification is not consistent with the terms of PR Notice 98-10 and 40 CFR 152.46, this product may be in violation of FIFRA and I may be subject to enforcement action and penalties under sections 12 and 14 of FIFRA.

Furthermore, the added use sites are within an already registered use pattern category for the product (i.e. textile preservatives), and there are no Agency decisions or directives explicitly prohibiting these additions. Further, no additional data is required for the added nonfood sites, exposure is not expected to increase, and the dosage, concentration, frequency or method of application are not changed by this notification.

If you have any further questions regarding this submission, please feel free to contact me at (858) 794-3213, arego@sflf.com or Bobby Arash, Director of Regulatory Affairs (802) 578-9486, barash@sflf.com.

Best regards,

Albert Rego PhD
Vice President, Regulatory Affairs and Quality Assurance

Triosyn Corp.
Headquarters
1191 South Brownell Road
Williston, VT 05495
USA
Tel: (866) 865-5084
Fax: (802) 658-2681
info@triosyn.com

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

June 28, 2005

OFFICE OF
PREVENTION, PESTICIDES AND
TOXIC SUBSTANCES

Kate Kasowitz
Triosyn Corp.
1191 South Brownell Road
Williston, VT 05495

Subject: T50 Powder
EPA Registration No. 72897-2
Application Date: April 26, 2005
Receipt Date: April 27, 2005

Dear Ms. Kasowitz:

The following amendment, submitted in connection with registration under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), as amended, is accepted.

The signal word for this product based on the submitted data is "WARNING" The precautionary Statements under Hazards to Humans and Domestic Animal agrees with the signal word.

A stamped copy of the labeling is enclosed. Submit one copy of your final printed labeling before distributing or selling the product bearing the revised labeling.

Should you have any questions or comments concerning this letter, please contact Wanda Henson at (703) 308-6345.

Sincerely,

for Emily H. Mitchell
Product Manager - Team 32
Regulatory Management Branch II
Antimicrobials Division (7510C)

PRECAUTIONARY STATEMENTS

HAZARDS TO HUMANS AND DOMESTIC ANIMALS

WARNING: CAUSES SUBSTANTIAL BUT TEMPORARY EYE INJURY. DO NOT GET IN EYES OR ON CLOTHING. WEAR PROTECTIVE EYEWEAR (GOGGLES OR FACE SHIELD OR SAFETY GLASSES). WASH HANDS THOROUGHLY WITH SOAP AND WATER AFTER HANDLING AND BEFORE EATING, DRINKING, CHEWING GUM, USING TOBACCO, OR USING THE RESTROOM. REMOVE AND WASH CONTAMINATED CLOTHING BEFORE REUSE.

ENVIRONMENTAL HAZARDS

This pesticide is toxic to fish and wildlife. Do not discharge effluent containing this active ingredient into lakes, streams, ponds, estuaries, oceans, or other waters, unless this product is specifically identified and addressed in an NPDES permit. Do not discharge effluent containing this product to sewer systems without previously notifying the sewage treatment plant authority. For guidance contact your State Water Board or Regional Office of the EPA.

STORAGE AND DISPOSAL

Do not contaminate water, food or feed by storage or disposal.

PESTICIDE STORAGE: Keep container closed when not in use. For extended periods, store in cool, dry location. Keep tightly closed during storage. Do not expose to direct sunlight. Open dumping is prohibited.

PESTICIDE DISPOSAL: Wastes resulting from the use of this product may be disposed of on site or at an approved waste disposal facility.

CONTAINER DISPOSAL: Triple rinse. Then offer for recycling or reconditioning, or puncture and dispose of in a sanitary landfill, or incineration or if allowed by state and local authorities by burning. If burned stay out of smoke.

Triosyn Corp.

TRIOSYN®T50 POWDER

Microbiostatic Agent*

SOLD FOR INDUSTRIAL USE ONLY

Active Ingredient:	
Iodine*	45.2 %
Other Ingredients	54.8 %
Total	100.0 %

*From Quat amine divinylbenzene/styrene copolymer iodine complex

KEEP OUT OF REACH OF CHILDREN

WARNING

(See side panel for additional precautionary statements)

FIRST AID

IF IN EYES:

- Hold eye open and rinse slowly and gently with water for 15-20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye.
- Call a poison control center or doctor for treatment advice.

HOT LINE NUMBER

For medical questions, emergencies or accidents involving this product call: 1-800-222-1222. Have the product container or label with you when calling a poison control center or doctor.

ACCEPTED
JUN 28 2005
Under the Federal Insecticide, Fungicide, and Rodenticide, Act as amended, for the pesticide, registered under EPA Reg. No. 72897-2

EPA Reg. No. 72897-2 / EPA Est. No. 72897-VT-1
Net Contents: xx lbs / xx kgs
Lot No.-------

Manufactured by
Triosyn Corp.
1191 South Brownell Road
Williston VT 05495

* A microbiostatic agent is an agent that inhibits the growth of odor causing bacteria, which cause staining & discoloration, fungi (mold & mildew), and algae. This product does not protect users or others against food-borne or disease-causing bacteria.

DIRECTIONS FOR USE:

It is a violation of Federal law to use this product in a manner inconsistent with its labeling. Use only under agreement with Triosyn Corp. Triosyn technical experts are available to determine optimum manufacturing conditions for specific application purposes.

When incorporated into the manufacturing process, Triosyn® T50 powder provides built-in antimicrobial and antifungal activity in the types of manufactured materials and finished products listed below. Triosyn® T50 Powder inhibits the growth of microorganisms such as bacteria, mold, mildew, and fungus that may cause odor, stain, discoloration, unsightly texture, decay, or deterioration of physical properties of the materials and finished products. This product is intended for use as an additive during the manufacturing process for the following materials/applications:

Paints, stains, and other coating systems, including enamel urethanes, wood stains, and alkyd epoxy enamels, for use on exterior surfaces only. Triosyn® T50 Powder will normally impart protection when added at levels between 20% and 30% (wt/wt). More may be required in hot, humid areas, where mildew is particularly severe.

Synthetic and non-woven textile materials for use in aquarium filters, air filters/materials, door and floor mats, and outdoor equipment such as awnings, tarpaulins, and portable outdoor shelters. Triosyn® T50 Powder will normally impart protection when added at levels between 12.5% and 45% (wt/wt) of the laminate.

Not for use in HVAC filters or products that come into contact with food. Finished products containing Triosyn® T50 Powder may not make public health claims relating to antimicrobial activity without first obtaining the necessary regulatory approvals.

PRECAUTIONARY STATEMENTS

HAZARDS TO HUMANS AND DOMESTIC ANIMALS

WARNING: Causes substantial but temporary eye injury. Do not get in eyes or on clothing. Wear protective eyewear (goggles or face shield or safety glasses). Wash hands thoroughly with soap and water after handling and before eating, drinking, chewing gum, using tobacco, or using the restroom. Remove and wash contaminated clothing before reuse.

ENVIRONMENTAL HAZARDS

This pesticide is toxic to fish and wildlife. Do not discharge effluent containing this active ingredient into lakes, streams, ponds, estuaries, oceans, or other waters, unless this product is specifically identified and addressed in an NPDES permit. Do not discharge effluent containing this product to sewer systems without previously notifying the sewage treatment plant authority. For guidance contact your State Water Board or Regional Office of the EPA.

STORAGE AND DISPOSAL

Do not contaminate water, food or feed by storage or disposal.

PESTICIDE STORAGE: Keep container closed when not in use. For extended periods, store in cool, dry location. Keep tightly closed during storage. Do not expose to direct sunlight. Open dumping is prohibited.

PESTICIDE DISPOSAL: Wastes resulting from the use of this product may be disposed of on site or at an approved waste disposal facility.

CONTAINER DISPOSAL: Triple rinse. Then offer for recycling or reconditioning, or puncture and dispose of in a sanitary landfill, or incineration or if allowed by state and local authorities by burning. If burned stay out of smoke.

Triosyn Corp.

TRIOSYN®T50 POWDER

Microbiostatic Agent*

SOLD FOR INDUSTRIAL USE ONLY

Active Ingredient:	
Iodine*	45.2 %
Other Ingredients	54.8 %
Total	100.0 %

*From Quat amine divinylbenzene/styrene copolymer iodine complex

KEEP OUT OF REACH OF CHILDREN

WARNING

(See side panel for additional precautionary statements)

FIRST AID

IF IN EYES:

- Hold eye open and rinse slowly and gently with water for 15-20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye.
- Call a poison control center or doctor for treatment advice.

HOT LINE NUMBER

For medical questions, emergencies or accidents involving this product call: 1-800-222-1222. Have the product container or label with you when calling a poison control center or doctor.

EPA Reg. No. 72897-2 / EPA Est. No. 72897-VT-1
Net Contents: xxxx lbs / xxxx kgs
Lot No. xxxxx

Manufactured by
Triosyn Corp.
1191 South Brownell Road
Williston VT 05495

* A microbiostatic agent is an agent that inhibits the growth of odor causing bacteria, which cause staining & discoloration, fungi (mold & mildew), and algae. This product does not protect users or others against food-borne or disease-causing bacteria.

DIRECTIONS FOR USE:

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When incorporated into the manufacturing process, Triosyn® T50 powder provides built-in antimicrobial and antifungal activity in the types of manufactured materials and finished products listed below. Triosyn® T50 Powder inhibits the growth of microorganisms such as bacteria, mold, mildew, and fungus that may cause odor, stain, discoloration, unsightly texture, decay, or deterioration of physical properties of the materials and finished products. This product is intended for use as an additive during the manufacturing process for the following materials/applications:

Paints, stains, and other coating systems, including enamel urethanes, wood stains, and alkyd epoxy enamels, for use on exterior surfaces only. Triosyn® T50 Powder will normally impart protection when added at levels between 20% and 30% (wt/wt). More may be required in hot, humid areas, where mildew is particularly severe.

Synthetic and non-woven textile materials for use in aquarium filters, vacuum bags and filters, air filters/materials, HVAC&R and other air filters and filter materials, door and floor mats, and outdoor equipment such as awnings, tarpaulins, and portable outdoor shelters. Triosyn® T50 Powder will normally impart protection when added at levels between 12.5% and 45% (wt/wt) of the laminate.

Not for use in ~~HVAC filters or~~ products that come into contact with food. Do not use in or on air ducts, duct fittings, duct liners, fans, supply ducts, return ducts, exhaust ducts, intakes, outlets, louvers, dampers, diffusers, plenums, outdoor air intakes, air handling units, or any other duct work of heating, ventilation, air conditioning, or refrigeration (HVAC&R) systems. Finished products containing Triosyn® T50 Powder may not make public health claims relating to antimicrobial activity without first obtaining the necessary regulatory approvals.

PRECAUTIONARY STATEMENTS

HAZARDS TO HUMANS AND DOMESTIC ANIMALS

WARNING: Causes substantial but temporary eye injury. Do not get in eyes or on clothing. Wear protective eyewear (goggles or face shield or safety glasses). Wash hands thoroughly with soap and water after handling and before eating, drinking, chewing gum, using tobacco, or using the restroom. Remove and wash contaminated clothing before reuse.

ENVIRONMENTAL HAZARDS

This pesticide is toxic to fish and wildlife. Do not discharge effluent containing this active ingredient into lakes, streams, ponds, estuaries, oceans, or other waters, unless this product is specifically identified and addressed in an NPDES permit. Do not discharge effluent containing this product to sewer systems without previously notifying the sewage treatment plant authority. For guidance contact your State Water Board or Regional Office of the EPA.

STORAGE AND DISPOSAL

Do not contaminate water, food or feed by storage or disposal.

PESTICIDE STORAGE: Keep container closed when not in use. For extended periods, store in cool, dry location. Keep tightly closed during storage. Do not expose to direct sunlight. Open dumping is prohibited.

PESTICIDE DISPOSAL: Wastes resulting from the use of this product may be disposed of on site or at an approved waste disposal facility.

CONTAINER DISPOSAL: Triple rinse. Then offer for recycling or reconditioning, or puncture and dispose of in a sanitary landfill, or incineration or if allowed by state and local authorities by burning. If burned stay out of smoke.

Triosyn Corp.

TRIOSYN®T50 POWDER

Microbiostatic Agent*

SOLD FOR INDUSTRIAL USE ONLY

Active Ingredient:	
Iodine*	45.2 %
Other Ingredients	54.8 %
Total	100.0 %

*From Quat amine divinylbenzene/styrene copolymer iodine complex

KEEP OUT OF REACH OF CHILDREN

WARNING

(See side panel for additional precautionary statements)

FIRST AID

IF IN EYES:

- Hold eye open and rinse slowly and gently with water for 15-20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye.
- Call a poison control center or doctor for treatment advice.

HOT LINE NUMBER

For medical questions, emergencies or accidents involving this product call: 1-800-222-1222. Have the product container or label with you when calling a poison control center or doctor.

EPA Reg. No. 72897-2 / EPA Est. No. 72897-VT-1
Net Contents: xxxx lbs / xxxx kgs
Lot No. xxxxx

Manufactured by
Triosyn Corp.
1191 South Brownell Road
Williston VT 05495

* A microbiostatic agent is an agent that inhibits the growth of odor causing bacteria, which cause staining & discoloration, fungi (mold & mildew), and algae. This product does not protect users or others against food-borne or disease-causing bacteria.

DIRECTIONS FOR USE:

It is a violation of Federal law to use this product in a manner inconsistent with its labeling. Use only under agreement with Triosyn Corp. Triosyn technical experts are available to determine optimum manufacturing conditions for specific application purposes.

When incorporated into the manufacturing process, Triosyn® T50 powder provides built-in antimicrobial and antifungal activity in the types of manufactured materials and finished products listed below. Triosyn® T50 Powder inhibits the growth of microorganisms such as bacteria, mold, mildew, and fungus that may cause odor, stain, discoloration, unsightly texture, decay, or deterioration of physical properties of the materials and finished products. This product is intended for use as an additive during the manufacturing process for the following materials/applications:

Paints, stains, and other coating systems, including enamel urethanes, wood stains, and alkyd epoxy enamels, for use on exterior surfaces only. Triosyn® T50 Powder will normally impart protection when added at levels between 20% and 30% (wt/wt). More may be required in hot, humid areas, where mildew is particularly severe.

Synthetic and non-woven textile materials for use in aquarium filters, vacuum bags and filters, air filters/materials, HVAC&R and other air filters and filter materials, door and floor mats, and outdoor equipment such as awnings, tarpaulins, and portable outdoor shelters. Triosyn® T50 Powder will normally impart protection when added at levels between 12.5% and 45% (wt/wt) of the laminate.

Not for use in products that come into contact with food. Do not use in or on air ducts, duct fittings, duct liners, fans, supply ducts, return ducts, exhaust ducts, intakes, outlets, louvers, dampers, diffusers, plenums, outdoor air intakes, air handling units, or any other duct work of heating, ventilation, air conditioning, or refrigeration (HVAC&R) systems. Finished products containing Triosyn® T50 Powder may not make public health claims relating to antimicrobial activity without first obtaining the necessary regulatory approvals.

15 ANNEX 7: FIELD EVALUATION QUESTIONNAIRE AND TEST PLAN

Triosyn T-5000 Disposable Respirator Field Evaluation Questionnaire

The manufacturer of the T-5000 is collecting information to help improve this respirator. Please answer the questions to the best of your ability. Your opinions are valuable. The responses will be grouped together, and no information will be attributed to an individual.

Respirator Evaluation

Please rate the T-5000 on a scale of 1 to 5 based on your experience with the respirator today. For any items you rate 4 or 5, please write your comments below the question.

	strongly agree	mildly agree	neutral	mildly disagree	strongly disagree	
1 The user instructions were clear and easy to follow	1	2	3	4	5	N/A
Comments:						
2 The nosepiece was easy to fit to my nose	1	2	3	4	5	N/A
Comments:						
3 The straps were easy to adjust	1	2	3	4	5	N/A
Comments:						
4 The T-5000 stayed in place when I moved my head	1	2	3	4	5	N/A
Comments:						
5 I could wear glasses/safety goggles with the T-5000	1	2	3	4	5	N/A
Comments:						
6 The T-5000 seemed to fit well, I didn't feel air leaking	1	2	3	4	5	N/A
Comments:						
7 The T-5000 was easy to breathe through (compared to other respirators I've worn)	1	2	3	4	5	N/A
Comments:						
8 The T-5000 was comfortable to wear	1	2	3	4	5	N/A
Comments:						
9 The T-5000 was comfortable on my nose	1	2	3	4	5	N/A
Comments:						
10 The T-5000 was comfortable on my cheeks	1	2	3	4	5	N/A
Comments:						
11 The T-5000 was comfortable on my chin	1	2	3	4	5	N/A
Comments:						
12 The straps were comfortable around my head	1	2	3	4	5	N/A
Comments:						

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Respirator Use Information

13. How often do you wear a respirator or facemask? (circle one)	Once a day or more	Once a week or more	Once a month or more	Less than once a month
14. Have you used a tight-fitting respirator?	Yes	No	What kind?	_____
15. How many times have you worn the T-5000 before? (circle one)	0-1	2-5	6-10	11 or more
16. Were you fit tested before wearing the T-5000? (circle one)	Yes	No	Result, if known :	_____
17. How long did you wear the T-5000 today? (circle one)	Less than 1 hour	1-3 hours	3-6 hours	More than 6 hours
18. What environment were you in while wearing the T-5000 today? (circle all that apply)	Medical	Laboratory	Outside	High dust or particles
19. What was your main activity level while wearing the T-5000 today? (circle one)	Sitting	Standing	Walking	Strenuous

General Feedback

20. What feature or aspect of the T-5000 do you like the best?

21. If there is one thing that you could change in the T-5000, what would it be?

22. What other types of similar products have you worn before?

23. In what way, if any, is the T-5000 better than other similar products you've worn?

24. If it were up to you, would you choose the T-5000 over other similar products? Why or why not?

25. If you needed to carry the T-5000 before you put it on, did you find it easy to carry? Why or why not?

26. Do you feel safer knowing that the T-5000 offers antimicrobial protection?

27. Is there anything else about the T-5000 that you'd like to mention?

Participant Information

Age : _____ Sex : M F Height : _____ Weight : _____

Field User Evaluation of the T-5000 Disposable Respirator

Principal Investigator
Dr. Joe Wander?
Division:
Branch:
Team:
Field Element:
Phone Number:
Email address:

Associate Investigator(s)
Triosyn Corp.?

Location of Research
TBD
Building
Building number

Data Collection Dates
TBD

Background
The Air Force Surgeon General's Modernization Directorate (AF/SGR) has purchased 375,000 T-5000 disposable respirators for evaluation and use. The T-5000 disposable respirator is a commercially-available cup-style filtering facepiece that is NIOSH-approved as a P95 for particulate filtration. The T-5000 incorporates Triosyn antimicrobial resin to offer users increased protection from exposure to disease-causing microorganisms and biological warfare agents.

Any respirator product must balance the need to provide the maximum protection from airborne particulates with the user's need for comfort and usability. The T-5000 offers excellent protection to its users: it is a NIOSH-approved P95 and has near perfect face fit scores across the full range of face sizes. Previous user testing and focus groups have shown that users find the respirator comfortable and easy to use.

The goal of the proposed effort is to evaluate the T-5000 for use by military field medical personnel. Comments will be collected from military users after they wear the respirator in an actual use environment. Their comments will indicate whether the respirator helps these users complete their missions safely. Their responses will also help the manufacturer understand whether certain features could be added or upgraded to improve the comfort, usability, and/or wearability of the respirator for military users.

Objective:
The objective of the proposed field user evaluation is to understand the suitability of the commercially-available T-5000 disposable respirator for use by military field medical personnel. The Air Force Surgeon General's Office has purchased these commercial respirators for use and evaluation. This study will ask for feedback from military personnel who use this respirator in the course of their daily duties. Data collected will be used to improve the respirator, if needed, to enhance its usability, wearability, and/or comfort. The results of this evaluation may also help AF/SGR or DoD personnel in

future purchasing decisions.

Participants
a. Nature of Sample: The desired test population is military users who wear a facemask or respirator regularly while completing their duties. Participants of varied age, gender, size, and ethnicity are requested to represent the full military user population. A total of 100 participants is requested, divided into two subgroups. One subgroup would use the respirator indoors, perhaps in a laboratory setting, while the other subgroup would use the respirator outdoors or at a higher activity level. With 50 users in each sub-group, there will be enough data points for meaningful analysis of the data.

b. Volunteer recruitment: (TBD – need to add who will recruit and how)

Instruments and Apparatus:
A questionnaire has been created to rate the participants' experiences with the T-5000. The questionnaire includes questions designed to evaluate the respirator's comfort, usability, and wearability, as well as to understand the user's familiarity with respirators and the use environment of the T-5000 during the trial.

Procedures and Methodology:
Participants will wear the T-5000 in place of the respirator or facemask they would typically use while completing their duties. The participants should perform any actions that would typically be required in their day-to-day activities. It is desirable that the participants wear the respirator for the maximum duration permitted by their responsibilities. A use duration of at least 1 hour and not more than 8 hours is requested. At the end of their work day, participants will be asked to complete the questionnaire to evaluate their experience with the T-5000.

Participants will be assigned a generic code, if needed, to protect their confidentiality. Personally identifiable information is not required for the completion of this evaluation. Audio and/or video taping of the tests are not required. Data will be collected and stored by (TBD).

Experimental Design:
This field user evaluation consists of participants completing a questionnaire after wearing the T-5000 disposable respirator. Whenever possible, questions were formulated to allow numeric ranking. Therefore, responses can be averaged or otherwise tabulated to provide a concise summary. In addition to averaging, responses to each numeric question can be displayed in a bar graph format to show the range of answers. Comments will also be compiled and reviewed as part of the evaluation.

Questions assess the respirator in three key categories: usability, wearability, and comfort, as shown below.

Usability

The user instructions were clear and easy to follow

The nosepiece was easy to fit to my nose

The straps were easy to adjust

Wearability

The T-5000 stayed in place when I moved my head

I could wear glasses/safety goggles with the T-5000

The T-5000 seemed to fit well, I didn't feel air leaking

The T-5000 was easy to breathe through (compared to other respirators I've worn)

Comfort

The T-5000 was comfortable to wear

The T-5000 was comfortable on my nose

The T-5000 was comfortable on my cheeks

The T-5000 was comfortable on my chin

The straps were comfortable around my head

One hundred participants are requested for this evaluation so feedback can be obtained from a wide range of users, including users of varied age, size, gender, and ethnicity. Using a large participant pool may also broaden the range of use conditions and daily activities for which evaluations are received.

Data Analysis:
Statistical methods will not be required for the evaluation proposed in this protocol. The average rating for each numeric question will be calculated. Responses to text-based questions will be summarized.

Participant Scenario:
Participants will don the T-5000 instead of the filtering facepiece they typically wear. Participants will then go about their daily duties as if they were wearing their typical facepiece. One participant group will conduct indoor seated or standing activities, while the second participant group will conduct outdoor or more strenuous activities. At the end of the shift, participants will complete a short questionnaire evaluating their experience with the T-5000. There are no risks to participants associated with this evaluation beyond the risks they encounter in their daily duties.

Benefits:
The benefit gained from testing will be an understanding of the T-5000's utility for military personnel. Specific benefits of the T-5000 and areas for improvement will be identified. The results of this evaluation may also help AF/SGR or DoD personnel in future purchasing decisions.

Risks:
There are no adverse health risks for participants in this evaluation. The T-5000 is a commercially-available NIOSH-approved P95 respirator. This test plan requests that military personnel who typically wear a facemask or respirator in their daily duties evaluate their experience wearing the T-5000 respirator.

Participants should follow all use instructions and precautions listed on the T-5000's packaging. As with all respirators, OSHA recommends that face fit testing be conducted before using the respirator in a work environment.

References:
N/A

16 ANNEX 8: MICROBIOLOGICAL RESULTS

Date	Test Number	Challenge Microorganism		Flow rate	Length	Details	Conditions	
		Tested	Type				Temp. °C	% RH
8/16/2007	M07-0356	MS2	coliphage	31.8 LPM	6 hours	Meltblown composite & Glass fiber media combination	20±5°C	50±25%
8/17/2007	M07-0357	MS2	coliphage	31.8 LPM	8 hours	Meltblown composite & Glass fiber media combination	20±5°C	50±25%
8/20/2007	M07-0358	MS2	coliphage	31.8 LPM	8 hours	Meltblown composite & Glass fiber media combination	20±5°C	50±25%
8/23/2007	M07-0363	MS2	coliphage	31.8 LPM	6 hours	Meltblown composite & Glass fiber media combination vs charge neutralized virus	20±5°C	50±15%
8/28/2007	M07-0367	MS2	coliphage	31.8 LPM	6 hours	Meltblown composite & Glass fiber media combination environmental condition testing	20±3°C	50±15%
8/29/2007	M07-0368	MS2	coliphage	31.8 LPM	6 hours	Meltblown composite & Glass fiber media combination environmental condition testing	5±3°C	75±15%
8/30/2007	M07-0369	MS2	coliphage	31.8 LPM	6 hours	Meltblown composite & Glass fiber media combination environmental condition testing	5±3°C	75±15%
8/31/2007	M07-0370	MS2	coliphage	31.8 LPM	6 hours	Meltblown composite & Glass fiber media combination environmental condition testing	30±3°C	85±15%
9/04/2007	M07-0377	MS2	coliphage	n/a	60 min	Glass fiber media contact study AATCC 100	n/a	n/a
9/5/2007	M07-0378	MS2	coliphage	4.0 LPM	3 hours	Meltblown composite & Glass fiber media combination consistency study	20±5°C	50±25%
9/7/2007	M07-0381	MS2	coliphage	n/a	60 min	Meltblown composite & Glass fiber media combination contact study AATCC 100	n/a	n/a
9/7/2007	M07-0385	MS2	coliphage	4.0 LPM	3 hours	Meltblown composite & Glass fiber media combination consistency study	20±5°C	50±25%
9/11/2007	M07-0387	*S. aureus*	bacteria	n/a	24 hours	Meltblown composite & Glass fiber media combination contact study AATCC 100	n/a	n/a
9/11/2007	M07-0389	MS2	coliphage	32.0 LPM	3 hours	Meltblown composite & various lot of Glass fiber media combination	20±5°C	50±25%
9/12/2007	M07-0390	MS2	coliphage	n/a	24 hours	Meltblown composite & Glass fiber media combination contact study AATCC 100	n/a	n/a
9/12/2007	M07-0392	MS2	coliphage	32.0 LPM	3 hours	Meltblown composite & various lot of Glass fiber media combination	20±5°C	50±25%
10/2/2007	M07-0416	MS2	coliphage	4.0 LPM	3 hours	Meltblown composite & various lot of Glass fiber media combination	20±5°C	50±25%
10/3/2007	M07-0417	MS2	coliphage	4.0 LPM	3 hours	Meltblown composite & various lot of Glass fiber media combination	20±5°C	50±25%
10/4/2007	M07-0418	MS2	coliphage	4.0 LPM	3 hours	Meltblown composite & various lot of Glass fiber media combination	20±5°C	50±25%
10/5/2007	M07-0421	MS2	coliphage	4.0 LPM	3 hours	Meltblown composite & various lot of Glass fiber media combination	20±5°C	50±25%
10/11/2007	M07-0429	MS2	coliphage	4.0 LPM	3 hours	IP2/CP2 stack: consistency study	20±5°C	50±25%
10/11/2007	M07-0430	MS2	coliphage	4.0 LPM	3 hours	IP2/CP2 stack: consistency study	20±5°C	50±25%
10/12/2007	M07-0431	MS2	coliphage	4.0 LPM	3 hours	IP2/CP2 stack: consistency study	20±5°C	50±25%
10/12/2007	V07-0030	Influenza PR 8	animal virus	4.0 LPM	3 hours	IP2/CP2 stack: animal virus model testing	20±5°C	50±25%
10/15/2007	M07-0433	*B. atrophaeus*	bacterial spore	n/a	24 hours	IP2/CP2 stack: contact study AATCC 100	n/a	n/a
10/15/2007	M07-0434	MS2	coliphage	31.8 LPM	3 hours	IP2/CP2 stack: environmental condition testing	20±5°C	50±15%
10/15/2007	M07-0435	MS2	coliphage	31.8 LPM	3 hours	IP2/CP2 stack: environmental condition testing	20±5°C	50±15%
10/16/2007	M07-0437	*S. aureus*	bacteria	n/a	24 hours	IP2/CP2 stack: contact study AATCC 100	n/a	n/a
10/16/2007	M07-0438	MS2	coliphage	31.8 LPM	3 hours	IP2/CP2 stack: environmental condition testing	30±3°C	85±15%
10/16/2007	M07-0439	MS2	coliphage	31.8 LPM	3 hours	IP2/CP2 stack: environmental condition testing	30±3°C	85±15%
10/17/2007	M07-0440	*S. aureus*	bacteria	31.8 LPM	3 hours	IP2/CP2 stack: BFE (vegetative bacteria)	20±5°C	50±25%
10/17/2007	M07-0441	MS2	coliphage	31.8 LPM	3 hours	IP2/CP2 stack: environmental condition testing	30±3°C	30±15%
10/17/2007	M07-0442	MS2	coliphage	31.8 LPM	3 hours	IP2/CP2 stack: environmental condition testing	30±3°C	30±15%
10/18/2007	M07-0446	MS2	coliphage	31.8 LPM	3 hours	IP2/CP2 stack: environmental condition testing	5±3°C	75±15%
10/18/2007	M07-0447	MS2	coliphage	31.8 LPM	3 hours	IP2/CP2 stack: environmental condition testing	5±3°C	75±15%
10/18/2007	M07-0448	MS2	coliphage	31.8 LPM	3 hours	IP2/CP2 stack: soil loading agent (DOP)	20±5°C	50±25%
10/19/2007	M07-0449	MS2	coliphage	31.8 LPM	3 hours	IP2/CP2 stack: soil loading agent (DOP)	20±5°C	50±25%
10/19/2007	M07-0450	*B. atrophaeus*	bacterial spore	31.8 LPM	3 hours	IP2/CP2 stack: BFE (bacterial spore)	20±5°C	50±25%
10/22/2007	M07-0451	A niger	fungal spore	n/a	24 hours	IP2/CP2 stack: contact study AATCC 100	n/a	n/a
10/22/2007	M07-0452	MS2	coliphage	4.0 LPM	3 hours	IP2/CP2 stack: soil loading agent (Dust 25%)	20±5°C	50±25%
10/22/2007	M07-0453	MS2	coliphage	4.0 LPM	3 hours	IP2/CP2 stack: soil loading agent (Dust 25%)	20±5°C	50±25%
10/23/2007	M07-0454	MS2	coliphage	n/a	24 hours	IP2/CP2 stack: contact study AATCC 100	n/a	n/a
10/23/2007	M07-0455	*S. aureus*	bacteria	n/a	24 hours	IP2/CP2 stack: contact study AATCC 100	n/a	n/a
10/24/2007	M07-0459	MS2	coliphage	4.0 LPM	3 hours	IP2/CP2 stack: soil loading agent (Dust 50%)	20±5°C	50±25%
10/24/2007	M07-0460	MS2	coliphage	4.0 LPM	3 hours	IP2/CP2 stack: soil loading agent (Dust 50%)	20±5°C	50±25%
10/25/2007	M07-0462	MS2	coliphage	4.0 LPM	3 hours	IP2/CP2 stack: soil loading agent (Dust 75%)	20±5°C	50±25%
10/25/2007	M07-0463	MS2	coliphage	4.0 LPM	3 hours	IP2/CP2 stack: soil loading agent (Dust 75%)	20±5°C	50±25%
10/25/2007	M07-0464	*A niger*	fungal spore	n/a	24 hours	IP2/CP2 stack: contact study AATCC 100	n/a	n/a
10/26/2007	M07-0465	*S. aureus*	bacteria	n/a	24 hours	IP2/CP2 stack: contact study AATCC 100	n/a	n/a
10/26/2007	M07-0466	MS2	coliphage	4.0 LPM	3 hours	IP2/CP2 stack: soil loading agent (Dust 100%)	20±5°C	50±25%
10/26/2007	M07-0467	MS2	coliphage	4.0 LPM	3 hours	IP2/CP2 stack: soil loading agent (Dust 100%)	20±5°C	50±25%
10/26/2007	M07-0468	MS2	coliphage	31.8 LPM	3 hours	IP2/CP2 stack: environmental condition testing	20±5°C	50±15%
10/26/2007	V07-0032	Influenza PR 8	animal virus	4.0 LPM	3 hours	IP2/CP2 stack: animal virus model testing	20±5°C	50±25%
10/29/2007	M07-0470	MS2	coliphage	4.0 LPM	3 hours	IP2/CP2 stack: soil loading agent (Smoke)	20±5°C	50±25%
10/29/2007	M07-0471	MS2	coliphage	4.0 LPM	3 hours	IP2/CP2 stack: soil loading agent (Smoke)	20±5°C	50±25%
10/29/2007	M07-0472	*B. atrophaeus*	bacterial spore	n/a	24 hours	IP2/CP2 stack: contact study AATCC 100	n/a	n/a
10/29/2007	M07-0473	MS2	coliphage	n/a	24 hours	IP2/CP2 stack: contact study AATCC 100	n/a	n/a
10/29/2007	M07-0476	MS2	coliphage	31.8 LPM	3 hours	IP2/CP2 stack: environmental condition testing	20±5°C	50±15%
10/30/2007	M07-0477	MS2	coliphage	n/a	24 hours	IP2/CP2 stack: contact study AATCC 100	n/a	n/a
11/1/2007	M07-0483	MS2	coliphage	n/a	24 hours	IP2/CP2 stack: contact study AATCC 100	n/a	n/a
11/12/2007	M07-0495	MS2	coliphage	n/a	24 hours	IP2/CP2 stack: contact study AATCC 100	n/a	n/a

Experiment No M07-0356: Biocidal air filtration membrane project:
Purpose: Testing meltblown composite media and Blank glass fiber media produced at Lydall in 2007
Challenge: MS2 coliphage at 20ºC ± 5ºC and 50% ± 15% RH a 31.8 LPM for 6 hours of filtration
Date:2007/08/16

Micro 2									MS2 1 Hour 31.8 LPM	
Filter code	raw results					total	d.l.	# platings	PFU total	% Reduction
MFT075-081607-01	25	31	22	31	15	124	100.0	25.0	4.96E+02	99.998347%
MFT075-081607-02	16	17	18	21	19	91	100.0	25.0	3.64E+02	99.998787%
MFT075-081607-03	21	13	15	14	15	78	100.0	25.0	3.12E+02	99.998960%
MFT071-081607-01	0	0	0	0	0	0	100.0	25.0	<4.00E+00	>99.999987%
MFT071-081607-02	0	0	0	0	0	0	100.0	25.0	<4.00E+00	>99.999987%
MFT071-081607-03	0	0	0	0	0	0	100.0	25.0	<4.00E+00	>99.999987%
C+	04					3.00E+05	100.0	1.0	3.00E+07	

Micro 2									MS2 4 Hour 31.8 LPM	
Filter code	raw results					total	d.l.	# platings	PFU total	% Reduction
MFT075-081607-01	50	70	68	64	68	320	100.0	25.0	1.28E+03	99.996235%
MFT075-081607-02	44	54	36	41	46	221	100.0	25.0	8.84E+02	99.997400%
MFT075-081607-03	45	56	58	70	62	291	100.0	25.0	1.16E+03	99.996576%
MFT071-081607-01	0	0	0	0	0	0	100.0	25.0	<4.00E+00	>99.999988%
MFT071-081607-02	1	0	1	0	0	2	100.0	25.0	8.00E+00	99.999976%
MFT071-081607-03	0	1	0	1	0	2	100.0	25.0	8.00E+00	99.999976%
C+	04					3.40E+05	100.0	1.0	3.40E+07	

Micro 2									MS2 2 Hour 31.8 LPM	
Filter code	raw results					total	d.l.	# platings	PFU total	% Reduction
MFT075-081607-01	50	33	36	41	34	194	100.0	25.0	7.76E+02	99.998060%
MFT075-081607-02	40	38	34	36	38	186	100.0	25.0	7.44E+02	99.998140%
MFT075-081607-03	40	23	26	31	33	153	100.0	25.0	6.12E+02	99.998470%
MFT071-081607-01	0	0	0	0	1	1	100.0	25.0	4.00E+00	99.999900%
MFT071-081607-02	0	0	0	0	0	0	100.0	25.0	<4.00E+00	>99.999990%
MFT071-081607-03	0	0	0	0	0	0	100.0	25.0	<4.00E+00	>99.999990%
C+	04					4.00E+05	100.0	1.0	4.00E+07	

Micro 2									MS2 5 Hour 31.8 LPM	
Filter code	raw results					total	d.l.	# platings	PFU total	% Reduction
MFT075-081607-01	65	70	53	67	62	317	100.0	25.0	1.27E+03	99.998526%
MFT075-081607-02	61	68	64	60	68	321	100.0	25.0	1.28E+03	99.998507%
MFT075-081607-03	72	118	97	84	93	464	100.0	25.0	1.86E+03	99.997842%
MFT071-081607-01	0	0	0	0	0	0	100.0	25.0	<4.00E+00	>99.999995%
MFT071-081607-02	0	1	0	1	0	2	100.0	25.0	8.00E+00	99.999991%
MFT071-081607-03	0	0	1	2	0	3	100.0	25.0	1.20E+01	99.999986%
C+	04					8.60E+05	100.0	1.0	8.60E+07	

Micro 2									MS2 3 Hour 31.8 LPM	
Filter code	raw results					total	d.l.	# platings	PFU total	% Reduction
MFT075-081607-01	46	38	36	35	33	188	100.0	25.0	7.52E+02	99.997968%
MFT075-081607-02	49	47	40	44	45	225	100.0	25.0	9.00E+02	99.997568%
MFT075-081607-03	94	67	53	78	81	373	100.0	25.0	1.49E+03	99.995968%
MFT071-081607-01	0	0	0	0	1	1	100.0	25.0	4.00E+00	99.999989%
MFT071-081607-02	0	0	1	0	1	2	100.0	25.0	8.00E+00	99.999978%
MFT071-081607-03	0	0	0	0	0	0	100.0	25.0	<4.00E+00	>99.999989%
C+	04					3.70E+05	100.0	1.0	3.70E+07	

Micro 2									MS2 6 Hour 31.8 LPM	
Filter code	raw results					total	d.l.	# platings	PFU total	% Reduction
MFT075-081607-01	71	88	90	96	78	423	100.0	25.0	1.69E+03	99.998929%
MFT075-081607-02	62	66	76	70	62	336	100.0	25.0	1.34E+03	99.999149%
MFT075-081607-03	137	144	164	98	168	711	100.0	25.0	2.84E+03	99.998200%
MFT071-081607-01	0	0	0	0	1	1	100.0	25.0	4.00E+00	99.999997%
MFT071-081607-02	0	1	0	0	0	1	100.0	25.0	4.00E+00	99.999997%
MFT071-081607-03	0	4	0	1	0	5	100.0	25.0	2.00E+01	99.999987%
C+	+04					1.58E+06	100.0	1.0	1.58E+08	

Experiment No M07-0357: Biocidal air filtration membrane project:
Purpose: Testing meltblown composite media and Blank glass fiber media produced at Lydall in 2007
Challenge: MS2 coliphage at 20ºC ± 5ºC and 50% ± 15% RH a 31.8 LPM for 8 hours of filtration
Date:2007/08/17

Micro 2											MS2 1 Hour 31.8 LPM	
Filter code	raw results										PFU total	% Reduction
MFT075-081707-01	22	16	23	15	13	12	15	5	6	9	136	100.0	50.0	2.72E+02	99.998912%
MFT075-081707-02	10	13	17	9	9	12	11	10	11	15	117	100.0	50.0	2.34E+02	99.999064%
MFT075-081707-03	16	19	22	25	17	18	23	15	20	15	190	100.0	50.0	3.80E+02	99.998480%
MFT071-081707-01	0	0	0	0	0	0	0	0	0	0	0	100.0	50.0	<2.00E+00	>99.999992%
MFT071-081707-02	0	0	0	0	0	0	0	0	0	0	0	100.0	50.0	<2.00E+00	>99.999992%
MFT071-081707-03	0	0	0	0	0	0	0	0	0	0	0	100.0	50.0	<2.00E+00	>99.999992%
C+	25E+04										2.50E+05	100.0	1.0	2.50E+07	

Micro 2											MS2 5 Hour 31.8 LPM	
Filter code	raw results										PFU total	% Reduction
MFT075-081707-01	12	6	6	5	4	5	10	7	8	12	75	100.0	50.0	1.50E+02	99.999545%
MFT075-081707-02	7	4	8	1	3	7	7	6	4	5	52	100.0	50.0	1.04E+02	99.999685%
MFT075-081707-03	25	23	20	22	24	25	24	31	28	21	243	100.0	50.0	4.86E+02	99.998527%
MFT071-081707-01	0	0	0	0	0	0	0	0	0	0	0	100.0	50.0	<2.00E+00	>99.999994%
MFT071-081707-02	0	0	0	0	1	1	0	0	1	0	3	100.0	50.0	6.00E+00	99.999982%
MFT071-081707-03	0	1	1	0	0	0	0	0	0	0	2	100.0	50.0	4.00E+00	99.999988%
C+	33E+04										3.30E+05	100.0	1.0	3.30E+07	

Micro 2											MS2 2 Hour 31.8 LPM	
Filter code	raw results										PFU total	% Reduction
MFT075-081707-01	25	18	17	26	27	17	31	23	25	23	232	100.0	50.0	4.64E+02	99.996778%
MFT075-081707-02	26	25	18	21	20	29	31	33	24	27	254	100.0	50.0	5.08E+02	99.996472%
MFT075-081707-03	23	24	25	30	22	18	22	22	20	17	223	100.0	50.0	4.46E+02	99.996903%
MFT071-081707-01	0	0	0	0	0	0	0	0	0	0	0	100.0	50.0	<2.00E+00	>99.999986%
MFT071-081707-02	0	0	0	0	0	0	0	0	0	0	0	100.0	50.0	<2.00E+00	>99.999986%
MFT071-081707-03	1	0	0	0	0	0	0	0			1	100.0	40.0	2.50E+00	99.999983%
C+	144E+03										1.44E+05	100.0	1.0	1.44E+07	

Micro 2											MS2 6 Hour 31.8 LPM	
Filter code	raw results										PFU total	% Reduction
MFT075-081707-01	42	40	54	44	42	41	43	55	38	45	444	100.0	50.0	8.88E+02	99.997388%
MFT075-081707-02	34	29	33	34	27	30	40	28	36	26	317	100.0	50.0	6.34E+02	99.998135%
MFT075-081707-03	27	34	41	41	38	39	34	45	40	68	407	100.0	50.0	8.14E+02	99.997606%
MFT071-081707-01	4	2	1	1	1	1	1	1	0	0	12	100.0	50.0	2.40E+01	99.999929%
MFT071-081707-02	1	0	0	0	0	0	0	0	0	0	1	100.0	50.0	2.00E+00	99.999994%
MFT071-081707-03	1	1	0	2	0	0	1	1	0	0	6	100.0	50.0	1.20E+01	99.999965%
C+	34E+04										3.40E+05	100.0	1.0	3.40E+07	

Micro 2											MS2 3 Hour 31.8 LPM	
Filter code	raw results										PFU total	% Reduction
MFT075-081707-01	26	26	30	33	27	42	30	25	20	21	280	100.0	50.0	5.60E+02	99.998194%
MFT075-081707-02	30	29	58	27	31	44	38	40	28	32	357	100.0	50.0	7.14E+02	99.997697%
MFT075-081707-03	34	24	25	20	38	22	31	27	24	40	285	100.0	50.0	5.70E+02	99.998161%
MFT071-081707-01	0	0	0	1	0	1	0	0	0	0	2	100.0	50.0	4.00E+00	99.999987%
MFT071-081707-02	0	0	0	0	1	0	0	0	0	0	1	100.0	50.0	2.00E+00	99.999994%
MFT071-081707-03	0	0	1	0	0	0	1	0	0	0	2	100.0	50.0	4.00E+00	99.999987%
C+	31E+04										3.10E+05	100.0	1.0	3.10E+07	

Micro 2											MS2 7 Hour 31.8 LPM	
Filter code	raw results										PFU total	% Reduction
MFT075-081707-01	35	38	36	52	55	48	40	41	60	46	451	100.0	50.0	9.02E+02	99.997687%
MFT075-081707-02	70	78	87	76	76	88	89	75	91	72	802	100.0	50.0	1.60E+03	99.995887%
MFT075-081707-03	88	92	93	89	103	80	84	85	85	76	875	100.0	50.0	1.75E+03	99.995513%
MFT071-081707-01	1	0	1	0	1	0	1	1	0	0	5	100.0	50.0	1.00E+01	99.999974%
MFT071-081707-02	0	0	0	0	1	0	0	0	0	0	1	100.0	50.0	2.00E+00	99.999995%
MFT071-081707-03	1	1	1	0	0	1	0	1	0	0	5	100.0	50.0	1.00E+01	99.999974%
C+	39E+04										3.90E+05	100.0	1.0	3.90E+07	

Micro 2											MS2 4 Hour 31.8 LPM	
Filter code	raw results										PFU total	% Reduction
MFT075-081707-01	22	17	16	18	18	24	30	17	11	10	183	100.0	50.0	3.66E+02	99.998738%
MFT075-081707-02	32	29	25	26	26	38	39	24	25	25	289	100.0	50.0	5.78E+02	99.998007%
MFT075-081707-03	41	41	45	46	47	53	50	39	41	40	443	100.0	50.0	8.86E+02	99.996945%
MFT071-081707-01	0	0	1	0	0	2	0	0	0	0	3	100.0	50.0	6.00E+00	99.999979%
MFT071-081707-02	0	0	1	0	1	0	1	0	0	0	3	100.0	50.0	6.00E+00	99.999979%
MFT071-081707-03	0	0	0	0	0	0	0	0	0	0	0	100.0	50.0	<2.00E+00	>99.999993%
C+	29E+04										2.90E+05	100.0	1.0	2.90E+07	

Micro 2											MS2 8 Hour 31.8 LPM	
Filter code	raw results										PFU total	% Reduction
MFT075-081707-01	30	35	33	21	22	15	26	23	22	20	247	100.0	50.0	4.94E+02	99.998789%
MFT075-081707-02	68	48	40	40	37	59	61	57	58	50	518	100.0	50.0	1.04E+03	99.997461%
MFT075-081707-03	92	84	90	91	99	105	103	100	95	96	955	100.0	50.0	1.91E+03	99.995319%
MFT071-081707-01	5	3	3	3	3	1	1	1	0	0	20	100.0	50.0	4.00E+01	99.999902%
MFT071-081707-02	4	3	3	2	2	1	0	0	0	0	15	100.0	50.0	3.00E+01	99.999926%
MFT071-081707-03	0	0	4	1	0	1	1	0	0	0	7	100.0	50.0	1.40E+01	99.999966%
C+	408E+03										4.08E+05	100.0	1.0	4.08E+07	

Experiment No M07-0358: Biocidal air filtration membrane project:
Purpose: Testing meltblown composite media and Blank glass fiber media produced at Lydall in 2007
Challenge: MS2 coliphage at 20ºC ± 5ºC and 50% ± 15% RH a 31.8 LPM for 8 hours of filtration
Date:2007/08/20

Micro 2 — MS2, 1 Hour, 31.8 LPM

Filter code	raw results										total	d.l.	# platings	PFU total	% Reduction
MFT075-082007-01	11	10	3	9	8	10	11	10	8	11	91	100.0	50.0	1.82E+02	99.998198%
MFT075-082007-02	14	10	14	12	13	17	16	8	12	5	121	100.0	50.0	2.42E+02	99.997604%
MFT075-082007-03	8	13	10	6	12	8	7	7	12	11	94	100.0	50.0	1.88E+02	99.998139%
MFT071-082007-01	17	17	11	12	13						70	100.0	25.0	2.80E+02	99.997228%
MFT071-082007-02	1	0	0	0	0	0	0	0	0	0	1	100.0	50.0	2.00E+00	99.999980%
MFT071-082007-03	0	0	0	0	0	0	1	0	0	0	1	100.0	50.0	2.00E+00	99.999980%
C+	101E+03										1.01E+05	100.0	1.0	1.01E+07	

Micro 2 — MS2, 5 Hour, 31.8 LPM

Filter code	raw results										total	d.l.	# platings	PFU total	% Reduction
MFT075-082007-01	41	52	47	55	33	38	39	33	24	33	395	100.0	50.0	7.90E+02	99.998655%
MFT075-082007-02	205	186									391	100.0	10.0	3.91E+03	99.994333%
MFT075-082007-03	78	82	83	83	70	102	90	113	85	90	876	100.0	50.0	1.75E+03	99.997461%
MFT071-082007-01	0	0	0	1	1	0	0	1	0	0	3	100.0	50.0	6.00E+00	99.999991%
MFT071-082007-02	0	0	0	0	0	1	0	0	1	0	2	100.0	50.0	4.00E+00	99.999994%
MFT071-082007-03	0	0	0	0	0	0	0	0	0	0	0	100.0	50.0	<2.00E+00	>99.999997%
C+	69E+04										6.90E+05	100.0	1.0	6.90E+07	

Micro 2 — MS2, 2 Hour, 31.8 LPM

Filter code	raw results										total	d.l.	# platings	PFU total	% Reduction
MFT075-082007-01	12	11	18	11	8	3	17	13	9	11	113	100.0	50.0	2.26E+02	99.997103%
MFT075-082007-02	27	36	29	36	33	27	36	45	25	26	320	100.0	50.0	6.40E+02	99.991795%
MFT075-082007-03	18	17	18	15	15	9	15	16	9	11	143	100.0	50.0	2.86E+02	99.996333%
MFT071-082007-01	0	0	0	0	0	0	1	0	0	0	1	100.0	50.0	2.00E+00	99.999974%
MFT071-082007-02	0	0	0	1	0	0	0	0	0	0	1	100.0	50.0	2.00E+00	99.999974%
MFT071-082007-03	0	0	0	0	0	0	0	0	0	0	0	100.0	50.0	<2.00E+00	>99.999974%
C+	78E+03										7.80E+04	100.0	1.0	7.80E+06	

Micro 2 — MS2, 6 Hour, 31.8 LPM

Filter code	raw results										total	d.l.	# platings	PFU total	% Reduction
MFT075-082007-01	105	98	134	127	129	120	100	90	80	77	1060	100.0	50.0	2.12E+03	99.998107%
MFT075-082007-02		272		296		220		298		308	1394	100.0	25.0	5.58E+03	99.995021%
MFT075-082007-03	89	84	81	75	92	66	91	90	87	105	860	100.0	50.0	1.72E+03	99.998464%
MFT071-082007-01	0	1	0	2	0	1	1	0	0	0	5	100.0	50.0	1.00E+01	99.999991%
MFT071-082007-02	3	0	1	0	2	0	1	0	1	2	10	100.0	50.0	2.00E+01	99.999982%
MFT071-082007-03	0	0	0	1	0	0	0	0	0	0	1	100.0	50.0	2.00E+00	99.999998%
C+	112E+04										1.12E+06	100.0	1.0	1.12E+08	

Micro 2 — MS2, 3 Hour, 31.8 LPM

Filter code	raw results										total	d.l.	# platings	PFU total	% Reduction
MFT075-082007-01	20	19	24	16	15	20	25	28	19	19	205	100.0	50.0	4.10E+02	99.998949%
MFT075-082007-02	17	16	13	16	12	12	10	11	13	13	133	100.0	50.0	2.66E+02	99.999318%
MFT075-082007-03	17	18	7	17	13	12	15	18	10	15	142	100.0	50.0	2.84E+02	99.999272%
MFT071-082007-01	0	0	0	0	0	0	1	0	0	0	1	100.0	50.0	2.00E+00	99.999995%
MFT071-082007-02	0	0	0	0	0	0	0	0	0	0	0	100.0	50.0	<2.00E+00	>99.999995%
MFT071-082007-03	0	0	0	0	0	0	0	0	0	0	0	100.0	50.0	<2.00E+00	>99.999995%
C+	39E+04										3.90E+05	100.0	1.0	3.90E+07	

Micro 2 — MS2, 7 Hour, 31.8 LPM

Filter code	raw results										total	d.l.	# platings	PFU total	% Reduction
MFT075-082007-01	47	56	56	63	48	40	40	35	36	33	454	100.0	50.0	9.08E+02	99.998434%
MFT075-082007-02										271	271	100.0	5.0	5.42E+03	99.990655%
MFT075-082007-03	116	91	112	113	136	135	154	129	133	119	1238	100.0	50.0	2.48E+03	99.995731%
MFT071-082007-01	2	1	1	2	3	0	4	4	0	3	20	100.0	50.0	4.00E+01	99.999931%
MFT071-082007-02	0	1	5	3	0	1	1	2	4	3	20	100.0	50.0	4.00E+01	99.999931%
MFT071-082007-03	0	0	0	1	0	0	1	0	0	0	2	100.0	50.0	4.00E+00	99.999993%
C+	58E+04										5.80E+05	100.0	1.0	5.80E+07	

Micro 2 — MS2, 4 Hour, 31.8 LPM

Filter code	raw results										total	d.l.	# platings	PFU total	% Reduction
MFT075-082007-01	41	46	34	38	35	48	37	46	44	35	404	100.0	50.0	8.08E+02	99.998964%
MFT075-082007-02	189	164									353	100.0	10.0	3.53E+03	99.995474%
MFT075-082007-03	56	85	75	63	72	92	708	63	65	76	1355	100.0	50.0	2.71E+03	99.996526%
MFT071-082007-01	0	0	0	0	0	0	0	0	0	1	1	100.0	50.0	2.00E+00	99.999997%
MFT071-082007-02	1	1	1	2	0	0	1	1	1	0	8	100.0	50.0	1.60E+01	99.999979%
MFT071-082007-03	0	0	0	0	0	0	0	0	0	0	0	100.0	50.0	<2.00E+00	>99.999997%
C+	78E+04										7.80E+05	100.0	1.0	7.80E+07	

Micro 2 — MS2, 8 Hour, 31.8 LPM

Filter code	raw results										total	d.l.	# platings	PFU total	% Reduction
MFT075-082007-01	105	97	90	96	72	128	113	126	122	104	1053	100.0	50.0	2.11E+03	99.998417%
MFT075-082007-02										269	269	100.0	5.0	5.38E+03	99.995955%
MFT075-082007-03	150	141	159	120	127	110	132	134	127	150	1350	100.0	50.0	2.70E+03	99.997970%
MFT071-082007-01	3	0	1	3	0	2	2	0	2	0	13	100.0	50.0	2.60E+01	99.999980%
MFT071-082007-02	2	0	4	3	1	0	3	3	3	1	20	100.0	50.0	4.00E+01	99.999970%
MFT071-082007-03	1	0	1	1	0	1	1	0	0	0	5	100.0	50.0	1.00E+01	99.999992%
C+	133E+04										1.33E+06	100.0	1.0	1.33E+08	

Experiment No M07-0363: Biocidal air filtration membrane project:
Purpose: Testing meltblown composite media and BLANK glass fiber media produced at Lydall in 2007
Challenge: MS2 coliphage at 20ºC ± 5ºC and 50% ± 15% RH a 31.8 LPM for 6 hours of filtration
Date:2007/08/23

Micro 3 — MS2, 1 Hour, 31.8 LPM

Filter code	raw results (larger volume plating 5mL/petri)										total	d.l.	# platings	PFU total	% Reduction
MFT075-082307-01	0	0	0	0	0	0	0	0	0	0	0	100.0	50.0	<2.00E+00	>99.999987%
MFT075-082307-02	65	62	59	59	53	52	49	49	45	36	529	100.0	50.0	1.06E+03	99.992899%
MFT075-082307-03	37	38	43	48	48	49	50	52	56	66	487	100.0	50.0	9.74E+02	99.993463%
MFT071-082307-01	0	0	0	0	0	0	0	0	0	0	0	100.0	50.0	<2.00E+00	>99.999987%
MFT071-082307-02	0	0	0	0	0	0	0	0	0	0	0	100.0	50.0	<2.00E+00	>99.999987%
MFT071-082307-03	0	0	0	0	1	0	0	0	0	0	1	100.0	50.0	2.00E+00	99.999987%
C+	149E+03										1.49E+05	100.0	1.0	1.49E+07	

Micro 3 — MS2, 2 Hour, 31.8 LPM

Filter code	raw results (larger volume plating 5mL/petri)										total	d.l.	# platings	PFU total	% Reduction
MFT075-082307-01	0	0	0	0	0	0	0	0	0	0	0	100.0	50.0	<2.00E+00	>99.999992%
MFT075-082307-02	188										188	100.0	5.0	3.76E+03	99.984960%
MFT075-082307-03	138										138	100.0	5.0	2.76E+03	99.988960%
MFT071-082307-01	0	0	0	0	1	0	0	0	0	0	1	100.0	50.0	2.00E+00	99.999992%
MFT071-082307-02	0	0	0	2	0	0	1	0	0	0	3	100.0	50.0	6.00E+00	99.999976%
MFT071-082307-03	0	0	1	0	0	0	0	1	0	0	2	100.0	50.0	4.00E+00	99.999984%
C+	25E+04										2.50E+05	100.0	1.0	2.50E+07	

Micro 3 — MS2, 3 Hour, 31.8 LPM

Filter code	raw results (larger volume plating 5mL/petri)										total	d.l.	# platings	PFU total	% Reduction
MFT075-082307-01	0	0	0	0	0	0	0	0	0	0	0	100.0	50.0	<2.00E+00	>99.999992%
MFT075-082307-02	133										133	100.0	5.0	2.66E+03	99.989360%
MFT075-082307-03	123										123	100.0	5.0	2.46E+03	99.990160%
MFT071-082307-01	0	0	0	1	1	1	1	2	2	5	13	100.0	50.0	2.60E+01	99.999896%
MFT071-082307-02	1	0	1	1	0	0	1	1	1	3	9	100.0	50.0	1.80E+01	99.999928%
MFT071-082307-03	0	0	1	0	0	1	0	1	0	0	3	100.0	50.0	6.00E+00	99.999976%
C+	2.50E+05										250000	100.0	1.0	2.50E+07	

Micro 3 — MS2, 4 Hour, 31.8 LPM

Filter code	raw results (larger volume plating 5mL/petri)										total	d.l.	# platings	PFU total	% Reduction
MFT075-082307-01	0	0	0	0	0	0	0	0	0	1	1	100.0	50.0	<2.00E+00	>99.999992%
MFT075-082307-02	213										213	100.0	5.0	4.26E+03	99.982025%
MFT075-082307-03	212										212	100.0	5.0	4.24E+03	99.982110%
MFT071-082307-01	0	0	0	1	1	0	0	1	1	0	4	100.0	50.0	8.00E+00	99.999966%
MFT071-082307-02	1	1	1	1	1	5	4	2	0	0	16	100.0	50.0	3.20E+01	99.999865%
MFT071-082307-03	0	0	0	1	0	1	0	1	0	0	3	100.0	50.0	6.00E+00	99.999975%
C+	237E+03										2.37E+05	100.0	1.0	2.37E+07	

Micro 3 — MS2, 5 Hour, 31.8 LPM

Filter code	raw results (larger volume plating 5mL/petri)										total	d.l.	# platings	PFU total	% Reduction
MFT075-082307-01	0	0	0	0	0	0	0	0	0	1	1	100.0	50.0	<2.00E+00	>99.999991%
MFT075-082307-02	70	98	79	82	67	89	69	108	88	89	839	100.0	50.0	1.68E+03	99.992509%
MFT075-082307-03	55	80	67	64	66	103	102	83	73	79	772	100.0	50.0	1.54E+03	99.993107%
MFT071-082307-01	0	0	0	2	0	0	1	0	0	0	3	100.0	50.0	6.00E+00	99.999973%
MFT071-082307-02	0	0	2	0	2	1	1	1	1	1	9	100.0	50.0	1.80E+01	99.999920%
MFT071-082307-03	0	0	0	2	0	4	0	3	0	1	10	100.0	50.0	2.00E+01	99.999911%
C+	224E+03										2.24E+05	100.0	1.0	2.24E+07	

Micro 3 — MS2, 6 Hour, 31.8 LPM

Filter code	raw results (larger volume plating 5mL/petri)										total	d.l.	# platings	PFU total	% Reduction
MFT075-082307-01	0	0	0	0	0	0	0	0	0	0	0	100.0	50.0	<2.00E+00	>99.999993%
MFT075-082307-02	274										274	100.0	5.0	5.48E+03	99.979704%
MFT075-082307-03	228										228	100.0	5.0	4.56E+03	99.983111%
MFT071-082307-01	0	1	1	0	0	2	3	0	0	0	7	100.0	50.0	1.40E+01	99.999948%
MFT071-082307-02	5	5	1	4	2	9	4	4	3	0	37	100.0	50.0	7.40E+01	99.999726%
MFT071-082307-03	1	1	2	2	0	0	1	2	0	0	9	100.0	50.0	1.80E+01	99.999933%
C+	27E+04										2.70E+05	100.0	1.0	2.70E+07	

Charged Viruses

Charge Neutralized viruses

Experiment No M07-0367: Biocidal air filtration membrane project:
Purpose: Testing IP2/CP2 stack (Triosynated meltblown /BLANK glass fiber media) in environmental condition (20°C ± 3°C & 50% ± 15% RH)
Challenge: MS2 coliphage at 20ºC ± 3ºC and 50% ± 15% RH a 31.8 LPM for 6 hours of filtration
Date:2007/08/28

Micro 3														MS2 1 Hour 31.8 LPM	
Filter code	raw results (larger volume plating 5mL/petri)										total	d.l.	# platings	PFU total	% Reduction
MFT071-082807-01	3	3	3	3	2	1	0	0	0	0	15	100.0	50.0	3.00E+01	99.999885%
MFT071-082807-02	13	9	7	7	9	8	5	11	12	13	94	100.0	50.0	1.88E+02	99.999277%
MFT071-082807-03	2	3	3	3	1	1	1	1	1	0	16	100.0	50.0	3.20E+01	99.999877%
MFT075-082807-01	94	100	102	100	84	102	96	118	94	98	988	100.0	50.0	1.98E+03	99.992400%
MFT075-082807-02	86	68	80	78	88	86	68	84	90	88	816	100.0	50.0	1.63E+03	99.993723%
MFT075-082807-03	74	78	72	64	64	78	62	64	86	70	712	100.0	50.0	1.42E+03	99.994523%
C+	26E+04										2.60E+05	100.0	1.0	2.60E+07	

Micro 3														MS2 2 Hour 31.8 LPM	
Filter code	raw results (larger volume plating 5mL/petri)										total	d.l.	# platings	PFU total	% Reduction
MFT071-082807-01	6	11	5	13	5	8	2	2	3	4	59	100.0	50.0	1.18E+02	99.999653%
MFT071-082807-02		14	15	10	9	13	9	11	9	2	92	100.0	5.0	1.84E+03	99.994588%
MFT071-082807-03	2	9	1	4	4	8	2	12	4	4	50	100.0	50.0	1.00E+02	99.999706%
MFT075-082807-01	266										266	100.0	5.0	5.32E+03	99.984353%
MFT075-082807-02	148	176									324	100.0	10.0	3.24E+03	99.990471%
MFT075-082807-03	110	88	112	102	94	108	100	102	90	120	1026	100.0	50.0	2.05E+03	99.993965%
C+	34E+04										3.40E+05	100.0	1.0	3.40E+07	

Micro 3														MS2 3 Hour 31.8 LPM	
Filter code	raw results (larger volume plating 5mL/petri)										total	d.l.	# platings	PFU total	% Reduction
MFT071-082807-01	2	2	5	5	6	6	6	9	9	9	59	100.0	50.0	1.18E+02	99.999712%
MFT071-082807-02	13	16	16	17	17	17	20	22	27	19	184	100.0	50.0	3.68E+02	99.999102%
MFT071-082807-03	2	3	3	6	7	7	8	9	10	13	68	100.0	50.0	1.36E+02	99.999668%
MFT075-082807-01	328										328	100.0	5.0	6.56E+03	99.984000%
MFT075-082807-02	356										356	100.0	5.0	7.12E+03	99.982634%
MFT075-082807-03	260										260	100.0	5.0	5.20E+03	99.987317%
C+	4.10E+05										410000	100.0	1.0	4.10E+07	

Micro 3														MS2 4 Hour 31.8 LPM	
Filter code	raw results (larger volume plating 5mL/petri)										total	d.l.	# platings	PFU total	% Reduction
MFT071-082807-01	6	9	9	7	7	13	5	10	4	4	74	100.0	50.0	1.48E+02	99.999792%
MFT071-082807-02	20	25	19	9	22	18	18	20	14	12	177	100.0	50.0	3.54E+02	99.999501%
MFT071-082807-03	3	4	3	1	6	7	5	5	8	8	50	100.0	50.0	1.00E+02	99.999859%
MFT075-082807-01	304										304	100.0	5.0	6.08E+03	99.991437%
MFT075-082807-02	213										213	100.0	5.0	4.26E+03	99.994000%
MFT075-082807-03	229										229	100.0	5.0	4.58E+03	99.993549%
C+	71E+04										7.10E+05	100.0	1.0	7.10E+07	

Micro 3														MS2 5 Hour 31.8 LPM	
Filter code	raw results (larger volume plating 5mL/petri)										total	d.l.	# platings	PFU total	% Reduction
MFT071-082807-01	8	7	11	6	6	7	9	3	4	5	66	100.0	50.0	1.32E+02	99.999472%
MFT071-082807-02	3	6	6	7	9	9	11	10	11	11	83	100.0	50.0	1.66E+02	99.999336%
MFT071-082807-03	2	4	4	4	4	3	3	3	7	8	42	100.0	50.0	8.40E+01	99.999664%
MFT075-082807-01	211										211	100.0	5.0	4.22E+03	99.983120%
MFT075-082807-02	163										163	100.0	5.0	3.26E+03	99.986960%
MFT075-082807-03	71	72	79	86	91	67	58	80	102	78	784	100.0	50.0	1.57E+03	99.993728%
C+	25E+04										2.50E+05	100.0	1.0	2.50E+07	

Micro 3														MS2 6 Hour 31.8 LPM	
Filter code	raw results (larger volume plating 5mL/petri)										total	d.l.	# platings	PFU total	% Reduction
MFT071-082807-01	5	5	9	5	7	8	11	11	8	9	78	100.0	50.0	1.56E+02	99.999376%
MFT071-082807-02	16	5	12	6	17	14	16	8	22	12	128	100.0	50.0	2.56E+02	99.998976%
MFT071-082807-03	12	12	6	2	7	7	6	10	10	7	79	100.0	50.0	1.58E+02	99.999368%
MFT075-082807-01	244										244	100.0	5.0	4.88E+03	99.980480%
MFT075-082807-02	218										218	100.0	5.0	4.36E+03	99.982560%
MFT075-082807-03	166										166	100.0	5.0	3.32E+03	99.986720%
C+	25E+04										2.50E+05	100.0	1.0	2.50E+07	

Environmental condition		
Time	Temperature (°C)	Relative Humidity (%)
0	21.6	37.7
15	21	31.7
30	21	31
45	20.4	64.9
60	20.8	50.8
AVG 60	20.8	44.6
75	20.3	56.8
90	20.5	37.4
105		
120	20.6	66.4
AVG 120	20.5	53.5
135		
150	20.5	39.6
165	20.3	67.2
180	20.5	70.1
AVG 180	20.4	59.0
195		
210		
225		
240	20.6	69.2
AVG 240	20.6	69.2
255	21.2	42
270	21.5	40.9
285		
300	21.5	39.5
AVG 300	21.4	40.8
315	20.6	60
330	21.5	41.3
345	22.4	45.6
360	21.6	41.6
AVG 360	21.5	47.1
AVG	21.0	49.1

Experiment No M07-0368: Biocidal air filtration membrane project:
Purpose: Testing IP2/CP2 stack (Triosynated meltblown /BLANK glass fiber media) in environmental condition (5°C ± 3°C & 75% ± 15% RH)
Challenge: MS2 coliphage at 5ºC ± 3ºC and 75% ± 15% RH a 31.8 LPM for 6 hours of filtration
Date:2007/08/28

Micro 3 — MS2, 1 Hour, 31.8 LPM

Filter code	raw results (larger volume plating 5mL/petri)										total	d.l.	# platings	PFU total	% Reduction
MFT071-082907-01	10	3	4	1	7	6	3	8	3	8	53	100.0	50.0	1.06E+02	99.999826%
MFT071-082907-02	3	6	2	2	4	4	4	6	7	3	41	100.0	50.0	8.20E+01	99.999866%
MFT071-082907-03	6	3	5	6	2	6	5	4	8	1	46	100.0	50.0	9.20E+01	99.999849%
MFT075-082907-01	288										288	100.0	5.0	5.76E+03	99.990557%
MFT075-082907-02	288										288	100.0	5.0	5.76E+03	99.990557%
MFT075-082907-03	384										384	100.0	5.0	7.68E+03	99.987410%
C+	61E+04										6.10E+05	100.0	1.0	6.10E+07	

Micro 3 — MS2, 2 Hour, 31.8 LPM

Filter code	raw results (larger volume plating 5mL/petri)										total	d.l.	# platings	PFU total	% Reduction
MFT071-082907-01	8	4	1	6	4	5	5	6	4	7	50	100.0	50.0	1.00E+02	99.999783%
MFT071-082907-02	130	89	138	102	136	98	78	170	138	138	1217	100.0	50.0	2.43E+03	99.994709%
MFT071-082907-03	7	7	5	8	4	5	2	6	3	5	52	100.0	50.0	1.04E+02	99.999774%
MFT075-082907-01	252										252	100.0	5.0	5.04E+03	99.989043%
MFT075-082907-02	352										352	100.0	5.0	7.04E+03	99.984696%
MFT075-082907-03	230										230	100.0	5.0	4.60E+03	99.990000%
C+	46E+04										4.60E+05	100.0	1.0	4.60E+07	

Micro 3 — MS2, 3 Hour, 31.8 LPM

Filter code	raw results (larger volume plating 5mL/petri)										total	d.l.	# platings	PFU total	% Reduction
MFT071-082907-01	36	51	45	46	47	49	39	45	39	51	448	100.0	50.0	8.96E+02	99.998789%
MFT071-082907-02	10	11	16	8	13	11	14	13	12	11	119	100.0	50.0	2.38E+02	99.999678%
MFT071-082907-03	10	20	16	24	11	17	19	15	21	23	176	100.0	50.0	3.52E+02	99.999524%
MFT075-082907-01	660										660	100.0	5.0	1.32E+04	99.982162%
MFT075-082907-02	728										728	100.0	5.0	1.46E+04	99.980324%
MFT075-082907-03	728										728	100.0	5.0	1.46E+04	99.980324%
C+	7.40E+05										740000	100.0	1.0	7.40E+07	

Micro 3 — MS2, 4 Hour, 31.8 LPM

Filter code	raw results (larger volume plating 5mL/petri)										total	d.l.	# platings	PFU total	% Reduction
MFT071-082907-01	26	32	27	21	20	11	10	22	14	26	209	100.0	50.0	4.18E+02	99.999859%
MFT071-082907-02	21	20	11	19	20	15	16	20	14	20	176	100.0	50.0	3.52E+02	99.999881%
MFT071-082907-03	12	14	15	15	18	23	21	13	14	18	163	100.0	50.0	3.26E+02	99.999890%
MFT075-082907-01	752										752	100.0	5.0	1.50E+04	99.994936%
MFT075-082907-02	520										520	100.0	5.0	1.04E+04	99.996498%
MFT075-082907-03	936										936	100.0	5.0	1.87E+04	99.993697%
C+	297E+04										2.97E+06	100.0	1.0	2.97E+08	

Micro 3 — MS2, 5 Hour, 31.8 LPM

Filter code	raw results (larger volume plating 5mL/petri)										total	d.l.	# platings	PFU total	% Reduction
MFT071-082907-01	15	18	18	23	17	26	15	20	20	20	192	100.0	50.0	3.84E+02	99.999578%
MFT071-082907-02	13	13	8	11	11	17	12	12	12	12	121	100.0	50.0	2.42E+02	99.999734%
MFT071-082907-03	17	8	22	9	2	18	14	13	11	19	133	100.0	50.0	2.66E+02	99.999708%
MFT075-082907-01	484										484	100.0	5.0	9.68E+03	99.989363%
MFT075-082907-02	689										689	100.0	5.0	1.38E+04	99.984857%
MFT075-082907-03	896										896	100.0	5.0	1.79E+04	99.980308%
C+	91E+04										9.10E+05	100.0	1.0	9.10E+07	

Micro 3 — MS2, 6 Hour, 31.8 LPM

Filter code	raw results (larger volume plating 5mL/petri)										total	d.l.	# platings	PFU total	% Reduction
MFT071-082907-01	25	34	30	33	23	27	25	32	30	22	281	100.0	50.0	5.62E+02	99.999791%
MFT071-082907-02	26	25	29	25	29	20	27	13	23	23	240	100.0	50.0	4.80E+02	99.999822%
MFT071-082907-03	11	10	21	26	20	22	12	24	19	20	185	100.0	50.0	3.70E+02	99.999862%
MFT075-082907-01	472										472	100.0	5.0	9.44E+03	99.996491%
MFT075-082907-02	640										640	100.0	5.0	1.28E+04	99.995242%
MFT075-082907-03	912										912	100.0	5.0	1.82E+04	99.993219%
C+	269E+04										2.69E+06	100.0	1.0	2.69E+08	

Environmental condition

Time	Temperature (°C)	Relative Humidity (%)
0	10.6	79.9
15	9.2	67.4
30	8.9	72.5
45	8	74.6
60	7.5	74.6
AVG 60	8.4	72.3
75	6.9	73
90	6.6	68.9
105	6.5	64
120	6.4	71.4
AVG 120	6.6	69.3
135		
150	5.8	74.6
165	5.8	74.5
180	5.6	74.5
AVG 180	5.7	74.5
195	5.5	74.6
210	5.5	75.6
225	5.5	74.6
240	5.5	74.4
AVG 240	5.5	74.8
255	5.1	75.9
270	5.2	75.6
285	5.2	74.9
300	5.1	76.2
AVG 300	5.2	75.7
315	5.1	75.4
330	5.2	75.6
345	5	58.8
360	4.3	69.1
AVG 360	4.9	69.7
AVG	6.3	72.9

: contamination

Experiment No M07-0369: Biocidal air filtration membrane project:
Purpose: Testing IP2/CP2 stack (Triosynated meltblown /BLANK glass fiber media) in environmental condition (5°C ± 3°C & 75% ± 15% RH)
Challenge: MS2 coliphage at 5ºC ± 3ºC and 75% ± 15% RH a 31.8 LPM for 6 hours of filtration
Date:2007/08/30

Micro 3 — MS2, 1 Hour, 31.8 LPM

Filter code	raw results (larger volume plating 5mL/petri for all port)										total	d.l.	# platings	PFU total	% Reduction
MFT071-083007-01	13	13	13	10	10	14	14	14	15	24	140	100.0	50.0	2.80E+02	99.998250%
MFT071-083007-02	5	5	7	13	12	9	8	7	4	10	80	100.0	50.0	1.60E+02	99.999000%
MFT071-083007-03	8	8	9	6	6	5	5	22	12	7	88	100.0	50.0	1.76E+02	99.998900%
MFT075-083007-01	426										426	100.0	5.0	8.52E+03	99.946750%
MFT075-083007-02	452										452	100.0	5.0	9.04E+03	99.943500%
MFT075-083007-03	472										472	100.0	5.0	9.44E+03	99.941000%
C+	160E+03										1.60E+05	100.0	1.0	1.60E+07	

Micro 3 — MS2, 2 Hour, 31.8 LPM

Filter code	rger volume plating 5mL/petri for ports 1-3 & regular platin										total	d.l.	# platings	PFU total	% Reduction
MFT071-083007-01	31	39	41	26	26	25	35	35	37	30	325	100.0	50.0	6.50E+02	99.999330%
MFT071-083007-02	24	15	31	14	21	28	17	17	23	23	213	100.0	50.0	4.26E+02	99.999561%
MFT071-083007-03	17	17	19	12	13	14	15	15	23	21	166	100.0	50.0	3.32E+02	99.999658%
MFT075-083007-01	180										180	100.0	1.0	1.80E+04	99.981443%
MFT075-083007-02	239										239	100.0	1.0	2.39E+04	99.975361%
MFT075-083007-03	109	83	106	92	102						492	100.0	5.0	9.84E+03	99.989856%
C+	97E+04										9.70E+05	100.0	1.0	9.70E+07	

Micro 3 — MS2, 3 Hour, 31.8 LPM

Filter code	rger volume plating 5mL/petri for ports 1-3 & regular platin										total	d.l.	# platings	PFU total	% Reduction
MFT071-083007-01	26	25	29	22	31	26	36	32	32	24	283	100.0	50.0	5.66E+02	99.999705%
MFT071-083007-02	50	43	61	57	62	60	51	54	74	70	582	100.0	50.0	1.16E+03	99.999394%
MFT071-083007-03	15	24	30	31	40	42	35	35	35	35	322	100.0	50.0	6.44E+02	99.999665%
MFT075-083007-01	213										213	100.0	1.0	2.13E+04	99.988906%
MFT075-083007-02	182										182	100.0	1.0	1.82E+04	99.990521%
MFT075-083007-03	108	86	110	125	135						564	100.0	5.0	1.13E+04	99.994125%
C+	1.92E+06										1920000	100.0	1.0	1.92E+08	

Micro 3 — MS2, 4 Hour, 31.8 LPM

Filter code	rger volume plating 5mL/petri for ports 1-3 & regular platin										total	d.l.	# platings	PFU total	% Reduction
MFT071-083007-01	39	45	46	53	53	60	61	63	66	70	556	100.0	50.0	1.11E+03	99.999287%
MFT071-083007-02	15	18	22	27	27	28	28	30	35	36	266	100.0	50.0	5.32E+02	99.999659%
MFT071-083007-03	45	47	54	57	58	33	35	37	37	40	443	100.0	50.0	8.86E+02	99.999432%
MFT075-083007-01	113	137	135	164	167						716	100.0	5.0	1.43E+04	99.990821%
MFT075-083007-02	171										171	100.0	1.0	1.71E+04	99.989038%
MFT075-083007-03	121	160	153	150	132						716	100.0	5.0	1.43E+04	99.990821%
C+	156E+04										1.56E+06	100.0	1.0	1.56E+08	

Micro 3 — MS2, 5 Hour, 31.8 LPM

Filter code	rger volume plating 5mL/petri for ports 1-3 & regular platin										total	d.l.	# platings	PFU total	% Reduction
MFT071-083007-01	49	82	71	71	72	77	73	73	70	75	713	100.0	50.0	1.43E+03	99.999080%
MFT071-083007-02	35	40	31	29	47	30	47	37	41	31	368	100.0	50.0	7.36E+02	99.999525%
MFT071-083007-03	46	46	25	40	40	68	63	62	59	51	500	100.0	50.0	1.00E+03	99.999355%
MFT075-083007-01	176	148	174	150	142						790	100.0	5.0	1.58E+04	99.989806%
MFT075-083007-02	118	96	154	150	134						652	100.0	5.0	1.30E+04	99.991587%
MFT075-083007-03	79	102	142	139	151						613	100.0	5.0	1.23E+04	99.992090%
C+	155E+04										1.55E+06	100.0	1.0	1.55E+08	

Micro 3 — MS2, 6 Hour, 31.8 LPM

Filter code	rger volume plating 5mL/petri for ports 1-3 & regular platin										total	d.l.	# platings	PFU total	% Reduction
MFT071-083007-01	154	96	100	110	109	142	78	100	98	118	1105	100.0	50.0	2.21E+03	99.998878%
MFT071-083007-02	49	54	47	41	64	51	53	68	60	57	544	100.0	50.0	1.09E+03	99.999448%
MFT071-083007-03	70	57	66	55	55	57	102	978	62	76	1578	100.0	50.0	3.16E+03	99.998398%
MFT075-083007-01	153										153	100.0	1.0	1.53E+04	99.992234%
MFT075-083007-02	267										267	100.0	1.0	2.67E+04	99.986447%
MFT075-083007-03	162										162	100.0	1.0	1.62E+04	99.991777%
C+	197E+04										1.97E+06	100.0	1.0	1.97E+08	

Environmental condition		
Time	Temperature (°C)	Relative Humidity (%)
0	7.5	50
15	7.5	75.4
30	7.5	64
45	6.6	76.4
60	6.8	71.6
AVG 60	7.1	71.85
75	5.1	77.6
90	5.1	80
105	5.3	79.8
120	5.8	74.5
AVG 120	5.3	78.0
135	5.7	73.8
150	5.7	75.8
165	5.6	79.6
180	6	76.8
AVG 180	5.8	76.5
195	5.6	76.3
210	5.5	73.8
225	5.4	75.6
240	6.3	77.5
AVG 240	5.7	75.8
255	5.4	77.8
270	5.1	76.7
285	5.4	74.6
300	5.1	81.6
AVG 300	5.3	77.7
315	5.5	78.4
330	5	77.5
345		
360	4.9	75.8
AVG 360	5.1	77.2
AVG	5.8	75.0

Experiment No M07-0370: Biocidal air filtration membrane project:
Purpose: Testing IP2/CP2 stack (Triosynated meltblown /BLANK glass fiber media) in environmental condition (30°C ± 3°C & 85% ± 15% RH)
Challenge: MS2 coliphage at 30ºC ± 3ºC and 85% ± 15% RH a 31.8 LPM for 6 hours of filtration
Date:2007/08/31

Micro 3 — MS2, 1 Hour, 31.8 LPM

Filter code	raw results (larger volume plating 5mL/petri)									total	d.l.	# platings	PFU total	% Reduction
MFT071-083107-01	1	3	4	4	4	6	6	7	7	8	50	100.0	50.0	1.00E+02	99.999744%
MFT071-083107-02	0	2	2	3	3	3	3	3	4	5	28	100.0	50.0	5.60E+01	99.999856%
MFT071-083107-03	1	1	2	2	3	3	3	4	5	2	26	100.0	50.0	5.20E+01	99.999867%
MFT075-083107-01	20	25	27	36	31						139	100.0	5.0	2.78E+03	99.992872%
MFT075-083107-02	46	53	53	54	62						268	100.0	5.0	5.36E+03	99.986256%
MFT075-083107-03	18	21	22	24	33						118	100.0	5.0	2.36E+03	99.993949%
C+	39E+04										3.90E+05	100.0	1.0	3.90E+07	

Micro 3 — MS2, 2 Hour, 31.8 LPM

Filter code	raw results (larger volume plating 5mL/petri)									total	d.l.	# platings	PFU total	% Reduction
MFT071-083107-01	0	0	0	0	1	1	1	1	2	3	9	100.0	50.0	1.80E+01	99.999994%
MFT071-083107-02	5	5	6	9	9	10	10	12	11	14	91	100.0	50.0	1.82E+02	99.999938%
MFT071-083107-03	11	13	14	15	15	16	17	18	19	23	161	100.0	50.0	3.22E+02	99.999890%
MFT075-083107-01	37	38	44	31	36						186	100.0	5.0	3.72E+03	99.998735%
MFT075-083107-02	50	48	44	42	33						217	100.0	5.0	4.34E+03	99.998524%
MFT075-083107-03	69	81	91	104	115						460	100.0	5.0	9.20E+03	99.996871%
C+	294E+04										2.94E+06	100.0	1.0	2.94E+08	

Micro 3 — MS2, 3 Hour, 31.8 LPM

Filter code	raw results (larger volume plating 5mL/petri)									total	d.l.	# platings	PFU total	% Reduction
MFT071-083107-01	1	1	0	0	0	0	0	0	0	0	2	100.0	50.0	4.00E+00	99.999998%
MFT071-083107-02	6	7	7	7	8	11	11	11	13	17	98	100.0	50.0	1.96E+02	99.999892%
MFT071-083107-03	8	13	15	16	16	18	20	22	25	27	180	100.0	50.0	3.60E+02	99.999802%
MFT075-083107-01	105	97	88	86	79						455	100.0	5.0	9.10E+03	99.995000%
MFT075-083107-02	60	50	43	35	35						223	100.0	5.0	4.46E+03	99.997549%
MFT075-083107-03	56	61	63	66	65						311	100.0	5.0	6.22E+03	99.996582%
C+	1.82E+06										1820000	100.0	1.0	1.82E+08	

Micro 3 — MS2, 4 Hour, 31.8 LPM

Filter code	raw results (larger volume plating 5mL/petri)									total	d.l.	# platings	PFU total	% Reduction
MFT071-083107-01	21	22	24	28	38	16	16	25	25	25	240	100.0	50.0	4.80E+02	99.999284%
MFT071-083107-02	5	7	7	8	9	11	12	14	15	18	106	100.0	50.0	2.12E+02	99.999684%
MFT071-083107-03	9	10	10	12	12	15	15	17	17	15	132	100.0	50.0	2.64E+02	99.999606%
MFT075-083107-01	26	32	35	39	56						188	100.0	5.0	3.76E+03	99.994388%
MFT075-083107-02	34	40	41	42	55						212	100.0	5.0	4.24E+03	99.993672%
MFT075-083107-03	59	61	72	90	94						376	100.0	5.0	7.52E+03	99.988776%
C+	67E+04										6.70E+05	100.0	1.0	6.70E+07	

Micro 3 — MS2, 5 Hour, 31.8 LPM

Filter code	raw results (larger volume plating 5mL/petri)									total	d.l.	# platings	PFU total	% Reduction
MFT071-083107-01	30	30	34	38	40	42	43	44	46	48	395	100.0	50.0	7.90E+02	99.998481%
MFT071-083107-02	15	17	19	19	20	20	20	20	28	22	200	100.0	50.0	4.00E+02	99.999231%
MFT071-083107-03	8	8	10	10	13	14	15	17	17	19	131	100.0	50.0	2.62E+02	99.999496%
MFT075-083107-01	29	47	55	60	45						236	100.0	5.0	4.72E+03	99.990923%
MFT075-083107-02	29	40	41	42	33						185	100.0	5.0	3.70E+03	99.992885%
MFT075-083107-03	39	42	44	48	52						225	100.0	5.0	4.50E+03	99.991346%
C+	52E+04										5.20E+05	100.0	1.0	5.20E+07	

Micro 3 — MS2, 6 Hour, 31.8 LPM

Filter code	raw results (larger volume plating 5mL/petri)									total	d.l.	# platings	PFU total	% Reduction
MFT071-083107-01	46	47	48	48	48	49	51	55	60	68	520	100.0	50.0	1.04E+03	99.998980%
MFT071-083107-02	19	19	14	15	16	16	18	20	21	36	194	100.0	50.0	3.88E+02	99.999620%
MFT071-083107-03	19	19	23	26	26	26	37	35	21	38	270	100.0	50.0	5.40E+02	99.999471%
MFT075-083107-01	38	45	51	58	60						252	100.0	5.0	5.04E+03	99.995059%
MFT075-083107-02	70	77	82	82	109						420	100.0	5.0	8.40E+03	99.991765%
MFT075-083107-03	43	46	53	57	69						268	100.0	5.0	5.36E+03	99.994745%
C+	102E+04										1.02E+06	100.0	1.0	1.02E+08	

Environmental condition

Time	Temperature (°C)	Relative Humidity (%)
0	25.3	96.2
15	28.9	99.9
30	27.5	72.2
45	27.3	99.9
60	29	71
AVG 60	28.175	85.75
75	28.3	84.5
90	28.2	99.9
105		
120	28	99.9
AVG 120	28.2	94.8
135	29.6	99.9
150	29.2	99.9
165	30.2	99.9
180	29.1	77.1
AVG 180	29.5	94.2
195	28.7	87
210	28.8	64.3
225	29.3	76.3
240	29.3	66
AVG 240	29.0	73.4
255	28.7	73
270	29.1	73.2
285	30	65.6
300	29.7	76.8
AVG 300	29.4	72.2
315	29.3	72.3
330	29.2	62.4
345	29.6	86.7
360	28.7	96.1
AVG 360	29.2	79.4
AVG	28.8	83.3

Experiment No M07-0377: AATCC 100

Purpose: Evaluating the antiviral efficacy of Triosynated glass fiber media from June 2007 production

Challenge: MS2 coliphage by contact time during 0 minute, 15 minutes, 30 minutes, 60 minutes & 24 hours

Date:2007/09/04

MS2 coliphage results

Micro 2

Filter code	Description	Contact time	raw results			total	d.l.	vol plated	MS2 PFU total	MS2 % Reduction
MFT011-090407-01	Blank Glass fiber HEPA media from June 2007	0 min	68E+03			68000	10.0	1.0	6.80E+05	7.60E+05
MFT011-090407-02		0 min	93E+03			93000	10.0	1.0	9.30E+05	
MFT011-090407-03		0 min	67E+03			67000	10.0	1.0	6.70E+05	
MFT011-090407-04		15 min	0			0	10.0	1.0	<1.00E+01	>99.998684%
MFT011-090407-05		15 min	0			0	10.0	1.0	<1.00E+01	>99.998684%
MFT011-090407-06		15 min	0			0	10.0	1.0	<1.00E+01	>99.998684%
MFT011-090407-07		30 min	0			0	10.0	1.0	<1.00E+01	>99.998684%
MFT011-090407-08		30 min	0			0	10.0	1.0	<1.00E+01	>99.998684%
MFT011-090407-09		30 min	0			0	10.0	1.0	<1.00E+01	>99.998684%
MFT011-090407-10		60 min	0			0	10.0	1.0	<1.00E+01	>99.998684%
MFT011-090407-11		60 min	4			4	10.0	1.0	4.00E+01	99.994737%
MFT011-090407-12		60 min	0			0	10.0	1.0	<1.00E+01	>99.998684%

MS2 coliphage results

Micro 2

Filter code	Description	Contact time	raw results			total	d.l.	vol plated	MS2 PFU total	MS2 % Reduction
MFT068-090407-01	Triosynated Glass fiber HEPA media 200-400um from June 2007	0 min	7			7	10.0	1.0	7.00E+01	99.990789%
MFT068-090407-02		0 min	150			150	10.0	1.0	1.50E+03	99.802632%
MFT068-090407-03		0 min	208			208	10.0	1.0	2.08E+03	99.726316%
MFT068-090407-04		15 min	0	0	0	0	10.0	3.0	<3.33E+00	>99.999561%
MFT068-090407-05		15 min	1	1	0	2	10.0	3.0	6.67E+00	99.999123%
MFT068-090407-06		15 min	0	1	0	1	10.0	3.0	3.33E+00	99.999561%
MFT068-090407-07		30 min	0	0	0	0	10.0	3.0	<3.33E+00	>99.999561%
MFT068-090407-08		30 min	0	0	0	0	10.0	3.0	<3.33E+00	>99.999561%
MFT068-090407-09		30 min	0	0	0	0	10.0	3.0	<3.33E+00	>99.999561%
MFT068-090407-10		60 min	0	0	0	0	10.0	3.0	<3.33E+00	>99.999561%
MFT068-090407-11		60 min	0	0	0	0	10.0	3.0	<3.33E+00	>99.999561%
MFT068-090407-12		60 min	0	0	0	0	10.0	3.0	<3.33E+00	>99.999561%

Experiment No M07-0378: Biocidal air filtration membrane project:
Purpose: Testing consistency of Triosynated meltblown composite media and BLANK glass fiber media
Challenge: MS2 coliphage at 20ºC ± 5ºC and 50% ± 15% RH a 4.0 LPM for 3 hours of filtration
Date:2007/09/05

Micro 2									MS2 1 Hour 4.0 LPM	
Filter code	raw results (larger volume plating 2mL/petri)					total	d.l.	# platings	PFU total	% Reduction
MFT071-090507-01	1	0	0	0	0	1	40.0	10.0	4.00E+00	99.999993%
MFT071-090507-02	0	0	0	0	0	0	40.0	10.0	<4.00E+00	>99.999993%
MFT071-090507-03	29	36	24	33	27	149	40.0	10.0	5.96E+02	99.998912%
MFT071-090507-04	0	0	0	0	1	1	40.0	10.0	4.00E+00	99.999993%
MFT071-090507-05	1	0	0	0	0	1	40.0	10.0	4.00E+00	99.999993%
MFT071-090507-06	0	1	0	0	0	1	40.0	10.0	4.00E+00	99.999993%
MFT071-090507-07	0	0	0	0	0	0	40.0	10.0	<4.00E+00	>99.999993%
MFT071-090507-08	0	0	0	0	0	0	40.0	10.0	<4.00E+00	>99.999993%
MFT071-090507-09	0	0	0	0	0	0	40.0	10.0	<4.00E+00	>99.999993%
MFT071-090507-10	0	0	0	0	0	0	40.0	10.0	<4.00E+00	>99.999993%
C+	137E+04					1.37E+06	40.0	1.0	5.48E+07	

Micro 2									MS2 2 Hour 4.0 LPM	
Filter code	raw results (larger volume plating 2mL/petri)					total	d.l.	# platings	PFU total	% Reduction
MFT071-090507-01	2	1	1	0	0	4	40.0	10.0	1.60E+01	99.999973%
MFT071-090507-02	0	3	2	1	0	6	40.0	10.0	2.40E+01	99.999959%
MFT071-090507-03	50	54	45	54	53	256	40.0	10.0	1.02E+03	99.998259%
MFT071-090507-04	0	0	1	0	0	1	40.0	10.0	4.00E+00	99.999993%
MFT071-090507-05	0	0	0	0	0	0	40.0	10.0	<4.00E+00	>99.999993%
MFT071-090507-06	0	0	0	0	0	0	40.0	10.0	<4.00E+00	>99.999993%
MFT071-090507-07	2	1	0	0	1	4	40.0	10.0	1.60E+01	99.999973%
MFT071-090507-08	0	0	1	0	0	1	40.0	10.0	4.00E+00	99.999993%
MFT071-090507-09	0	0	0	0	0	0	40.0	10.0	<4.00E+00	>99.999993%
MFT071-090507-10	0	0	0	0	0	0	40.0	10.0	<4.00E+00	>99.999993%
C+	147E+04					1.47E+06	40.0	1.0	5.88E+07	

Micro 2									MS2 3 Hour 4.0 LPM	
Filter code	raw results (larger volume plating 2mL/petri)					total	d.l.	# platings	PFU total	% Reduction
MFT071-090507-01	0	0	0	0	0	0	40.0	10.0	<4.00E+00	>99.9999697%
MFT071-090507-02	0	0	0	0	0	0	40.0	10.0	<4.00E+00	>99.9999697%
MFT071-090507-03	30	41	23	30	20	144	40.0	10.0	5.76E+02	99.9956364%
MFT071-090507-04	0	0	0	0	0	0	40.0	10.0	<4.00E+00	>99.9999697%
MFT071-090507-05	0	0	0	0	0	0	40.0	10.0	<4.00E+00	>99.9999697%
MFT071-090507-06	0	0	0	0	0	0	40.0	10.0	<4.00E+00	>99.9999697%
MFT071-090507-07	0	0	0	0	0	0	40.0	10.0	<4.00E+00	>99.9999697%
MFT071-090507-08	0	0	0	0	0	0	40.0	10.0	<4.00E+00	>99.9999697%
MFT071-090507-09	0	0	0	0	0	0	40.0	10.0	<4.00E+00	>99.9999697%
MFT071-090507-10	0	0	0	0	0	0	40.0	10.0	<4.00E+00	>99.9999697%
C+	33E+04					3.30E+05	40.0	1.0	1.32E+07	

Experiment No M07-0381: AATCC 100

Purpose: Evaluating the antiviral efficacy of composite of Triosynated meltblow composite and blank glass fiber media from June 2007 production

Challenge: MS2 coliphage by contact time during 0 minute, 15 minutes, 30 minutes, 60 minutes & 24 hours

Date:2007/09/07

Micro 2								MS2	
Filter code	Contact time	raw results			total	d.l.	vol plated	PFU total	% Reduction
MFTEXP-090707-01	0 min	130E+03			130000	10.0	1.0	1.30E+06	1.07E+06
MFTEXP-090707-02	0 min	83E+03			83000	10.0	1.0	8.30E+05	
MFTEXP-090707-03	0 min	107E+03			107000	10.0	1.0	1.07E+06	
MFTEXP-090707-04	15 min	216E+02			21600	10.0	1.0	2.16E+05	79.750000%
MFTEXP-090707-05	15 min	62E+03			62000	10.0	1.0	6.20E+05	41.875000%
MFTEXP-090707-06	15 min	376E+02			37600	10.0	1.0	3.76E+05	64.750000%
MFTEXP-090707-07	30 min	27E+03			27000	10.0	1.0	2.70E+05	74.687500%
MFTEXP-090707-08	30 min	84E+03			84000	10.0	1.0	8.40E+05	21.250000%
MFTEXP-090707-09	30 min	31E+03			31000	10.0	1.0	3.10E+05	70.937500%
MFTEXP-090707-10	60 min	126E+02			12600	10.0	1.0	1.26E+05	88.187500%
MFTEXP-090707-11	60 min	94E+02			9400	10.0	1.0	9.40E+04	91.187500%
MFTEXP-090707-12	60 min	86E+02			8600	10.0	1.0	8.60E+04	91.937500%

Micro 2								MS2	
Filter code	Contact time	raw results			total	d.l.	vol plated	PFU total	% Reduction
MFTEXP-090707-16	0 min	147E+02			14700	10.0	1.0	1.47E+05	86.218750%
MFTEXP-090707-17	0 min	76E+02			7600	10.0	1.0	7.60E+04	92.875000%
MFTEXP-090707-18	0 min	184E+02			18400	10.0	1.0	1.84E+05	82.750000%
MFTEXP-090707-19	15 min	932			932	10.0	1.0	9.32E+03	99.126250%
MFTEXP-090707-20	15 min	408			408	10.0	1.0	4.08E+03	99.617500%
MFTEXP-090707-21	15 min	700			700	10.0	1.0	7.00E+03	99.343750%
MFTEXP-090707-22	30 min	48	75	63	186	10.0	3.0	6.20E+02	99.941875%
MFTEXP-090707-23	30 min	832			832	10.0	1.0	8.32E+03	99.220000%
MFTEXP-090707-24	30 min	424			424	10.0	1.0	4.24E+03	99.602500%
MFTEXP-090707-25	60 min	472			472	10.0	1.0	4.72E+03	99.557500%
MFTEXP-090707-26	60 min	508			508	10.0	1.0	5.08E+03	99.523750%
MFTEXP-090707-27	60 min	644			644	10.0	1.0	6.44E+03	99.396250%

Experiment No M07-0385: Biocidal air filtration membrane project:
Purpose: Testing consistency of Triosynated meltblown composite media and BLANK glass fiber media
Challenge: MS2 coliphage at 20ºC ± 5ºC and 50% ± 15% RH a 4.0 LPM for 3 hours of filtration
Date:2007/09/07

Micro 2									MS2 1 Hour 4.0 LPM	
Filter code	raw results (larger volume plating 2mL/petri)					total	d.l.	# platings	PFU total	% Reduction
MFT071-090707-01	1	1	1	2	0	5	40.0	10.0	2.00E+01	99.999990%
MFT071-090707-02	2	2	1	0	0	5	40.0	10.0	2.00E+01	99.999990%
MFT071-090707-03	1	1	1	2	0	5	40.0	10.0	2.00E+01	99.999990%
MFT071-090707-04	0	0	0	0	0	0	40.0	10.0	<4.00E+00	>99.999998%
MFT071-090707-05	1	1	2	0	0	4	40.0	10.0	1.60E+01	99.999992%
MFT071-090707-06	0	0	0	0	0	0	40.0	10.0	<4.00E+00	>99.999998%
MFT071-090707-07	0	0	0	0	0	0	40.0	10.0	<4.00E+00	>99.999998%
MFT071-090707-08	0	0	0	0	0	0	40.0	10.0	<4.00E+00	>99.999998%
MFT071-090707-09	4	1	1	4	0	10	40.0	10.0	4.00E+01	99.999981%
MFT071-090707-10	3	0	4	1	0	8	40.0	10.0	3.20E+01	99.999985%
C+	52E+05					5.20E+06	40.0	1.0	2.08E+08	

Micro 2									MS2 2 Hour 4.0 LPM	
Filter code	raw results (larger volume plating 2mL/petri)					total	d.l.	# platings	PFU total	% Reduction
MFT071-090707-01	8	5	7	8	5	33	40.0	10.0	1.32E+02	99.999947%
MFT071-090707-02	1	0	0	0	0	1	40.0	10.0	4.00E+00	99.999998%
MFT071-090707-03	0	0	0	1	3	4	40.0	10.0	1.60E+01	99.999994%
MFT071-090707-04	0	1	0	0	0	1	40.0	10.0	4.00E+00	99.999998%
MFT071-090707-05	2	1	4	2	3	12	40.0	10.0	4.80E+01	99.999981%
MFT071-090707-06	0	0	0	0	0	0	40.0	10.0	<4.00E+00	>99.999998%
MFT071-090707-07	0	0	0	0	0	0	40.0	10.0	<4.00E+00	>99.999998%
MFT071-090707-08	0	0	0	0	0	0	40.0	10.0	<4.00E+00	>99.999998%
MFT071-090707-09	0	1	3	1	1	6	40.0	10.0	2.40E+01	99.999990%
MFT071-090707-10	1	3	4	6	2	16	40.0	10.0	6.40E+01	99.999974%
C+	62E+05					6.20E+06	40.0	1.0	2.48E+08	

Micro 2									MS2 3 Hour 4.0 LPM	
Filter code	raw results (larger volume plating 2mL/petri)					total	d.l.	# platings	PFU total	% Reduction
MFT071-090707-01	0	0	1	0	0	1	40.0	10.0	4.00E+00	99.999998%
MFT071-090707-02	4	0	2	2	0	8	40.0	10.0	3.20E+01	99.999984%
MFT071-090707-03	3	6	7	7	3	26	40.0	10.0	1.04E+02	99.999949%
MFT071-090707-04	0	0	0	0	0	0	40.0	10.0	<4.00E+00	>99.999998%
MFT071-090707-05	3	9	6	5	5	28	40.0	10.0	1.12E+02	99.999945%
MFT071-090707-06	0	0	0	0	0	0	40.0	10.0	<4.00E+00	>99.999998%
MFT071-090707-07	0	0	0	0	0	0	40.0	10.0	<4.00E+00	>99.999998%
MFT071-090707-08	0	0	0	0	0	0	40.0	10.0	<4.00E+00	>99.999998%
MFT071-090707-09	0	0	0	0	0	0	40.0	10.0	<4.00E+00	>99.999998%
MFT071-090707-10	4	6	8	5	11	34	40.0	10.0	1.36E+02	99.999933%
C+	51E+05					5.10E+06	40.0	1.0	2.04E+08	

Experiment No M07-0387: AATCC 100

Purpose: Evaluating the antiviral efficacy of composite of Triosynated meltblow composite and blank glass fiber media from June 2007 production

Challenge: *Staphylococcus aureus* vegetative bacteria by contact time during 0 minute, 15 minutes, 30 minutes, 60 minutes & 24 hours

Date:2007/09/11

Micro 2								S. aureus	
Filter code	Contact time	raw results			total	d.l.	vol plated	CFU total	% Reduction
MFTEXP-091107-01	0 min	233E+02			23300	10.0	0.2	1.17E+06	9.10E+05
MFTEXP-091107-02	0 min	136E+02			13600	10.0	0.2	6.80E+05	
MFTEXP-091107-03	0 min	177E+02			17700	10.0	0.2	8.85E+05	
MFTEXP-091107-04	15 min	61E+02			6100	10.0	0.2	3.05E+05	66.483516%
MFTEXP-091107-05	15 min	92E+02			9200	10.0	0.2	4.60E+05	49.450549%
MFTEXP-091107-06	15 min	54E+02			5400	10.0	0.2	2.70E+05	70.329670%
MFTEXP-091107-07	30 min	55E+02			5500	10.0	0.2	2.75E+05	69.780220%
MFTEXP-091107-08	30 min	154E+02			15400	10.0	0.2	7.70E+05	15.384615%
MFTEXP-091107-09	30 min	91E+02			9100	10.0	0.2	4.55E+05	50.000000%
MFTEXP-091107-10	60 min	137E+02			13700	10.0	0.2	6.85E+05	24.725275%
MFTEXP-091107-11	60 min	58E+02			5800	10.0	0.2	2.90E+05	68.131868%
MFTEXP-091107-12	60 min	127E+02			12700	10.0	0.2	6.35E+05	30.219780%
MFTEXP-091107-13	24 hours	0			0	10.0	0.2	<1.00E+01	>99.994505%
MFTEXP-091107-14	24 hours	14			14	10.0	0.2	7.00E+02	99.923077%
MFTEXP-091107-15	24 hours	0			0	10.0	0.2	<1.00E+01	>99.994505%

Micro 2								S. aureus	
Filter code	Contact time	raw results			total	d.l.	vol plated	CFU total	% Reduction
MFTEXP-091107-16	0 min	283E+01			2830	10.0	0.2	1.42E+05	84.450549%
MFTEXP-091107-17	0 min	36E+02			3600	10.0	0.2	1.80E+05	80.219780%
MFTEXP-091107-18	0 min	24E+02			2400	10.0	0.2	1.20E+05	86.813187%
MFTEXP-091107-19	15 min	0	0	0	0	10.0	0.6	<1.67E+01	>99.998168%
MFTEXP-091107-20	15 min	0	0	0	0	10.0	0.6	<1.67E+01	>99.998168%
MFTEXP-091107-21	15 min	0	0	0	0	10.0	0.6	<1.67E+01	>99.998168%
MFTEXP-091107-22	30 min	0	0	0	0	10.0	0.6	<1.67E+01	>99.998168%
MFTEXP-091107-23	30 min	0	0	0	0	10.0	0.6	<1.67E+01	>99.998168%
MFTEXP-091107-24	30 min	0	0	0	0	10.0	0.6	<1.67E+01	>99.998168%
MFTEXP-091107-25	60 min	0	0	0	0	10.0	0.6	<1.67E+01	>99.998168%
MFTEXP-091107-26	60 min	1	0	0	1	10.0	0.6	1.67E+01	99.998168%
MFTEXP-091107-27	60 min	0	0	0	0	10.0	0.6	<1.67E+01	>99.998168%
MFTEXP-091107-28	24 hours	0	0	0	0	10.0	0.6	<1.67E+01	>99.998168%
MFTEXP-091107-29	24 hours	0	0	0	0	10.0	0.6	<1.67E+01	>99.998168%
MFTEXP-091107-30	24 hours	0	0	0	0	10.0	0.6	<1.67E+01	>99.998168%

Experiment No M07-0389: Biocidal air filtration membrane project:
Purpose: Comparing the VFE performance of BLANK high alpha HEPA purchased at Lydall to BLANK June 2007 HEPA production

Challenge: MS2 coliphage at 20ºC ± 5ºC and 50% ± 15% RH a 32.0 LPM for 3 hours of filtration
Date:2007/09/11

Micro 2

							MS2 1 Hour 32.0 LPM	
Filter code	raw results			total	d.l.	# platings	PFU total	% Reduction
MFTEXP-091107-31	710			710	100.0	1.0	7.10E+04	99.925263%
MFTEXP-091107-32	74400			74400	100.0	1.0	7.44E+06	92.168421%
MFTEXP-091107-33	38			38	100.0	1.0	3.80E+03	99.996000%
MFTEXP-091107-34	970			970	100.0	1.0	9.70E+04	99.897895%
MFTEXP-091107-35	1770			1770	100.0	1.0	1.77E+05	99.813684%
MFTEXP-091107-36	57			57	100.0	1.0	5.70E+03	99.994000%
MFT011-091107-01	47200			47200	100.0	1.0	4.72E+06	95.031579%
MFT011-091107-02	43			43	100.0	1.0	4.30E+03	99.995474%
MFT011-091107-03	40400			40400	100.0	1.0	4.04E+06	95.747368%
MFT011-091107-04	19800			19800	100.0	1.0	1.98E+06	97.915789%
MFT011-091107-05	8300			8300	100.0	1.0	8.30E+05	99.126316%
C+	95E+04			9.50E+05	100.0	1.0	9.50E+07	

Micro 2

							MS2 2 Hour 32.0 LPM	
Filter code	raw results			total	d.l.	# platings	PFU total	% Reduction
MFTEXP-091107-31	890			890	100.0	1.0	8.90E+04	99.939456%
MFTEXP-091107-32	87200			87200	100.0	1.0	8.72E+06	94.068027%
MFTEXP-091107-33	96			96	100.0	1.0	9.60E+03	99.993469%
MFTEXP-091107-34	1270			1270	100.0	1.0	1.27E+05	99.913605%
MFTEXP-091107-35	1680			1680	100.0	1.0	1.68E+05	99.885714%
MFTEXP-091107-36	33			33	100.0	1.0	3.30E+03	99.997755%
MFT011-091107-01	127200			127200	100.0	1.0	1.27E+07	91.346939%
MFT011-091107-02	90			90	100.0	1.0	9.00E+03	99.993878%
MFT011-091107-03	176800			176800	100.0	1.0	1.77E+07	87.972789%
MFT011-091107-04	17600			17600	100.0	1.0	1.76E+06	98.802721%
MFT011-091107-05	570			570	100.0	1.0	5.70E+04	99.961224%
C+	147E+04			1.47E+06	100.0	1.0	1.47E+08	

Micro 2

							MS2 3 Hour 32.0 LPM	
Filter code	raw results			total	d.l.	# platings	PFU total	% Reduction
MFTEXP-091107-31	1510			1510	100.0	1.0	1.51E+05	99.875207%
MFTEXP-091107-32	102400			102400	100.0	1.0	1.02E+07	91.537190%
MFTEXP-091107-33	84			84	100.0	1.0	8.40E+03	99.993058%
MFTEXP-091107-34	840			840	100.0	1.0	8.40E+04	99.930579%
MFTEXP-091107-35	1830			1830	100.0	1.0	1.83E+05	99.848760%
MFTEXP-091107-36	39			39	100.0	1.0	3.90E+03	99.996777%
MFT011-091107-01	85600			85600	100.0	1.0	8.56E+06	92.925620%
MFT011-091107-02	105			105	100.0	1.0	1.05E+04	99.991322%
MFT011-091107-03	144000			144000	100.0	1.0	1.44E+07	88.099174%
MFT011-091107-04	15200			15200	100.0	1.0	1.52E+06	98.743802%
MFT011-091107-05	6400			6400	100.0	1.0	6.40E+05	99.471074%
C+	121E+04			1.21E+06	100.0	1.0	1.21E+08	

: Filter placed in the filter holder are very thin. Several type of gasket are available. Improper gaskets were use for F.H. assembly

Experiment No M07-0390: AATCC 100

Purpose: Evaluating the antiviral efficacy of composite of Triosynated meltblow composite and blank glass fiber media from June 2007 production

Challenge: MS2 coliphage by contact time during 0 minute, 15 minutes, 30 minutes, 60 minutes & 24 hours

Date:2007/09/12

Micro 2								MS2	
Filter code	Contact time	raw results			total	d.l.	vol plated	PFU total	% Reduction
MFTEXP-091207-82	0 min	84E+03			84000	10.0	1.0	8.40E+05	1.02E+06
MFTEXP-091207-83	0 min	115E+03			115000	10.0	1.0	1.15E+06	
MFTEXP-091207-84	0 min	107E+03			107000	10.0	1.0	1.07E+06	
MFTEXP-091207-85	15 min	90E+02			9000	10.0	1.0	9.00E+04	91.176471%
MFTEXP-091207-86	15 min	56E+02			5600	10.0	1.0	5.60E+04	94.509804%
MFTEXP-091207-87	15 min	36E+03			36000	10.0	1.0	3.60E+05	64.705882%
MFTEXP-091207-88	30 min	179E+02			17900	10.0	1.0	1.79E+05	82.450980%
MFTEXP-091207-89	30 min	202E+02			20200	10.0	1.0	2.02E+05	80.196078%
MFTEXP-091207-90	30 min	233E+02			23300	10.0	1.0	2.33E+05	77.156863%
MFTEXP-091207-91	60 min	55E+02			5500	10.0	1.0	5.50E+04	94.607843%
MFTEXP-091207-92	60 min	7E+01			70	10.0	1.0	7.00E+02	99.931373%
MFTEXP-091207-93	60 min	68E+02			6800	10.0	1.0	6.80E+04	93.333333%
MFTEXP-091207-94	24 hours	0			0	10.0	1.0	<1.00E+01	>99.999020%
MFTEXP-091207-95	24 hours	1			1	10.0	1.0	1.00E+01	99.999020%
MFTEXP-091207-96	24 hours	0			0	10.0	1.0	<1.00E+01	>99.999020%

Micro 2								MS2	
Filter code	Contact time	raw results			total	d.l.	vol plated	PFU total	% Reduction
MFTEXP-091207-97	0 min	42E+02			4200	10.0	1.0	4.20E+04	95.882353%
MFTEXP-091207-98	0 min	105E+01			1050	10.0	1.0	1.05E+04	98.970588%
MFTEXP-091207-99	0 min	36E+02			3600	10.0	1.0	3.60E+04	96.470588%
MFTEXP-091207-100	15 min	0			0	10.0	1.0	<1.00E+01	>99.999020%
MFTEXP-091207-101	15 min	0			0	10.0	1.0	<1.00E+01	>99.999020%
MFTEXP-091207-102	15 min	0			0	10.0	1.0	<1.00E+01	>99.999020%
MFTEXP-091207-103	30 min	0			0	10.0	1.0	<1.00E+01	>99.999020%
MFTEXP-091207-104	30 min	0			0	10.0	1.0	<1.00E+01	>99.999020%
MFTEXP-091207-105	30 min	0			0	10.0	1.0	<1.00E+01	>99.999020%
MFTEXP-091207-106	60 min	1			1	10.0	1.0	1.00E+01	99.999020%
MFTEXP-091207-107	60 min	0			0	10.0	1.0	<1.00E+01	>99.999020%
MFTEXP-091207-108	60 min	0			0	10.0	1.0	<1.00E+01	>99.999020%
MFTEXP-091207-109	24 hours	0	0	0	0	10.0	3.0	<3.33E+00	>99.999673%
MFTEXP-091207-110	24 hours	0	0	0	0	10.0	3.0	<3.33E+00	>99.999673%
MFTEXP-091207-111	24 hours	0	0	0	0	10.0	3.0	<3.33E+00	>99.999673%

Experiment No M07-0392: Biocidal air filtration membrane project:
Purpose: Comparing the VFE performance of BLANK high alpha HEPA purchased at Lydall to BLANK June 2007 HEPA production
Challenge: MS2 coliphage at 20ºC ± 5ºC and 50% ± 15% RH a 4.0 LPM for 3 hours of filtration
Date:2007/09/12

Micro 2							MS2 1 Hour 4.0 LPM	
Filter code	raw results			total	d.l.	# platings	PFU total	% Reduction
MFTEXP-091207-112	0	0	0	0	40.0	3.0	<1.33E+01	>99.999556%
MFTEXP-091207-113	0	0	0	0	40.0	3.0	<1.33E+01	>99.999556%
MFTEXP-091207-114	0	0	0	0	40.0	3.0	<1.33E+01	>99.999556%
MFTEXP-091207-115	3	0	0	3	40.0	3.0	4.00E+01	99.998667%
MFTEXP-091207-116	0	0	0	0	40.0	3.0	<1.33E+01	>99.999556%
MFTEXP-091207-117	0	1	0	1	40.0	3.0	1.33E+01	99.999556%
MFT011-091207-01	0	1	3	4	40.0	3.0	5.33E+01	99.998222%
MFT011-091207-02	3	2	0	5	40.0	3.0	6.67E+01	99.997778%
MFT011-091207-03	4	1	2	7	40.0	3.0	9.33E+01	99.996889%
MFT011-091207-04	0	0	0	0	40.0	3.0	<1.33E+01	>99.999556%
MFT011-091207-05	0	0	0	0	40.0	3.0	<1.33E+01	>99.999556%
C+	75E+03			7.50E+04	40.0	1.0	3.00E+06	

Micro 2							MS2 2 Hour 4.0 LPM	
Filter code	raw results			total	d.l.	# platings	PFU total	% Reduction
MFTEXP-091207-112	2	0	0	2	40.0	3.0	2.67E+01	99.998851%
MFTEXP-091207-113	1	1	2	4	40.0	3.0	5.33E+01	99.997701%
MFTEXP-091207-114	3	2	3	8	40.0	3.0	1.07E+02	99.995402%
MFTEXP-091207-115	0	0	0	0	40.0	3.0	<1.33E+01	>99.999425%
MFTEXP-091207-116	0	0	0	0	40.0	3.0	<1.33E+01	>99.999425%
MFTEXP-091207-117	0	0	1	1	40.0	3.0	1.33E+01	99.999425%
MFT011-091207-01	0	0	0	0	40.0	3.0	<1.33E+01	>99.999425%
MFT011-091207-02	2	1	0	3	40.0	3.0	4.00E+01	99.998276%
MFT011-091207-03	1	0	2	3	40.0	3.0	4.00E+01	99.998276%
MFT011-091207-04	1	0	1	2	40.0	3.0	2.67E+01	99.998851%
MFT011-091207-05	0	0	0	0	40.0	3.0	<1.33E+01	>99.999425%
C+	58E+03			5.80E+04	40.0	1.0	2.32E+06	

Micro 2							MS2 3 Hour 4.0 LPM	
Filter code	raw results			total	d.l.	# platings	PFU total	% Reduction
MFTEXP-091207-112	0	0	0	0	40.0	3.0	<1.33E+01	>99.999242%
MFTEXP-091207-113	0	0	0	0	40.0	3.0	<1.33E+01	>99.999242%
MFTEXP-091207-114	5	0	0	5	40.0	3.0	6.67E+01	99.996212%
MFTEXP-091207-115	0	0	0	0	40.0	3.0	<1.33E+01	>99.999242%
MFTEXP-091207-116	1	0	0	1	40.0	3.0	1.33E+01	99.999242%
MFTEXP-091207-117	0	0	0	0	40.0	3.0	<1.33E+01	>99.999242%
MFT011-091207-01	2	0	0	2	40.0	3.0	2.67E+01	99.998485%
MFT011-091207-02	0	1	0	1	40.0	3.0	1.33E+01	99.999242%
MFT011-091207-03	0	0	0	0	40.0	3.0	<1.33E+01	>99.999242%
MFT011-091207-04	0	0	0	0	40.0	3.0	<1.33E+01	>99.999242%
MFT011-091207-05	1	0	0	1	40.0	3.0	1.33E+01	99.999242%
C+	44E+03			4.40E+04	40.0	1.0	1.76E+06	

Experiment No M07-0416: Biocidal air filtration membrane project:
Challenge: MS2 coliphage at 20ºC ± 5ºC and 50% ± 15% RH a 4.0 LPM for 3 hours of filtration
Date:2007/10/02

Micro 2							MS2 1 Hour 4.0 LPM	
Filter code	raw results (larger volume plating 5mL/petri)			total	d.l.	# platings	PFU total	% Reduction
MFT074-100207-01	111	92	116	319	40.0	15.0	8.51E+02	99.999392%
MFT074-100207-02	107	142	106	355	40.0	15.0	9.47E+02	99.999324%
MFT074-100207-03	87	99	92	278	40.0	15.0	7.41E+02	99.999470%
MFT075-100207-01	26	32	23	81	40.0	15.0	2.16E+02	99.999846%
MFT075-100207-02	35	49	33	117	40.0	15.0	3.12E+02	99.999777%
MFT075-100207-03	28	20	29	77	40.0	15.0	2.05E+02	99.999853%
MFT074-100207-04	52	47	48	147	40.0	15.0	3.92E+02	99.999720%
MFT074-100207-05	246	180	232	658	40.0	15.0	1.75E+03	99.998747%
MFT074-100207-06	121	102	107	330	40.0	15.0	8.80E+02	99.999371%
MFT075-100207-04	54	56	59	169	40.0	15.0	4.51E+02	99.999678%
MFT075-100207-05	30	23	31	84	40.0	15.0	2.24E+02	99.999840%
C+	35E+05			3.50E+06	40.0	1.0	1.40E+08	

Micro 2							MS2 2 Hour 4.0 LPM	
Filter code	raw results (larger volume plating 5mL/petri)			total	d.l.	# platings	PFU total	% Reduction
MFT074-100207-01	27	46	35	108	40.0	15.0	2.88E+02	99.999915%
MFT074-100207-02	54	68	38	160	40.0	15.0	4.27E+02	99.999875%
MFT074-100207-03	45	60	72	177	40.0	15.0	4.72E+02	99.999861%
MFT075-100207-01	36	48	34	118	40.0	15.0	3.15E+02	99.999907%
MFT075-100207-02	90	90	116	296	40.0	15.0	7.89E+02	99.999768%
MFT075-100207-03	33	30	35	98	40.0	15.0	2.61E+02	99.999923%
MFT074-100207-04	22	28	23	73	40.0	15.0	1.95E+02	99.999943%
MFT074-100207-05	242	204	272	718	40.0	15.0	1.91E+03	99.999437%
MFT074-100207-06	123	74	84	281	40.0	15.0	7.49E+02	99.999780%
MFT075-100207-04	154	204	160	518	40.0	15.0	1.38E+03	99.999594%
MFT075-100207-05	78	76	46	200	40.0	15.0	5.33E+02	99.999843%
C+	85E+05			8.50E+06	40.0	1.0	3.40E+08	

Micro 2							MS2 3 Hour 4.0 LPM	
Filter code	raw results (larger volume plating 5mL/petri)			total	d.l.	# platings	PFU total	% Reduction
MFT074-100207-01	8	9	17	34	40.0	15.0	9.07E+01	99.9999218%
MFT074-100207-02	28	19	22	69	40.0	15.0	1.84E+02	99.9998414%
MFT074-100207-03	16	13	7	36	40.0	15.0	9.60E+01	99.9999172%
MFT075-100207-01	27	16	17	60	40.0	15.0	1.60E+02	99.9998621%
MFT075-100207-02	54	58	58	170	40.0	15.0	4.53E+02	99.9996092%
MFT075-100207-03	22	24	22	68	40.0	15.0	1.81E+02	99.9998437%
MFT074-100207-04	8	14	23	45	40.0	15.0	1.20E+02	99.9998966%
MFT074-100207-05	92	88	107	287	40.0	15.0	7.65E+02	99.9993402%
MFT074-100207-06	43	46	39	128	40.0	15.0	3.41E+02	99.9997057%
MFT075-100207-04	144	134	82	360	40.0	15.0	9.60E+02	99.9991724%
MFT075-100207-05	53	42	38	133	40.0	15.0	3.55E+02	99.9996943%
C+	29E+05			2.90E+06	40.0	1.0	1.16E+08	

Experiment No M07-0417: Biocidal air filtration membrane project:
Challenge: MS2 coliphage at 20ºC ± 5ºC and 50% ± 15% RH a 4.0 LPM for 3 hours of filtration
Date:2007/10/03

Micro 2							MS2 1 Hour 4.0 LPM	
Filter code	raw results (larger volume plating 5mL/petri)			total	d.l.	# platings	PFU total	% Reduction
MFT074-100307-01	15	9	8	32	40.0	15.0	8.53E+01	99.999971%
MFT074-100307-02	2	4	4	10	40.0	15.0	2.67E+01	99.999991%
MFT074-100307-03	11	7	8	26	40.0	15.0	6.93E+01	99.999976%
MFT071-100307-01	34	32	37	103	40.0	15.0	2.75E+02	99.999906%
MFT071-100307-02	26	48	39	113	40.0	15.0	3.01E+02	99.999897%
MFT071-100307-03	42	34	33	109	40.0	15.0	2.91E+02	99.999900%
MFT074-100307-04	17	15	10	42	40.0	15.0	1.12E+02	99.999962%
MFT074-100307-05	6	7	4	17	40.0	15.0	4.53E+01	99.999984%
MFT074-100307-06	10	9	12	31	40.0	15.0	8.27E+01	99.999972%
MFT071-100307-04	109	107	96	312	40.0	15.0	8.32E+02	99.999715%
MFT071-100307-05	66	51	41	158	40.0	15.0	4.21E+02	99.999856%
C+	7300000			7.30E+06	40.0	1.0	2.92E+08	

Micro 2							MS2 2 Hour 4.0 LPM	
Filter code	raw results (larger volume plating 5mL/petri)			total	d.l.	# platings	PFU total	% Reduction
MFT074-100307-01	1	2	3	6	40.0	15.0	1.60E+01	99.999976%
MFT074-100307-02	2	1	4	7	40.0	15.0	1.87E+01	99.999973%
MFT074-100307-03	4	2	4	10	40.0	15.0	2.67E+01	99.999961%
MFT071-100307-01	51	46	55	152	40.0	15.0	4.05E+02	99.999404%
MFT071-100307-02	59	54	60	173	40.0	15.0	4.61E+02	99.999322%
MFT071-100307-03	42	26	40	108	40.0	15.0	2.88E+02	99.999576%
MFT074-100307-04	32	32	38	102	40.0	15.0	2.72E+02	99.999600%
MFT074-100307-05	6	6	7	19	40.0	15.0	5.07E+01	99.999925%
MFT074-100307-06	30	33	34	97	40.0	15.0	2.59E+02	99.999620%
MFT071-100307-04	167	178	159	504	40.0	15.0	1.34E+03	99.998024%
MFT071-100307-05	94	92	96	282	40.0	15.0	7.52E+02	99.998894%
C+	170E+04			1.70E+06	40.0	1.0	6.80E+07	

Micro 2							MS2 3 Hour 4.0 LPM	
Filter code	raw results (larger volume plating 5mL/petri)			total	d.l.	# platings	PFU total	% Reduction
MFT074-100307-01	2	5	3	10	40.0	15.0	2.67E+01	99.9999534%
MFT074-100307-02	2	7	4	13	40.0	15.0	3.47E+01	99.9999394%
MFT074-100307-03	5	4	8	17	40.0	15.0	4.53E+01	99.9999207%
MFT071-100307-01	73	75	68	216	40.0	15.0	5.76E+02	99.9989930%
MFT071-100307-02	79	66	76	221	40.0	15.0	5.89E+02	99.9989697%
MFT071-100307-03	100	99	98	297	40.0	15.0	7.92E+02	99.9986154%
MFT074-100307-04	32	19	29	80	40.0	15.0	2.13E+02	99.9996270%
MFT074-100307-05	17	13	20	50	40.0	15.0	1.33E+02	99.9997669%
MFT074-100307-06	28	22	18	68	40.0	15.0	1.81E+02	99.9996830%
MFT071-100307-04	160	162	169	491	40.0	15.0	1.31E+03	99.9977110%
MFT071-100307-05	119	112	113	344	40.0	15.0	9.17E+02	99.9983963%
C+	143E+04			1.43E+06	40.0	1.0	5.72E+07	

Experiment No M07-0418: Biocidal air filtration membrane project:
Challenge: MS2 coliphage at 20ºC ± 5ºC and 50% ± 15% RH a 4.0 LPM for 3 hours of filtration
Date:2007/10/04

Micro 2							MS2 1 Hour 4.0 LPM	
Filter code	raw results (larger volume plating 5mL/petri)			total	d.l.	# platings	PFU total	% Reduction
MFT074-100407-01	22	20	22	64	40.0	15.0	1.71E+02	99.999867%
MFT074-100407-02	6	6	3	15	40.0	15.0	4.00E+01	99.999969%
MFT074-100407-03	22	16	13	51	40.0	15.0	1.36E+02	99.999894%
MFT071-100407-01	192	156	166	514	40.0	15.0	1.37E+03	99.998929%
MFT071-100407-02	109	134	123	366	40.0	15.0	9.76E+02	99.999238%
MFT071-100407-03	42	26	36	104	40.0	15.0	2.77E+02	99.999783%
MFT074-100407-04	28	18	25	71	40.0	15.0	1.89E+02	99.999852%
MFT074-100407-05	14	17	20	51	40.0	15.0	1.36E+02	99.999894%
MFT074-100407-06	49	55	52	156	40.0	15.0	4.16E+02	99.999675%
MFT071-100407-04	197	176	182	555	40.0	15.0	1.48E+03	99.998844%
MFT071-100407-05	157	182	186	525	40.0	15.0	1.40E+03	99.998906%
C+	3200000			3.20E+06	40.0	1.0	1.28E+08	

Micro 2							MS2 2 Hour 4.0 LPM	
Filter code	raw results (larger volume plating 5mL/petri)			total	d.l.	# platings	PFU total	% Reduction
MFT074-100407-01	12	14	8	34	40.0	15.0	9.07E+01	99.999894%
MFT074-100407-02	0	1	2	3	40.0	15.0	8.00E+00	99.999991%
MFT074-100407-03	13	12	4	29	40.0	15.0	7.73E+01	99.999910%
MFT071-100407-01	78	104	74	256	40.0	15.0	6.83E+02	99.999202%
MFT071-100407-02	106	120	125	351	40.0	15.0	9.36E+02	99.998907%
MFT071-100407-03	23	13	19	55	40.0	15.0	1.47E+02	99.999829%
MFT074-100407-04	2	2	0	4	40.0	15.0	1.07E+01	99.999988%
MFT074-100407-05	36	28	27	91	40.0	15.0	2.43E+02	99.999717%
MFT074-100407-06	17	28	32	77	40.0	15.0	2.05E+02	99.999760%
MFT071-100407-04	255	222	226	703	40.0	15.0	1.87E+03	99.997810%
MFT071-100407-05	196	232	226	654	40.0	15.0	1.74E+03	99.997963%
C+	214E+04			2.14E+06	40.0	1.0	8.56E+07	

Micro 2							MS2 3 Hour 4.0 LPM	
Filter code	raw results (larger volume plating 5mL/petri)			total	d.l.	# platings	PFU total	% Reduction
MFT074-100407-01	29	27	27	83	40.0	15.0	2.21E+02	99.9999231%
MFT074-100407-02	5	4	5	14	40.0	15.0	3.73E+01	99.9999870%
MFT074-100407-03	24	23	24	71	40.0	15.0	1.89E+02	99.9999343%
MFT071-100407-01	204			204	40.0	5.0	1.63E+03	99.9994333%
MFT071-100407-02	282			282	40.0	5.0	2.26E+03	99.9992167%
MFT071-100407-03	48	43	62	153	40.0	15.0	4.08E+02	99.9998583%
MFT074-100407-04	5	5	1	11	40.0	15.0	2.93E+01	99.9999898%
MFT074-100407-05	93	71	59	223	40.0	15.0	5.95E+02	99.9997935%
MFT074-100407-06	126	102	76	304	40.0	15.0	8.11E+02	99.9997185%
MFT071-100407-04	462			462	40.0	5.0	3.70E+03	99.9987167%
MFT071-100407-05	664			664	40.0	5.0	5.31E+03	99.9981556%
C+	72E+05			7.20E+06	40.0	1.0	2.88E+08	

Experiment No M07-0421: Biocidal air filtration membrane project:
Challenge: MS2 coliphage at 20ºC ± 5ºC and 50% ± 15% RH a 4.0 LPM for 3 hours of filtration
Date:2007/10/05

Micro 2							MS2 1 Hour 4.0 LPM	
Filter code	raw results (larger volume plating 5mL/petri)			total	d.l.	# platings	PFU total	% Reduction
MFT074-100507-01	3	2	2	7	40.0	15.0	1.87E+01	99.999983%
MFT074-100507-02	18	11	11	40	40.0	15.0	1.07E+02	99.999901%
MFT074-100507-03	0	0	1	1	40.0	15.0	2.67E+00	99.999998%
MFT071-100507-01	62	42	51	155	40.0	15.0	4.13E+02	99.999617%
MFT071-100507-02	43	39	42	124	40.0	15.0	3.31E+02	99.999694%
MFT071-100507-03	64	52	50	166	40.0	15.0	4.43E+02	99.999590%
MFT074-100507-04	9	10	8	27	40.0	15.0	7.20E+01	99.999933%
MFT074-100507-05	17	17	19	53	40.0	15.0	1.41E+02	99.999869%
MFT074-100507-06	1	2	2	5	40.0	15.0	1.33E+01	99.999988%
MFT071-100507-04	92	76	84	252	40.0	15.0	6.72E+02	99.999378%
MFT071-100507-05	50	60	81	191	40.0	15.0	5.09E+02	99.999528%
C+	2700000			2.70E+06	40.0	1.0	1.08E+08	

Micro 2							MS2 2 Hour 4.0 LPM	
Filter code	raw results (larger volume plating 5mL/petri)			total	d.l.	# platings	PFU total	% Reduction
MFT074-100507-01	2	0	2	4	40.0	15.0	1.07E+01	99.999991%
MFT074-100507-02	9	6	8	23	40.0	15.0	6.13E+01	99.999947%
MFT074-100507-03	3	0	1	4	40.0	15.0	1.07E+01	99.999991%
MFT071-100507-01	41	49	58	148	40.0	15.0	3.95E+02	99.999660%
MFT071-100507-02	33	41	46	120	40.0	15.0	3.20E+02	99.999724%
MFT071-100507-03	106	82	104	292	40.0	15.0	7.79E+02	99.999329%
MFT074-100507-04	22	22	15	59	40.0	15.0	1.57E+02	99.999864%
MFT074-100507-05	17	23	10	50	40.0	15.0	1.33E+02	99.999885%
MFT074-100507-06	18	19	18	55	40.0	15.0	1.47E+02	99.999874%
MFT071-100507-04	114			114	40.0	5.0	9.12E+02	99.999214%
MFT071-100507-05	126			126	40.0	5.0	1.01E+03	99.999131%
C+	29E+05			2.90E+06	40.0	1.0	1.16E+08	

Micro 2							MS2 3 Hour 4.0 LPM	
Filter code	raw results (larger volume plating 5mL/petri)			total	d.l.	# platings	PFU total	% Reduction
MFT074-100507-01	3	1	3	7	40.0	15.0	1.87E+01	99.9999901%
MFT074-100507-02	9	3	7	19	40.0	15.0	5.07E+01	99.9999730%
MFT074-100507-03	3	0	1	4	40.0	15.0	1.07E+01	99.9999943%
MFT071-100507-01	88	82	96	266	40.0	15.0	7.09E+02	99.9996227%
MFT071-100507-02	10	12	9	31	40.0	15.0	8.27E+01	99.9999560%
MFT071-100507-03	60	67	44	171	40.0	15.0	4.56E+02	99.9997574%
MFT074-100507-04	34	30	39	103	40.0	15.0	2.75E+02	99.9998539%
MFT074-100507-05	26	31	25	82	40.0	15.0	2.19E+02	99.9998837%
MFT074-100507-06	28	36	39	103	40.0	15.0	2.75E+02	99.9998539%
MFT071-100507-04	154			154	40.0	5.0	1.23E+03	99.9993447%
MFT071-100507-05	144			144	40.0	5.0	1.15E+03	99.9993872%
C+	47E+05			4.70E+06	40.0	1.0	1.88E+08	

Experiment No M07-0429: Biocidal air filtration membrane project:
Purpose: Testing consistency of Triosynated meltblown/Triosynated HEPA composite
Challenge: MS2 coliphage at 20ºC ± 5ºC and 50% ± 15% RH a 4.0 LPM for 3 hours of filtration
Date:2007/10/11

Micro 2									MS2 1 Hour 4.0 LPM	
Filter code	raw results (larger volume plating 5mL/petri)					total	d.l.	# platings	PFU total	% Reduction
MFT074-101107-01	16	3	7	11		37	40.0	20.0	7.40E+01	99.999947%
MFT074-101107-02	23	31	23	26		103	40.0	20.0	2.06E+02	99.999853%
MFT074-101107-03	33	45	44	43		165	40.0	20.0	3.30E+02	99.999764%
MFT074-101107-04	7	7	12	5		31	40.0	20.0	6.20E+01	99.999956%
MFT074-101107-05	22	29	29	14		94	40.0	20.0	1.88E+02	99.999866%
MFT074-101107-06	22	17	18	20		77	40.0	20.0	1.54E+02	99.999890%
MFT074-101107-07	33	47	48	49		177	40.0	20.0	3.54E+02	99.999747%
MFT074-101107-08	78	84	82	74		318	40.0	20.0	6.36E+02	99.999546%
MFT074-101107-09	8	9	8	10		35	40.0	20.0	7.00E+01	99.999950%
MFT074-101107-10	2	8	2	7		19	40.0	20.0	3.80E+01	99.999973%
MFT071-101107-01	146					146	40.0	5.0	1.17E+03	99.999166%
C+	35E+05					3.50E+06	40.0	1.0	1.40E+08	

Micro 2									MS2 2 Hour 4.0 LPM	
Filter code	raw results (larger volume plating 2mL/petri)					total	d.l.	# platings	PFU total	% Reduction
MFT074-101107-01	6	10	11	12		39	40.0	20.0	7.80E+01	99.999866%
MFT074-101107-02	35	37	37	31		140	40.0	20.0	2.80E+02	99.999521%
MFT074-101107-03	56	99	82	82		319	40.0	20.0	6.38E+02	99.998908%
MFT074-101107-04	11	9	5	8		33	40.0	20.0	6.60E+01	99.999887%
MFT074-101107-05	20	22	18	23		83	40.0	20.0	1.66E+02	99.999716%
MFT074-101107-06	14	34	22	19		89	40.0	20.0	1.78E+02	99.999695%
MFT074-101107-07	16	23	14	14		67	40.0	20.0	1.34E+02	99.999771%
MFT074-101107-08	113	116	100	90		419	40.0	20.0	8.38E+02	99.998565%
MFT074-101107-09	17	14	9	5		45	40.0	20.0	9.00E+01	99.999846%
MFT074-101107-10	8	14	9	11		42	40.0	20.0	8.40E+01	99.999856%
MFT071-101107-01	388					388	40.0	5.0	3.10E+03	99.994685%
C+	146E+04					1.46E+06	40.0	1.0	5.84E+07	

Micro 2									MS2 3 Hour 4.0 LPM	
Filter code	raw results (larger volume plating 2mL/petri)					total	d.l.	# platings	PFU total	% Reduction
MFT074-101107-01	24	26	13	23		86	40.0	20.0	1.72E+02	99.999877%
MFT074-101107-02	50	63	44	43		200	40.0	20.0	4.00E+02	99.999714%
MFT074-101107-03	76	97	80	65		318	40.0	20.0	6.36E+02	99.999546%
MFT074-101107-04	23	23	27	29		102	40.0	20.0	2.04E+02	99.999854%
MFT074-101107-05	34	29	24	30		117	40.0	20.0	2.34E+02	99.999833%
MFT074-101107-06	35	25	24	28		112	40.0	20.0	2.24E+02	99.999840%
MFT074-101107-07	2	2	1	1		6	40.0	20.0	1.20E+01	99.999991%
MFT074-101107-08	108	129	137	115		489	40.0	20.0	9.78E+02	99.999301%
MFT074-101107-09	22	12	15	12		61	40.0	20.0	1.22E+02	99.999913%
MFT074-101107-10	7	5	7	16		35	40.0	20.0	7.00E+01	99.999950%
MFT071-101107-01	77	59	63	54	94	2.53E+02	40.0	5.0	2.02E+03	99.998554%
C+	35E+05					3.50E+06	40.0	1.0	1.40E+08	

Experiment No M07-0430: Biocidal air filtration membrane project:
Purpose: Testing consistency of Triosynated meltblown/Triosynated HEPA composite
Challenge: MS2 coliphage at 20ºC ± 5ºC and 50% ± 15% RH a 4.0 LPM for 3 hours of filtration
Date:2007/10/11

Micro 2									MS2 1 Hour 4.0 LPM	
Filter code	raw results (larger volume plating 5mL/petri)					total	d.l.	# platings	PFU total	% Reduction
MFT074-101107-11	30	35	28	38		131	40.0	20.0	2.62E+02	99.999748%
MFT074-101107-12	35	16	24	28		103	40.0	20.0	2.06E+02	99.999802%
MFT074-101107-13	36	28	21	27		112	40.0	20.0	2.24E+02	99.999785%
MFT074-101107-14	48	63	50	63		224	40.0	20.0	4.48E+02	99.999569%
MFT074-101107-15	30	20	19	18		87	40.0	20.0	1.74E+02	99.999833%
MFT074-101107-16	31	23	18	28		100	40.0	20.0	2.00E+02	99.999808%
MFT074-101107-17	23	21	26	26		96	40.0	20.0	1.92E+02	99.999815%
MFT074-101107-18	85	107	115	109		416	40.0	20.0	8.32E+02	99.999200%
MFT074-101107-19	108	99	99	100		406	40.0	20.0	8.12E+02	99.999219%
MFT074-101107-20	98	89	72	51		310	40.0	20.0	6.20E+02	99.999404%
MFT071-101107-02	276					276	40.0	5.0	2.21E+03	99.997877%
C+	26E+05					2.60E+06	40.0	1.0	1.04E+08	

Micro 2									MS2 2 Hour 4.0 LPM	
Filter code	raw results (larger volume plating 2mL/petri)					total	d.l.	# platings	PFU total	% Reduction
MFT074-101107-11	34	44	41	34		153	40.0	20.0	3.06E+02	99.999727%
MFT074-101107-12	28	28	22	39		117	40.0	20.0	2.34E+02	99.999791%
MFT074-101107-13	52	63	44	49		208	40.0	20.0	4.16E+02	99.999629%
MFT074-101107-14	43	60	49	51		203	40.0	20.0	4.06E+02	99.999638%
MFT074-101107-15	42	30	30	37		139	40.0	20.0	2.78E+02	99.999752%
MFT074-101107-16	45	35	48	26		154	40.0	20.0	3.08E+02	99.999725%
MFT074-101107-17	36	37	19	21		113	40.0	20.0	2.26E+02	99.999798%
MFT074-101107-18	134	152	127	128		541	40.0	20.0	1.08E+03	99.999034%
MFT074-101107-19	117	142	154	120		533	40.0	20.0	1.07E+03	99.999048%
MFT074-101107-20	45	49	41	43		178	40.0	20.0	3.56E+02	99.999682%
MFT071-101107-02	404					404	40.0	5.0	3.23E+03	99.997114%
C+	28E+05					2.80E+06	40.0	1.0	1.12E+08	

Micro 2									MS2 3 Hour 4.0 LPM	
Filter code	raw results (larger volume plating 2mL/petri)					total	d.l.	# platings	PFU total	% Reduction
MFT074-101107-11	88	76	82	88		334	40.0	20.0	6.68E+02	99.999702%
MFT074-101107-12	41	30	42	35		148	40.0	20.0	2.96E+02	99.999868%
MFT074-101107-13	95	116	102	106		419	40.0	20.0	8.38E+02	99.999626%
MFT074-101107-14	96	103	104	86		389	40.0	20.0	7.78E+02	99.999653%
MFT074-101107-15	210					210	40.0	5.0	1.68E+03	99.999250%
MFT074-101107-16	195					195	40.0	5.0	1.56E+03	99.999304%
MFT074-101107-17	54	57	42	43		196	40.0	20.0	3.92E+02	99.999825%
MFT074-101107-18	352					352	40.0	5.0	2.82E+03	99.998743%
MFT074-101107-19	274					274	40.0	5.0	2.19E+03	99.999021%
MFT074-101107-20	164					164	40.0	5.0	1.31E+03	99.999414%
MFT071-101107-02	542					542	40.0	5.0	4.34E+03	99.998064%
C+	56E+05					5.60E+06	40.0	1.0	2.24E+08	

Experiment No M07-0431: Biocidal air filtration membrane project:
Purpose: Testing consistency of Triosynated meltblown/Triosynated HEPA composite
Challenge: MS2 coliphage at 20ºC ± 5ºC and 50% ± 15% RH a 4.0 LPM for 3 hours of filtration
Date:2007/10/12

Micro 2									MS2 1 Hour 4.0 LPM	
Filter code	raw results (larger volume plating 5mL/petri)					total	d.l.	# platings	PFU total	% Reduction
MFT074-101207-04	218					218	40.0	5.0	1.74E+03	99.999468%
MFT074-101207-05	101	83	113	130		427	40.0	20.0	8.54E+02	99.999740%
MFT074-101207-06	51	72	75	85		283	40.0	20.0	5.66E+02	99.999827%
MFT074-101207-07	90	81	132	105		408	40.0	20.0	8.16E+02	99.999751%
MFT074-101207-08	292					292	40.0	5.0	2.34E+03	99.999288%
MFT074-101207-09	300					300	40.0	5.0	2.40E+03	99.999268%
MFT074-101207-10	228					228	40.0	5.0	1.82E+03	99.999444%
MFT074-101207-11	78	69	73	74		294	40.0	20.0	5.88E+02	99.999821%
MFT074-101207-12	566					566	40.0	5.0	4.53E+03	99.998620%
MFT074-101207-13	608					608	40.0	5.0	4.86E+03	99.998517%
MFT071-101207-04	720					720	40.0	5.0	5.76E+03	99.998244%
C+	82E+05					8.20E+06	40.0	1.0	3.28E+08	

Micro 2									MS2 2 Hour 4.0 LPM	
Filter code	raw results (larger volume plating 2mL/petri)					total	d.l.	# platings	PFU total	% Reduction
MFT071-090707-01	248					248	40.0	5.0	1.98E+03	99.999553%
MFT071-090707-02	39	30	51	52		172	40.0	20.0	3.44E+02	99.999923%
MFT071-090707-03	102	70	125	133		430	40.0	20.0	8.60E+02	99.999806%
MFT071-090707-04	83	95	100	78		356	40.0	20.0	7.12E+02	99.999840%
MFT071-090707-05	264					264	40.0	5.0	2.11E+03	99.999524%
MFT071-090707-06	288					288	40.0	5.0	2.30E+03	99.999481%
MFT071-090707-07	176					176	40.0	5.0	1.41E+03	99.999683%
MFT071-090707-08	73	82	68	77		300	40.0	20.0	6.00E+02	99.999865%
MFT071-090707-09	784					784	40.0	5.0	6.27E+03	99.998587%
MFT071-090707-10	464					464	40.0	5.0	3.71E+03	99.999164%
	187	183	213	216	173	972	40.0	5.0	7.78E+03	99.998249%
C+	111E+05					1.11E+07	40.0	1.0	4.44E+08	

Micro 2									MS2 3 Hour 4.0 LPM	
Filter code	raw results (larger volume plating 2mL/petri)					total	d.l.	# platings	PFU total	% Reduction
MFT071-090707-01	560					560	40.0	5.0	4.48E+03	99.998833%
MFT071-090707-02	75	69	65	78		287	40.0	20.0	5.74E+02	99.999851%
MFT071-090707-03	116	176	100	148		540	40.0	20.0	1.08E+03	99.999719%
MFT071-090707-04	80	69	39	60		248	40.0	20.0	4.96E+02	99.999871%
MFT071-090707-05	172					172	40.0	5.0	1.38E+03	99.999642%
MFT071-090707-06	236					236	40.0	5.0	1.89E+03	99.999508%
MFT071-090707-07	224					224	40.0	5.0	1.79E+03	99.999533%
MFT071-090707-08	44	47	54	47		192	40.0	20.0	3.84E+02	99.999900%
MFT071-090707-09	566					566	40.0	5.0	4.53E+03	99.998821%
MFT071-090707-10	566					566	40.0	5.0	4.53E+03	99.998821%
	768					7.68E+02	40.0	5.0	6.14E+03	99.998400%
C+	96E+05					9.60E+06	40.0	1.0	3.84E+08	

Experiment No M07-0431: Biocidal air filtration membrane project:
Purpose: Testing consistency of Triosynated meltblown/Triosynated HEPA composite
Challenge: MS2 coliphage at 20ºC ± 5ºC and 50% ± 15% RH a 4.0 LPM for 3 hours of filtration
Date:2007/10/12

Micro 2									MS2 1 Hour 4.0 LPM	
Filter code	raw results (larger volume plating 5mL/petri)					total	d.l.	# platings	PFU total	% Reduction
MFT074-101207-04	218					218	40.0	5.0	1.74E+03	99.999468%
MFT074-101207-05	101	83	113	130		427	40.0	20.0	8.54E+02	99.999740%
MFT074-101207-06	51	72	75	85		283	40.0	20.0	5.66E+02	99.999827%
MFT074-101207-07	90	81	132	105		408	40.0	20.0	8.16E+02	99.999751%
MFT074-101207-08	292					292	40.0	5.0	2.34E+03	99.999288%
MFT074-101207-09	300					300	40.0	5.0	2.40E+03	99.999268%
MFT074-101207-10	228					228	40.0	5.0	1.82E+03	99.999444%
MFT074-101207-11	78	69	73	74		294	40.0	20.0	5.88E+02	99.999821%
MFT074-101207-12	566					566	40.0	5.0	4.53E+03	99.998620%
MFT074-101207-13	608					608	40.0	5.0	4.86E+03	99.998517%
MFT071-101207-04	720					720	40.0	5.0	5.76E+03	99.998244%
C+	82E+05					8.20E+06	40.0	1.0	3.28E+08	

Micro 2									MS2 2 Hour 4.0 LPM	
Filter code	raw results (larger volume plating 2mL/petri)					total	d.l.	# platings	PFU total	% Reduction
MFT071-090707-01	248					248	40.0	5.0	1.98E+03	99.999553%
MFT071-090707-02	39	30	51	52		172	40.0	20.0	3.44E+02	99.999923%
MFT071-090707-03	102	70	125	133		430	40.0	20.0	8.60E+02	99.999806%
MFT071-090707-04	83	95	100	78		356	40.0	20.0	7.12E+02	99.999840%
MFT071-090707-05	264					264	40.0	5.0	2.11E+03	99.999524%
MFT071-090707-06	288					288	40.0	5.0	2.30E+03	99.999481%
MFT071-090707-07	176					176	40.0	5.0	1.41E+03	99.999683%
MFT071-090707-08	73	82	68	77		300	40.0	20.0	6.00E+02	99.999865%
MFT071-090707-09	784					784	40.0	5.0	6.27E+03	99.998587%
MFT071-090707-10	464					464	40.0	5.0	3.71E+03	99.999164%
	187	183	213	216	173	972	40.0	5.0	7.78E+03	99.998249%
C+	111E+05					1.11E+07	40.0	1.0	4.44E+08	

Micro 2									MS2 3 Hour 4.0 LPM	
Filter code	raw results (larger volume plating 2mL/petri)					total	d.l.	# platings	PFU total	% Reduction
MFT071-090707-01	560					560	40.0	5.0	4.48E+03	99.998833%
MFT071-090707-02	75	69	65	78		287	40.0	20.0	5.74E+02	99.999851%
MFT071-090707-03	116	176	100	148		540	40.0	20.0	1.08E+03	99.999719%
MFT071-090707-04	80	69	39	60		248	40.0	20.0	4.96E+02	99.999871%
MFT071-090707-05	172					172	40.0	5.0	1.38E+03	99.999642%
MFT071-090707-06	236					236	40.0	5.0	1.89E+03	99.999508%
MFT071-090707-07	224					224	40.0	5.0	1.79E+03	99.999533%
MFT071-090707-08	44	47	54	47		192	40.0	20.0	3.84E+02	99.999900%
MFT071-090707-09	566					566	40.0	5.0	4.53E+03	99.998821%
MFT071-090707-10	566					566	40.0	5.0	4.53E+03	99.998821%
	768					7.68E+02	40.0	5.0	6.14E+03	99.998400%
C+	96E+05					9.60E+06	40.0	1.0	3.84E+08	

Experiment No. V07-0030 AFRL-General Research

Purpose: Task B: Testing Triosynated meltblown/Triosynated HEPA composite against animal virus model

Challenge: Undiluted, purified Influenza A/PR/8/34 prep at 20ºC ± 5ºC and 50% ± 15% RH at 4.0 LPM for 3 hours filtration

Date:2007/10/12

Micro 1												INFLUENZA A PR8 1 hour 4.0 LPM	
Filter code	raw results						Total	vol. imp.	vol. pla.	replicats	d.l.	PFU total	% reduction
MFT074-101207-01	0	0	0	0	0	0	0	40	0.3	6.0	22.2	<2.22E+01	>99.989247%
MFT074-101207-02	0	0	0	0	0	0	0	40	0.3	6.0	22.2	<2.22E+01	>99.989247%
MFT074-101207-03	0	0	0	0	0	0	0	40	0.3	6.0	22.2	<2.22E+01	>99.989247%
MFT071-101207-01	0	0	0	0	0	0	0	40	0.3	6.0	22.2	<2.22E+01	>99.989247%
MFT071-101207-02	0	0	0	0	0	0	0	40	0.3	6.0	22.2	<2.22E+01	>99.989247%
MFT071-101207-03	0	0	0	0	0	0	0	40	0.3	6.0	22.2	<2.22E+01	>99.989247%
C+	20E+02	11E+02					3100	40	0.3	2.0	66.7	2.07E+05	

Micro 1												INFLUENZA A PR8 2 hour 4.0 LPM	
Filter code	raw results						Total	vol. imp.	vol. pla.	replicats	d.l.	PFU total	% reduction
MFT074-101207-01	0	0	0	0	0	0	0	40	0.3	6.0	22.2	<2.22E+01	>99.990196%
MFT074-101207-02	0	0	0	0	0	0	0	40	0.3	6.0	22.2	<2.22E+01	>99.990196%
MFT074-101207-03	0	0	0	0	0	0	0	40	0.3	6.0	22.2	<2.22E+01	>99.990196%
MFT071-101207-01	0	0	0	0	0	0	0	40	0.3	6.0	22.2	<2.22E+01	>99.990196%
MFT071-101207-02	0	0	0	0	0	0	0	40	0.3	6.0	22.2	<2.22E+01	>99.990196%
MFT071-101207-03	0	0	0	0	0	0	0	40	0.3	6.0	22.2	<2.22E+01	>99.990196%
C+	17E+02	17E+02					3400	40	0.3	2.0	66.7	2.27E+05	

Micro 1												INFLUENZA A PR8 3 hour 4.0 LPM	
Filter code	raw results						Total	vol. imp.	vol. pla.	replicats	d.l.	PFU total	% reduction
MFT074-101207-01	0	0	0	0	0	0	0	40	0.3	6.0	22.2	<2.22E+01	>99.986667%
MFT074-101207-02	0	0	0	0	0	0	0	40	0.3	6.0	22.2	<2.22E+01	>99.986667%
MFT074-101207-03	1	0	0	0	0	0	1	40	0.3	6.0	22.2	2.22E+01	99.986667%
MFT071-101207-01	0	0	BM	BM	BM	BM	0	40	0.3	2.0	66.7	<6.67E-01	>99.960000%
MFT071-101207-02	0	0	BM	BM	BM	BM	0	40	0.3	2.0	66.7	<6.67E-01	>99.960000%
MFT071-101207-03	0	0	BM	BM	BM	BM	0	40	0.3	2.0	66.7	<6.67E-01	>99.960000%
C+	11E+02	14E+02					2500	40	0.3	2.0	66.7	1.67E+05	

BM: bad monolayer

Experiment No M07-0433: AATCC 100

Purpose: Comparing the sporicidal efficacy of Triosynated meltblown/Triosynated HEPA composite

Challenge: *Baciullus atrophaeus* spores by contact time during 0 minute and 24 hours

Date:2007/10/15

Micro 2								*B. atrophaeus* spores	
Filter code	Contact time	raw results			total	d.l.	vol plated	PFU total	% Reduction
MFTEXP101507-01	0 min	176E+03			176000	10.0	0.2	8.80E+06	8.87E+06
MFTEXP101507-02	0 min	177E+03			177000	10.0	0.2	8.85E+06	
MFTEXP101507-03	0 min	179E+03			179000	10.0	0.2	8.95E+06	
MFTEXP101507-04	24 hours	268E+02			26800	10.0	0.2	1.34E+06	84.887218%
MFTEXP101507-05	24 hours	412E+02			41200	10.0	0.2	2.06E+06	76.766917%
MFTEXP101507-06	24 hours	269E+02			26900	10.0	0.2	1.35E+06	84.830827%

Micro 2								*B. atrophaeus* spores	
Filter code	Contact time	raw results			total	d.l.	vol plated	PFU total	% Reduction
MFTEXP-101507-07	0 min	292E+03			292000	10.0	0.2	1.46E+07	0.000000%
MFTEXP-101507-08	0 min	327E+03			327000	10.0	0.2	1.64E+07	0.000000%
MFTEXP-101507-09	0 min	214E+03			214000	10.0	0.2	1.07E+07	0.000000%
MFTEXP-101507-10	24 hours	28E+03			28000	10.0	0.2	1.40E+06	84.210526%
MFTEXP-101507-11	24 hours	35E+03			35000	10.0	0.2	1.75E+06	80.263158%
MFTEXP-101507-12	24 hours	25E+03			25000	10.0	0.2	1.25E+06	85.902256%

Experiment No M07-0434: Biocidal air filtration membrane project:

Purpose: Testing IP2/CP2 stack (Triosynated meltblown/Triosynated HEPA composite) in environmental condition (20°C ± 3°C & 50% ± 15% RH)

Challenge: MS2 coliphage at 20ºC ± 3ºC and 50% ± 15% RH a 31.8 LPM for 3 hours of filtration

Date:2007/10/15

Environmental Condition: 20°C ± 3°C & 50% ± 15% RH

Micro 3														MS2 1 Hour 31.8 LPM	
Filter code	raw results (larger volume plating 5mL/petri)										total	d.l.	# platings	PFU total	% Reduction
MFT074-101507-01	25	20	24	20	19	25	32	15	18	23	221	100.0	50.0	4.42E+02	99.999673%
MFT074-101507-02	31	29	21	25	27	38	42	23	20	23	279	100.0	50.0	5.58E+02	99.999587%
MFT074-101507-03	25	33	24	21	16	26	22	15	25	18	225	100.0	50.0	4.50E+02	99.999667%
MFT071-101507-01	636										636	100.0	5.0	1.27E+04	99.990578%
MFT071-101507-02	628										628	100.0	5.0	1.26E+04	99.990696%
C+	135E+04										1.35E+06	100.0	1.0	1.35E+08	

Micro 3														MS2 2 Hour 31.8 LPM	
Filter code	raw results (larger volume plating 5mL/petri)										total	d.l.	# platings	PFU total	% Reduction
MFT074-101507-01	30	24	30	25	15	31	17	15	16	19	222	100.0	50.0	4.44E+02	99.999094%
MFT074-101507-02	35	21	29	39	28	31	41	31	21	18	294	100.0	50.0	5.88E+02	99.998800%
MFT074-101507-03	73	67	50	78	62	63	78	83	82	75	711	100.0	50.0	1.42E+03	99.997098%
MFT071-101507-01	572										572	100.0	5.0	1.14E+04	99.976653%
MFT071-101507-02	492										492	100.0	5.0	9.84E+03	99.979918%
C+	49E+04										4.90E+05	100.0	1.0	4.90E+07	

Micro 3														MS2 3 Hour 31.8 LPM	
Filter code	raw results (larger volume plating 5mL/petri)										total	d.l.	# platings	PFU total	% Reduction
MFT074-101507-01	219										219	100.0	5.0	4.38E+03	99.997553%
MFT074-101507-02	203										203	100.0	5.0	4.06E+03	99.997732%
MFT074-101507-03	267										267	100.0	5.0	5.34E+03	99.997017%
MFT071-101507-01	664										664	100.0	5.0	1.33E+04	99.992581%
MFT071-101507-02	1464										1464	100.0	5.0	2.93E+04	99.983642%
C+	1.79E+06										1790000	100.0	1.0	1.79E+08	

Environmental condition		
Time	Temperature (°C)	Relative Humidity (%)
0	20.7	40.3
15	21.6	49.5
30	23.3	52
45	25	38
60	27.1	48.4
AVG 60	24.25	46.975
75	27.9	49.7
90	27.7	50.7
105	27.4	53.2
120	27.1	39.9
AVG 120	27.5	48.4
135		
150		
165	18.6	57.8
180	19.5	63.6
AVG 180	19.1	60.7
AVG	24.2	49.4

Experiment No M07-0435: Biocidal air filtration membrane project:

Purpose: Testing IP2/CP2 stack (Triosynated meltblown/Triosynated HEPA composite) in environmental condition (20°C ± 3°C & 50% ± 15% RH)

Challenge: MS2 coliphage at 20ºC ± 3ºC and 50% ± 15% RH a 31.8 LPM for 3 hours of filtration

Date:2007/10/15

Environmental Condition: 20°C ± 3°C & 50% ± 15% RH

Micro 3														MS2 1 Hour 31.8 LPM	
Filter code	raw results (larger volume plating 5mL/petri)										total	d.l.	# platings	PFU total	% Reduction
MFT074-101507-04	688										688	100.0	5.0	1.38E+04	99.997354%
MFT074-101507-05	644										644	100.0	5.0	1.29E+04	99.997523%
MFT074-101507-06	788										788	100.0	5.0	1.58E+04	99.996969%
MFT071-101507-03	1464										1464	100.0	5.0	2.93E+04	99.994369%
MFT071-101507-04	864										864	100.0	5.0	1.73E+04	99.996677%
C+	52E+05										5.20E+06	100.0	1.0	5.20E+08	

Micro 3														MS2 2 Hour 31.8 LPM	
Filter code	raw results (larger volume plating 5mL/petri)										total	d.l.	# platings	PFU total	% Reduction
MFT074-101507-04	432										432	100.0	5.0	8.64E+03	99.996914%
MFT074-101507-05	580										580	100.0	5.0	1.16E+04	99.995857%
MFT074-101507-06	428										428	100.0	5.0	8.56E+03	99.996943%
MFT071-101507-03	1280										1280	100.0	5.0	2.56E+04	99.990857%
MFT071-101507-04	832										832	100.0	5.0	1.66E+04	99.994057%
C+	28E+05										2.80E+06	100.0	1.0	2.80E+08	

Micro 3														MS2 3 Hour 31.8 LPM	
Filter code	raw results (larger volume plating 5mL/petri)										total	d.l.	# platings	PFU total	% Reduction
MFT074-101507-04	476										476	100.0	5.0	9.52E+03	99.996929%
MFT074-101507-05	289										289	100.0	5.0	5.78E+03	99.998135%
MFT074-101507-06	488										488	100.0	5.0	9.76E+03	99.996852%
MFT071-101507-03	1496										1496	100.0	5.0	2.99E+04	99.990348%
MFT071-101507-04	808										808	100.0	5.0	1.62E+04	99.994787%
C+	3.10E+06										3100000	100.0	1.0	3.10E+08	

Environmental condition		
Time	Temperature (°C)	Relative Humidity (%)
0	22.8	63.8
15	22.3	60.8
30		
45	22.6	61
60	22.4	60
AVG 60	22.4	60.6
75	20.5	62.1
90	20.2	39.7
105	21.6	52.8
120	21.8	43.1
AVG 120	21.0	49.4
135	21.9	40.8
150	22	41.7
165	22.1	56.6
180	21.7	41.1
AVG 180	21.9	45.1
AVG	21.8	52.0

Experiment No M07-0437: AATCC 100

Purpose: Evaluating the antibacterial efficacy of Triosynated meltblown/Triosynated HEPA composite

Challenge: *Staphylococcus aureus* by contact time during 0 minute, 15 minutes, 30 minutes, 60 minutes & 24 hours

Date:2007/10/16

Micro 2								*S. aureus*	
Filter code	Contact time	raw results			total	d.l.	vol plated	CFU total	% Reduction
MFTEXP-101607-01	0 min	3			3	10.0	0.2	1.50E+02	1.00E+02
MFTEXP-101607-02	0 min	3			3	10.0	0.2	1.50E+02	
MFTEXP-101607-03	0 min	0			0	10.0	0.2	0.00E+00	
MFTEXP-101607-04	15 min	0			0	10.0	0.2	<5.00E+01	>50.000000%
MFTEXP-101607-05	15 min	0			0	10.0	0.2	<5.00E+01	>50.000000%
MFTEXP-101607-06	15 min	1			1	10.0	0.2	5.00E+01	50.000000%
MFTEXP-101607-07	30 min	0			0	10.0	0.2	<5.00E+01	>50.000000%
MFTEXP-101607-08	30 min	0			0	10.0	0.2	<5.00E+01	>50.000000%
MFTEXP-101607-09	30 min	0			0	10.0	0.2	<5.00E+01	>50.000000%
MFTEXP-101607-10	60 min	0			0	10.0	0.2	<5.00E+01	>50.000000%
MFTEXP-101607-11	60 min	0			0	10.0	0.2	<5.00E+01	>50.000000%
MFTEXP-101607-12	60 min	0			0	10.0	0.2	<5.00E+01	>50.000000%
MFTEXP-101607-13	24 hours	0			0	10.0	0.2	<5.00E+01	>50.000000%
MFTEXP-101607-14	24 hours	0			0	10.0	0.2	<5.00E+01	>50.000000%
MFTEXP-101607-15	24 hours	0			0	10.0	0.2	<5.00E+01	>50.000000%

Micro 2								*S. aureus*	
Filter code	Contact time	raw results			total	d.l.	vol plated	CFU total	% Reduction
MFTEXP-101607-16	0 min	0			0	10.0	0.2	<5.00E+01	>50.000000%
MFTEXP-101607-17	0 min	3			3	10.0	0.2	1.50E+02	-50.000000%
MFTEXP-101607-18	0 min	0			0	10.0	0.2	<5.00E+01	>50.000000%
MFTEXP-101607-19	15 min	0			0	10.0	0.2	<5.00E+01	>50.000000%
MFTEXP-101607-20	15 min	0			0	10.0	0.2	<5.00E+01	>50.000000%
MFTEXP-101607-21	15 min	0			0	10.0	0.2	<5.00E+01	>50.000000%
MFTEXP-101607-22	30 min	0	0		0	10.0	0.4	<2.50E+01	>75.000000%
MFTEXP-101607-23	30 min	0	0		0	10.0	0.4	<2.50E+01	>75.000000%
MFTEXP-101607-24	30 min	0	0		0	10.0	0.4	<2.50E+01	>75.000000%
MFTEXP-101607-25	60 min	0	0		0	10.0	0.4	<2.50E+01	>75.000000%
MFTEXP-101607-26	60 min	0	0		0	10.0	0.4	<2.50E+01	>75.000000%
MFTEXP-101607-27	60 min	0	0		0	10.0	0.4	<2.50E+01	>75.000000%
MFTEXP-101607-28	24 hours	0	0	0	0	10.0	0.6	<1.67E+01	>83.333333%
MFTEXP-101607-29	24 hours	0	0	0	0	10.0	0.6	<1.67E+01	>83.333333%
MFTEXP-101607-30	24 hours	0	0	0	0	10.0	0.6	<1.67E+01	>83.333333%

Experiment No M07-0438: Biocidal air filtration membrane project:
Purpose: Testing IP2/CP2 stack (Triosynated meltblown/Triosynated HEPA composite) in environmental condition (30°C ± 3°C & 85% ± 15% RH)
Challenge: MS2 coliphage at 30ºC ± 3ºC and 85% ± 15% RH a 31.8 LPM for 3 hours of filtration
Date:2007/10/16
Environmental Condition: 30°C ± 3°C & 85% ± 15% RH

Micro 3														MS2 1 Hour 31.8 LPM	
Filter code	raw results (larger volume plating 5mL/petri)										total	d.l.	# platings	PFU total	% Reduction
MFT074-101607-01	5	7	8	10	9	4	8	13	16	11	91	100.0	50.0	1.82E+02	99.999918%
MFT074-101607-02	39	63	49	55	59	54	54	54	40	42	509	100.0	50.0	1.02E+03	99.999539%
MFT074-101607-03	9	12	6	7	2	14	8	4	3	7	72	100.0	50.0	1.44E+02	99.999935%
MFT071-101607-01	103	62	78	86	64	94	78	88	99	82	834	100.0	10.0	8.34E+03	99.996226%
MFT071-101607-02	112	80	114	110	82	96	100	102	82	62	940	100.0	10.0	9.40E+03	99.995747%
C+	221E+04										2.21E+06	100.0	1.0	2.21E+08	

Micro 3														MS2 2 Hour 31.8 LPM	
Filter code	raw results (larger volume plating 5mL/petri)										total	d.l.	# platings	PFU total	% Reduction
MFT074-101607-01	2	7	6	6	9	4	11	12	8	8	73	100.0	50.0	1.46E+02	99.999939%
MFT074-101607-02	18	20	23	17	21	24	27	39	21	26	236	100.0	50.0	4.72E+02	99.999802%
MFT074-101607-03	3	10	6	7	10	9	8	7	6	7	73	100.0	50.0	1.46E+02	99.999939%
MFT071-101607-01	245										245	100.0	1.0	2.45E+04	99.989706%
MFT071-101607-02	179										179	100.0	1.0	1.79E+04	99.992479%
C+	238E+04										2.38E+06	100.0	1.0	2.38E+08	

Micro 3														MS2 3 Hour 31.8 LPM	
Filter code	raw results (larger volume plating 5mL/petri)										total	d.l.	# platings	PFU total	% Reduction
MFT074-101607-01	94	90	81	65	98	76	75	89	77	79	824	100.0	50.0	1.65E+03	99.999783%
MFT074-101607-02							144	132	157	163	596	100.0	20.0	2.98E+03	99.999608%
MFT074-101607-03	13	20	11	15	9	5	7	6	6	14	106	100.0	50.0	2.12E+02	99.999972%
MFT071-101607-01	308										308	100.0	1.0	3.08E+04	99.995947%
MFT071-101607-02	496										496	100.0	1.0	4.96E+04	99.993474%
C+	7.60E+06										7600000	100.0	1.0	7.60E+08	

Environmental condition		
Time	Temperature (°C)	Relative Humidity (%)
0	30.3	70.3
15	28.3	79.4
30	27.8	80.6
45	27.3	86.6
60	27.1	86.8
AVG 60	27.625	83.35
75	27	73
90	28.3	83.5
105	29.2	80.9
120	28	93.3
AVG 120	28.1	82.7
135	28	91.3
150	27.6	89.4
165	28.2	74.9
180	29.2	71.7
AVG 180	28.3	81.8
AVG	28.2	81.7

Experiment No M07-0439: Biocidal air filtration membrane project:
Purpose: Testing IP2/CP2 stack (Triosynated meltblown/Triosynated HEPA composite) in environmental condition (30°C ± 3°C & 85% ± 15% RH)
Challenge: MS2 coliphage at 30ºC ± 3ºC and 85% ± 15% RH a 31.8 LPM for 3 hours of filtration
Date:2007/10/16
Environmental Condition: 30°C ± 3°C & 85% ± 15% RH

Micro 3														MS2 1 Hour 31.8 LPM	
Filter code	raw results (larger volume plating 5mL/petri)										total	d.l.	# platings	PFU total	% Reduction
MFT074-101607-04	9	16	22	13	16	20	17	24	20	20	177	100.0	50.0	3.54E+02	99.999937%
MFT074-101607-05	17	8	9	19	9	7	8	8	6	16	107	100.0	50.0	2.14E+02	99.999962%
MFT074-101607-06	6	4	8	7	7	6	7	5	6	6	62	100.0	50.0	1.24E+02	99.999978%
MFT071-101607-03	162										162	100.0	1.0	1.62E+04	99.997107%
MFT071-101607-04	242										242	100.0	1.0	2.42E+04	99.995679%
C+	56E+05										5.60E+06	100.0	1.0	5.60E+08	

Micro 3														MS2 2 Hour 31.8 LPM	
Filter code	raw results (larger volume plating 5mL/petri)										total	d.l.	# platings	PFU total	% Reduction
MFT074-101607-04	25	9	26	11	22	5	18	12	28	9	165	100.0	50.0	3.30E+02	99.999957%
MFT074-101607-05	5	3	6	12	10	16	15	6	7	15	95	100.0	50.0	1.90E+02	99.999975%
MFT074-101607-06	5	4	7	10	4	9	13	5	2	9	68	100.0	50.0	1.36E+02	99.999982%
MFT071-101607-03	308										308	100.0	1.0	3.08E+04	99.996000%
MFT071-101607-04	338										338	100.0	1.0	3.38E+04	99.995610%
C+	77E+05										7.70E+06	100.0	1.0	7.70E+08	

Micro 3														MS2 3 Hour 31.8 LPM	
Filter code	raw results (larger volume plating 5mL/petri)										total	d.l.	# platings	PFU total	% Reduction
MFT074-101607-04		45	53	54	56	53	61	55	37	46	460	100.0	45.0	1.02E+03	99.999881%
MFT074-101607-05	45	33	32	24	22	27	38	30	44	23	318	100.0	50.0	6.36E+02	99.999926%
MFT074-101607-06	19	27	25	18	9	14	19	20	24	16	191	100.0	50.0	3.82E+02	99.999956%
MFT071-101607-03	648										648	100.0	1.0	6.48E+04	99.992465%
MFT071-101607-04	326										326	100.0	1.0	3.26E+04	99.996209%
C+	8.60E+06										8600000	100.0	1.0	8.60E+08	

Environmental condition		
Time	Temperature (°C)	Relative Humidity (%)
0	30.5	90.2
15	29.7	16.6
30	28.3	90.2
45	28	82.4
60	29.2	88.4
AVG 60	28.8	69.4
75	28.7	83.9
90	28.3	82.7
105	28.1	84.9
120	28.9	79.8
AVG 120	28.5	82.8
135	28.3	90.8
150	28.1	79.2
165	27.8	90.8
180	30	81.8
AVG 180	28.6	85.7
AVG	28.8	80.1

Experiment No M07-0440: Biocidal air filtration membrane project:
Purpose: Testing Triosynated meltblown/Triosynated HEPA composite against vegetative bacteria
Challenge: *Staphylococcus aureus* at 20ºC ± 5ºC and 50% ± 15% RH a 31.8 LPM for 3 hours of filtration
Date:2007/10/17

Micro 2

									S.aureus 1 Hour 31.8 LPM	
Filter code	raw results (50mL filtration on mPCB)					total	d.l.	# platings	CFU total	% Reduction
MFT074-101707-01	0					0	100.0	50.0	<2.00E+00	>99.999994%
MFT074-101707-02	0					0	100.0	50.0	<2.00E+00	>99.999994%
MFT074-101707-03	0					0	100.0	50.0	<2.00E+00	>99.999994%
MFT074-101707-04	0					0	100.0	50.0	<2.00E+00	>99.999994%
MFT074-101707-05	0					0	100.0	50.0	<2.00E+00	>99.999994%
MFT074-101707-06	0					0	100.0	50.0	<2.00E+00	>99.999994%
MFT071-101707-01	1					1	100.0	50.0	2.00E+00	99.999994%
MFT071-101707-02	0					0	100.0	50.0	<2.00E+00	>99.999994%
MFT071-101707-03	0					0	100.0	50.0	<2.00E+00	>99.999994%
C+	64E+03					6.40E+04	100.0	0.2	3.20E+07	

Micro 2

									S.aureus 2 Hour 31.8 LPM	
Filter code	raw results (50mL filtration on mPCB)					total	d.l.	# platings	CFU total	% Reduction
MFT074-101707-01	0					0	100.0	50.0	<2.00E+00	>99.999994%
MFT074-101707-02	0					0	100.0	50.0	<2.00E+00	>99.999994%
MFT074-101707-03	1					1	100.0	50.0	2.00E+00	99.999994%
MFT074-101707-04	0					0	100.0	50.0	<2.00E+00	>99.999994%
MFT074-101707-05	0					0	100.0	50.0	<2.00E+00	>99.999994%
MFT074-101707-06	0					0	100.0	50.0	<2.00E+00	>99.999994%
MFT071-101707-01	0					0	100.0	50.0	<2.00E+00	>99.999994%
MFT071-101707-02	0					0	100.0	50.0	<2.00E+00	>99.999994%
MFT071-101707-03	0					0	100.0	50.0	<2.00E+00	>99.999994%
C+	68E+03					6.80E+04	100.0	0.2	3.40E+07	

Micro 2

									S.aureus 3 Hour 31.8 LPM	
Filter code	raw results (50mL filtration on mPCB)					total	d.l.	# platings	CFU total	% Reduction
MFT074-101707-01	0					0	100.0	50.0	<2.00E+00	>99.999990%
MFT074-101707-02	0					0	100.0	50.0	<2.00E+00	>99.999990%
MFT074-101707-03	0					0	100.0	50.0	<2.00E+00	>99.999990%
MFT074-101707-04	0					0	100.0	50.0	<2.00E+00	>99.999990%
MFT074-101707-05	0					0	100.0	50.0	<2.00E+00	>99.999990%
MFT074-101707-06	0					0	100.0	50.0	<2.00E+00	>99.999990%
MFT071-101707-01	0					0	100.0	50.0	<2.00E+00	>99.999990%
MFT071-101707-02	0					0	100.0	50.0	<2.00E+00	>99.999990%
MFT071-101707-03	0					0	100.0	50.0	<2.00E+00	>99.999990%
C+	41E+03					4.10E+04	100.0	0.2	2.05E+07	

Experiment No M07-0441: Biocidal air filtration membrane project:
Purpose: Testing IP2/CP2 stack (Triosynated meltblown/Triosynated HEPA composite) in environmental condition (30°C ± 3°C & 30% ± 15% RH)
Challenge: MS2 coliphage at 30ºC ± 3ºC and 30% ± 15% RH a 31.8 LPM for 3 hours of filtration
Date:2007/10/17
Environmental Condition: 30°C ± 3°C & 30% ± 15% RH

Micro 3											MS2 1 Hour 31.8 LPM				
Filter code	raw results (larger volume plating 5mL/petri)										total	d.l.	# platings	PFU total	% Reduction
MFT074-101707-07	54	41	36	61	44	47	40	57	25	36	441	100.0	50.0	8.82E+02	99.999253%
MFT074-101707-08	70	48	44	66	54	46	39	38	46	42	493	100.0	50.0	9.86E+02	99.999164%
MFT074-101707-09	16	31	26	31	21	24	22	26	19	25	241	100.0	50.0	4.82E+02	99.999592%
MFT071-101707-04	284										284	100.0	5.0	5.68E+03	99.995186%
MFT071-101707-05	552										552	100.0	5.0	1.10E+04	99.990644%
C+	118E+04										1.18E+06	100.0	1.0	1.18E+08	

Micro 3											MS2 2 Hour 31.8 LPM				
Filter code	raw results (larger volume plating 5mL/petri)										total	d.l.	# platings	PFU total	% Reduction
MFT074-101707-07	116										116	100.0	5.0	2.32E+03	99.998804%
MFT074-101707-08	64	52	78	56	81	52	68	48	62	78	639	100.0	50.0	1.28E+03	99.999341%
MFT074-101707-09	63	69	82	79	78	64	75	79	67	64	720	100.0	50.0	1.44E+03	99.999258%
MFT071-101707-04	127										127	100.0	1.0	1.27E+04	99.993454%
MFT071-101707-05	157										157	100.0	1.0	1.57E+04	99.991907%
C+	194E+04										1.94E+06	100.0	1.0	1.94E+08	

Micro 3											MS2 3 Hour 31.8 LPM				
Filter code	raw results (larger volume plating 5mL/petri)										total	d.l.	# platings	PFU total	% Reduction
MFT074-101707-07	98	103	80	84	78	78	78	102	111	70	882	100.0	50.0	1.76E+03	99.999329%
MFT074-101707-08	52	50	35	45	22	38	48	29	38	44	401	100.0	50.0	8.02E+02	99.999695%
MFT074-101707-09	50	33	46	40	49	31	67	23	35	23	397	100.0	50.0	7.94E+02	99.999698%
MFT071-101707-04	137										137	100.0	1.0	1.37E+04	99.994791%
MFT071-101707-05	107	70	78	62	106	98	120	82	84	114	921	100.0	10.0	9.21E+03	99.996498%
C+	2.63E+06										2630000	100.0	1.0	2.63E+08	

Environmental condition		
Time	Temperature (°C)	Relative Humidity (%)
0	30.7	47.6
15	30	20
30	30.1	20.2
45	29.7	20
60	29.8	20.9
AVG 60	29.9	20.275
75	29.2	21.3
90	29	19
105	28.7	19.1
120	28.2	27.3
AVG 120	28.8	21.7
135	28	23.1
150	27.8	21.5
165	27.6	23.7
180	28	22.8
AVG 180	27.9	22.8
AVG	29.0	23.6

Experiment No M07-0442: Biocidal air filtration membrane project:
Purpose: Testing IP2/CP2 stack (Triosynated meltblown/Triosynated HEPA composite) in environmental condition (30°C ± 3°C & 30% ± 15% RH)
Challenge: MS2 coliphage at 30ºC ± 3ºC and 30% ± 15% RH a 31.8 LPM for 3 hours of filtration
Date:2007/10/17
Environmental Condition: 30°C ± 3°C & 30% ± 15% RH

Micro 3											MS2 1 Hour 31.8 LPM				
Filter code	raw results (larger volume plating 5mL/petri)										total	d.l.	# platings	PFU total	% Reduction
MFT074-101707-10	216										216	100.0	5.0	4.32E+03	99.996847%
MFT074-101707-11	9	10	11	14	16	16	19	20	52	77	244	100.0	50.0	4.88E+02	99.999644%
MFT074-101707-12	84	81	67	63	89	82	93	81	54	70	764	100.0	50.0	1.53E+03	99.998885%
MFT071-101707-06	210	209	125	242	234						1020	100.0	5.0	2.04E+04	99.985109%
MFT071-101707-07	110	142	135	146	138						671	100.0	5.0	1.34E+04	99.990204%
C+	137E+04										1.37E+06	100.0	1.0	1.37E+08	

Micro 3											MS2 2 Hour 31.8 LPM				
Filter code	raw results (larger volume plating 5mL/petri)										total	d.l.	# platings	PFU total	% Reduction
MFT074-101707-10	0	1	2	3	3	4	4	4	5	5	31	100.0	50.0	6.20E+01	99.999721%
MFT074-101707-11	0	0	0	0	0	1	1	2	1	2	7	100.0	50.0	1.40E+01	99.999937%
MFT074-101707-12	0	0	1	1	1	2	2	2	3	3	15	100.0	50.0	3.00E+01	99.999865%
MFT071-101707-06	14	22	22	24	25	25	33	30	29	27	251	100.0	10.0	2.51E+03	99.988694%
MFT071-101707-07	20	30	32	32	32	31	35	37	37	46	332	100.0	10.0	3.32E+03	99.985045%
C+	222E+03										2.22E+05	100.0	1.0	2.22E+07	

Micro 3											MS2 3 Hour 31.8 LPM				
Filter code	raw results (larger volume plating 5mL/petri)										total	d.l.	# platings	PFU total	% Reduction
MFT074-101707-10	49	54	56	63	63	64	64	65	74	90	642	100.0	45.0	1.43E+03	99.999614%
MFT074-101707-11	4	4	5	10	13	14	15	15	18	16	114	100.0	50.0	2.28E+02	99.999938%
MFT074-101707-12	19	23	27	28	28	30	31	35	36	43	300	100.0	50.0	6.00E+02	99.999838%
MFT071-101707-06	271										271	100.0	1.0	2.71E+04	99.992676%
MFT071-101707-07	280										280	100.0	1.0	2.80E+04	99.992432%
C+	3.70E+06										3700000	100.0	1.0	3.70E+08	

Environmental condition		
Time	Temperature (°C)	Relative Humidity (%)
0	27.2	23.3
15	27.1	22.4
30	26.9	24.1
45	26.8	22.5
60	26.4	24.3
AVG 60	26.8	23.325
75	26.3	22.4
90	26	25
105	26.3	25
120	28	21.1
AVG 120	26.7	23.4
135	29.6	23.2
150	30.3	23
165		
180	30.3	25.3
AVG 180	30.1	23.8
AVG	27.6	23.5

Experiment No M07-0446: Biocidal air filtration membrane project:
Purpose: Testing IP2/CP2 stack (Triosynated meltblown/Triosynated HEPA composite) in environmental condition (5°C ± 3°C & 75% ± 15% RH)
Challenge: MS2 coliphage at 5ºC ± 3ºC and 75% ± 15% RH a 31.8 LPM for 6 hours of filtration
Date:2007/10/18
Environmental Condition: 5°C ± 3°C & 75% ± 15% RH

Micro 3														MS2 1 Hour 31.8 LPM	
Filter code	raw results (larger volume plating 5mL/petri)										total	d.l.	# platings	PFU total	% Reduction
MFT074-101807-10	195										195	100.0	5.0	3.90E+03	99.999602%
MFT074-101807-11	84	86	94	99	102	109	119	119	138	160	1110	100.0	50.0	2.22E+03	99.999773%
MFT074-101807-12	65	66	71	74	74	80	85	85	88	104	792	100.0	50.0	1.58E+03	99.999838%
MFT071-101807-01	664										664	100.0	1.0	6.64E+04	99.993224%
MFT071-101807-02	852										852	100.0	1.0	8.52E+04	99.991306%
C+	98E+05										9.80E+06	100.0	1.0	9.80E+08	

Micro 3														MS2 2 Hour 31.8 LPM	
Filter code	raw results (larger volume plating 5mL/petri)										total	d.l.	# platings	PFU total	% Reduction
MFT074-101807-10	286										286	100.0	5.0	5.72E+03	99.999485%
MFT074-101807-11	205										205	100.0	5.0	4.10E+03	99.999631%
MFT074-101807-12	260										260	100.0	5.0	5.20E+03	99.999532%
MFT071-101807-01	1456										1456	100.0	1.0	1.46E+05	99.986883%
MFT071-101807-02	1144										1144	100.0	1.0	1.14E+05	99.989694%
C+	111E+05										1.11E+07	100.0	1.0	1.11E+09	

Micro 3														MS2 3 Hour 31.8 LPM	
Filter code	raw results (larger volume plating 5mL/petri)										total	d.l.	# platings	PFU total	% Reduction
MFT074-101807-10	362										362	100.0	5.0	7.24E+03	99.999381%
MFT074-101807-11	1208										1208	100.0	5.0	2.42E+04	99.997935%
MFT074-101807-12	328										328	100.0	5.0	6.56E+03	99.999439%
MFT071-101807-01	1944										1944	100.0	1.0	1.94E+05	99.983385%
MFT071-101807-02	1024										1024	100.0	1.0	1.02E+05	99.991248%
C+	1.17E+07										11700000	100.0	1.0	1.17E+09	

Environmental condition		
Time	Temperature (°C)	Relative Humidity (%)
0	13.5	53.9
15	11.6	47.4
30	9.8	65.5
45	7.7	69.6
60	8.2	64.1
AVG 60	9.325	61.65
75	7.1	59.9
90	6.7	60.3
105	6.3	66
120	6.1	65.1
AVG 120	6.6	62.8
135	5.9	60.8
150	5.6	71
165	5.6	65.1
180	5.6	62.3
AVG 180	5.7	64.8
AVG	7.7	62.4

Experiment No M07-0447: Biocidal air filtration membrane project:
Purpose: Testing IP2/CP2 stack (Triosynated meltblown/Triosynated HEPA composite) in environmental condition (5°C ± 3°C & 75% ± 15% RH)
Challenge: MS2 coliphage at 5ºC ± 3ºC and 75% ± 15% RH a 31.8 LPM for 6 hours of filtration
Date:2007/10/18
Environmental Condition: 5°C ± 3°C & 75% ± 15% RH

Micro 3														MS2 1 Hour 31.8 LPM	
Filter code	raw results (larger volume plating 5mL/petri)										total	d.l.	# platings	PFU total	% Reduction
MFT074-101807-13	210										210	100.0	5.0	4.20E+03	99.999506%
MFT074-101807-14	376										376	100.0	5.0	7.52E+03	99.999115%
MFT074-101807-15	204										204	100.0	5.0	4.08E+03	99.999520%
MFT071-101807-03	1972										1972	100.0	1.0	1.97E+05	99.976800%
MFT071-101807-04	552										552	100.0	1.0	5.52E+04	99.993506%
C+	85E+05										8.50E+06	100.0	1.0	8.50E+08	

Micro 3														MS2 2 Hour 31.8 LPM	
Filter code	raw results (larger volume plating 5mL/petri)										total	d.l.	# platings	PFU total	% Reduction
MFT074-101807-13	332										332	100.0	5.0	6.64E+03	99.998156%
MFT074-101807-14	257										257	100.0	5.0	5.14E+03	99.998572%
MFT074-101807-15	229										229	100.0	5.0	4.58E+03	99.998728%
MFT071-101807-03	1584										1584	100.0	1.0	1.58E+05	99.956000%
MFT071-101807-04	912										912	100.0	1.0	9.12E+04	99.974667%
C+	36E+05										3.60E+06	100.0	1.0	3.60E+08	

Micro 3														MS2 3 Hour 31.8 LPM	
Filter code	raw results (larger volume plating 5mL/petri)										total	d.l.	# platings	PFU total	% Reduction
MFT074-101807-13	280										280	100.0	5.0	5.60E+03	99.999768%
MFT074-101807-14	305										305	100.0	5.0	6.10E+03	99.999747%
MFT074-101807-15	200										200	100.0	5.0	4.00E+03	99.999834%
MFT071-101807-03	3.20E+03										3200	100.0	1.0	3.20E+05	99.986722%
MFT071-101807-04	676										676	100.0	1.0	6.76E+04	99.997195%
C+	2.41E+07										24100000	100.0	1.0	2.41E+09	

Environmental condition		
Time	Temperature (°C)	Relative Humidity (%)
0	9.7	67.2
15	6.8	70.3
30	7.1	69.6
45	7.1	70.3
60		
AVG 60	7	70.06666667
75	6.2	73.7
90	6.2	69.8
105	6	72.7
120	6.7	71.5
AVG 120	6.3	71.9
135	6.7	70.1
150	6.3	67.5
165	6	66.8
180	9.9	54.3
AVG 180	7.2	64.7
AVG	7.1	68.7

Experiment No M07-0448: Biocidal air filtration membrane project:
Purpose: Testing Triosynated meltblown/Triosynated HEPA composite in presence of soil loading agent (DOP)
Challenge: MS2 coliphage at 20ºC ± 5ºC and 50% ± 15% RH a 31.8 LPM for 3 hours of filtration
Date:2007/10/18

														MS2	
														1 Hour	
Micro 2														31.8 LPM	
Filter code	raw results (larger volume plating 5mL/petri)										total	d.l.	# platings	PFU total	% Reduction
MFT074-101807-01	106	99	132	97	97	74	104	152	120	80	1061	100.0	50.0	2.12E+03	99.999333%
MFT074-101807-02	129	127	87	75	75	98	98	68	58	90	905	100.0	50.0	1.81E+03	99.999431%
MFT074-101807-03	186	176	182	183	156						883	100.0	25.0	3.53E+03	99.998889%
MFT074-101807-04	18	19	20	26	14	17	23	13	23	13	186	100.0	50.0	3.72E+02	99.999883%
MFT074-101807-05	117	127	175	132	170						721	100.0	25.0	2.88E+03	99.999093%
MFT074-101807-06	65	89	94	73	81	83	98	105	85	86	859	100.0	50.0	1.72E+03	99.999460%
MFT074-101807-07	91	71	81	84	85	102	78	65	100	122	879	100.0	50.0	1.76E+03	99.999447%
MFT074-101807-08	44	41	27	15	25	22	30	31	33	33	301	100.0	50.0	6.02E+02	99.999811%
MFT074-101807-09	48	43	39	29	34	48	35	35	57	58	426	100.0	50.0	8.52E+02	99.999732%
C+	318E+04										3.18E+06	100.0	1.0	3.18E+08	

														MS2	
														2 Hour	
Micro 2														31.8 LPM	
Filter code	raw results (larger volume plating 5mL/petri)										total	d.l.	# platings	PFU total	% Reduction
MFT074-101807-01	36	45	38	31	42	27	36	30	26	40	351	100.0	50.0	7.02E+02	99.999941%
MFT074-101807-02	245										245	100.0	5.0	4.90E+03	99.999585%
MFT074-101807-03	226										226	100.0	5.0	4.52E+03	99.999617%
MFT074-101807-04	70	42	39	54	42	41	59	48	42	32	469	100.0	50.0	9.38E+02	99.999921%
MFT074-101807-05	164										164	100.0	5.0	3.28E+03	99.999722%
MFT074-101807-06	108	90	126	100	63	100	62	88	98	94	929	100.0	50.0	1.86E+03	99.999843%
MFT074-101807-07	146										146	100.0	5.0	2.92E+03	99.999753%
MFT074-101807-08	108	74	76	82	102	66	50	82	106	84	830	100.0	50.0	1.66E+03	99.999859%
MFT074-101807-09	162										162	100.0	5.0	3.24E+03	99.999725%
C+	118E+05										1.18E+07	100.0	1.0	1.18E+09	

														MS2	
														3 Hour	
Micro 2														31.8 LPM	
Filter code	raw results (larger volume plating 5mL/petri)										total	d.l.	# platings	PFU total	% Reduction
MFT074-101807-01	134										134	100.0	5.0	2.68E+03	99.999377%
MFT074-101807-02	164										164	100.0	5.0	3.28E+03	99.999237%
MFT074-101807-03	256										256	100.0	5.0	5.12E+03	99.998809%
MFT074-101807-04	46	40	37	57	39	47	47	35	32	43	423	100.0	50.0	8.46E+02	99.999803%
MFT074-101807-05	192										192	100.0	5.0	3.84E+03	99.999107%
MFT074-101807-06	76	88	77	76	77	68	49	45	49	38	643	100.0	50.0	1.29E+03	99.999701%
MFT074-101807-07	63	82	102	82	79	95	100	94	12	98	807	100.0	50.0	1.61E+03	99.999625%
MFT074-101807-08	69	70	60	46	57	76	41	45	44	51	559	100.0	50.0	1.12E+03	99.999740%
MFT074-101807-09	89	90	82	82	104	102	58	54	92	82	835	100.0	50.0	1.67E+03	99.999612%
C+	43E+05										4.30E+06	100.0	1.0	4.30E+08	

Experiment No M07-0449: Biocidal air filtration membrane project:
Purpose: Testing Triosynated meltblown/Triosynated HEPA composite in presence of soil loading agent (DOP)
Challenge: MS2 coliphage at 20ºC ± 5ºC and 50% ± 15% RH a 31.8 LPM for 3 hours of filtration
Date:2007/10/19

Micro 2														MS2 1 Hour 31.8 LPM	
Filter code	raw results (larger volume plating 5mL/petri)										total	d.l.	# platings	PFU total	% Reduction
MFT074-101907-01	8	16	12	12	6	10	7	8	9	17	105	100.0	50.0	2.10E+02	99.999968%
MFT074-101907-02	6	15	13	17	11	11	17	14	14	10	128	100.0	50.0	2.56E+02	99.999961%
MFT074-101907-03	17	4	9	10	10	9	12	9	12	4	96	100.0	50.0	1.92E+02	99.999971%
MFT074-101907-04	26	21	30	26	26	33	21	28	31	20	262	100.0	50.0	5.24E+02	99.999921%
MFT074-101907-05	10	7	8	4	11	7	10	9	7	7	80	100.0	50.0	1.60E+02	99.999976%
MFT074-101907-06	88	104	52	80	78	86	68	92	86	84	818	100.0	50.0	1.64E+03	99.999752%
MFT074-101907-07	27	9	14	27	20	20	23	20	18	30	208	100.0	50.0	4.16E+02	99.999937%
MFT074-101907-08	23	27	31	37	32	32	28	25	18	32	285	100.0	50.0	5.70E+02	99.999914%
MFT074-101907-09	52	62	56	52	67	59	29	31	44	54	506	100.0	50.0	1.01E+03	99.999847%
C+	66E+05										6.60E+06	100.0	1.0	6.60E+08	

Micro 2														MS2 2 Hour 31.8 LPM	
Filter code	raw results (larger volume plating 5mL/petri)										total	d.l.	# platings	PFU total	% Reduction
MFT074-101907-01	14	20	26	16	18	15	12	23	11	21	176	100.0	50.0	3.52E+02	99.999957%
MFT074-101907-02	16	20	14	21	13	19	16	22	21	19	181	100.0	50.0	3.62E+02	99.999955%
MFT074-101907-03	18	20	31	16	21	18	20	29	17	18	208	100.0	50.0	4.16E+02	99.999949%
MFT074-101907-04	48	52	36	40	42	40	30	28	46	40	402	100.0	50.0	8.04E+02	99.999901%
MFT074-101907-05	16	15	8	14	20	16	9	14	13	15	140	100.0	50.0	2.80E+02	99.999965%
MFT074-101907-06										166	166	100.0	5.0	3.32E+03	99.999590%
MFT074-101907-07	17	26	22	11	17	22	18	20	22	13	188	100.0	50.0	3.76E+02	99.999954%
MFT074-101907-08	18	46	31	43	38	37	36	42	26	38	355	100.0	50.0	7.10E+02	99.999912%
MFT074-101907-09	31	62	42	64	66	59	98	60	66	60	608	100.0	50.0	1.22E+03	99.999850%
C+	81E+05										8.10E+06	100.0	1.0	8.10E+08	

Micro 2														MS2 3 Hour 31.8 LPM	
Filter code	raw results (larger volume plating 5mL/petri)										total	d.l.	# platings	PFU total	% Reduction
MFT074-101907-01	1	1	1	2	0	0	0	0	0	0	5	100.0	50.0	1.00E+01	99.999995%
MFT074-101907-02	1	4	1	1	2	2	0	2	3	3	19	100.0	50.0	3.80E+01	99.999981%
MFT074-101907-03	2	5	2	0	0	2	1	0	3	2	17	100.0	50.0	3.40E+01	99.999983%
MFT074-101907-04	5	2	3	4	5	2	0	2	3	3	29	100.0	50.0	5.80E+01	99.999971%
MFT074-101907-05	1	0	2	1	3	0	1	3	2	0	13	100.0	50.0	2.60E+01	99.999987%
MFT074-101907-06	10	9	8	10	12	7	8	9	4	6	83	100.0	50.0	1.66E+02	99.999916%
MFT074-101907-07	4	3	6	5	4	3	1	1	1	4	32	100.0	50.0	6.40E+01	99.999968%
MFT074-101907-08	2	2	2	0	0	2	3	6	0	0	17	100.0	50.0	3.40E+01	99.999983%
MFT074-101907-09	14	14	18	23	15	24	21	17	16	27	189	100.0	50.0	3.78E+02	99.999809%
C+	198E+04										1.98E+06	100.0	1.0	1.98E+08	

Experiment No M07-0450: Biocidal air filtration membrane project:
Purpose: Testing Triosynated meltblown/Triosynated HEPA composite against bacterial spores
Challenge: *Bacillus atrophaeus* spores at 20ºC ± 5ºC and 50% ± 15% RH a 31.8 LPM for 3 hours of filtration
Date:2007/10/19

Micro 2									***B atrophaeus* spores** 1 Hour 31.8 LPM	
Filter code	raw results (50mL filtration on mPCB)					total	d.l.	# platings	CFU total	% Reduction
MFT074-101907-10	0					0	100.0	50.0	<2.00E+00	>99.999886%
MFT074-101907-11	0					0	100.0	50.0	<2.00E+00	>99.999886%
MFT074-101907-12	0					0	100.0	50.0	<2.00E+00	>99.999886%
MFT074-101907-13	0					0	100.0	50.0	<2.00E+00	>99.999886%
MFT074-101907-14	0					0	100.0	50.0	<2.00E+00	>99.999886%
MFT074-101907-15	0					0	100.0	50.0	<2.00E+00	>99.999886%
MFT074-101907-16	0					0	100.0	50.0	<2.00E+00	>99.999886%
MFT074-101907-17	0					0	100.0	50.0	<2.00E+00	>99.999886%
MFT074-101907-18	0					0	100.0	50.0	<2.00E+00	>99.999886%
C+	35E+02					3.50E+03	100.0	0.2	1.75E+06	

Micro 2									***B atrophaeus* spores** 2 Hour 31.8 LPM	
Filter code	raw results (50mL filtration on mPCB)					total	d.l.	# platings	CFU total	% Reduction
MFT074-101907-10	0					0	100.0	50.0	<2.00E+00	>99.9997333%
MFT074-101907-11	0					0	100.0	50.0	<2.00E+00	>99.9997333%
MFT074-101907-12	0					0	100.0	50.0	<2.00E+00	>99.9997333%
MFT074-101907-13	0					0	100.0	50.0	<2.00E+00	>99.9997333%
MFT074-101907-14	0					0	100.0	50.0	<2.00E+00	>99.9997333%
MFT074-101907-15	0					0	100.0	50.0	<2.00E+00	>99.9997333%
MFT074-101907-16	0					0	100.0	50.0	<2.00E+00	>99.9997333%
MFT074-101907-17	0					0	100.0	50.0	<2.00E+00	>99.9997333%
MFT074-101907-18	0					0	100.0	50.0	<2.00E+00	>99.9997333%
C+	15E+02					1.50E+03	100.0	0.2	7.50E+05	

Micro 2									***B atrophaeus* spores** 3 Hour 31.8 LPM	
Filter code	raw results (50mL filtration on mPCB)					total	d.l.	# platings	CFU total	% Reduction
MFT074-101907-10	0					0	100.0	50.0	<2.00E+00	>99.9997333%
MFT074-101907-11	0					0	100.0	50.0	<2.00E+00	>99.9997333%
MFT074-101907-12	0					0	100.0	50.0	<2.00E+00	>99.9997333%
MFT074-101907-13	0					0	100.0	50.0	<2.00E+00	>99.9997333%
MFT074-101907-14	0					0	100.0	50.0	<2.00E+00	>99.9997333%
MFT074-101907-15	0					0	100.0	50.0	<2.00E+00	>99.9997333%
MFT074-101907-16	0					0	100.0	50.0	<2.00E+00	>99.9997333%
MFT074-101907-17	0					0	100.0	50.0	<2.00E+00	>99.9997333%
MFT074-101907-18	0					0	100.0	50.0	<2.00E+00	>99.9997333%
C+	15E+02					1.50E+03	100.0	0.2	7.50E+05	

Experiment No M07-0451: AATCC 100

Purpose: Comparing the antifungal efficacy of Triosynated meltblown/Triosynated HEPA composite

Challenge: *Aspergillus niger* by contact time during 0 minute and 24 hours

Date:2007/10/22

Micro 2								*Aspergillus niger*	
Filter code	Contact time	raw results			total	d.l.	vol plated	PFU total	% Reduction
MFTEXP102207-01	0 min	53E+02			5300	10.0	0.2	2.65E+05	
MFTEXP102207-02	0 min	38E+02			3800	10.0	0.2	1.90E+05	4.48E+05
MFTEXP102207-03	0 min	178E+02			17800	10.0	0.2	8.90E+05	
MFTEXP102207-04	24 hours	34E+01			340	10.0	0.2	1.70E+04	96.208178%
MFTEXP102207-05	24 hours	295			295	10.0	0.2	1.48E+04	96.710037%
MFTEXP102207-06	24 hours	73E+01			730	10.0	0.2	3.65E+04	91.858736%

Micro 2								*Aspergillus niger*	
Filter code	Contact time	raw results			total	d.l.	vol plated	PFU total	% Reduction
MFTEXP102207-07	0 min	808E+01			8080	10.0	0.2	4.04E+05	9.888476%
MFTEXP102207-08	0 min	53E+02			5300	10.0	0.2	2.65E+05	40.892193%
MFTEXP102207-09	0 min	71E+02			7100	10.0	0.2	3.55E+05	20.817844%
MFTEXP102207-10	24 hours	1			1	10.0	0.2	<5.00E+01	>99.988848%
MFTEXP102207-11	24 hours	0			0	10.0	0.2	<5.00E+01	>99.988848%
MFTEXP102207-12	24 hours	0			0	10.0	0.2	<5.00E+01	>99.988848%

Experiment No M07-0452: Biocidal air filtration membrane project:
Purpose: Testing Triosynated meltblown/Triosynated HEPA composite in presence of soil loading agent (dust 25% pressure drop)
Challenge: MS2 coliphage at 20ºC ± 5ºC and 50% ± 15% RH a 4.0 LPM for 3 hours of filtration
Date:2007/10/22

Micro 2									MS2 1 Hour 4.0 LPM (3.5 LPM sampled)	
Filter code	raw results (larger volume plating 5mL/petri)					total	d.l.	# platings	PFU total	% Reduction
MFT074-102207-01	7	8	3	2	2	22	45.7	25.0	4.02E+01	99.999902%
MFT074-102207-02	9	4	8	6	8	35	45.7	25.0	6.40E+01	99.999844%
MFT074-102207-03	2	1	0	1	0	4	45.7	25.0	7.31E+00	99.999982%
MFT074-102207-04	12	6	6	7	14	45	45.7	25.0	8.23E+01	99.999800%
MFT074-102207-05	8	12	7	6	7	40	45.7	25.0	7.31E+01	99.999822%
MFT074-102207-06	0	4	2	4	9	19	45.7	25.0	3.47E+01	99.999916%
MFT074-102207-07	5	6	1	0	3	15	45.7	25.0	2.74E+01	99.999933%
MFT074-102207-08	6	5	2	6	7	26	45.7	25.0	4.75E+01	99.999884%
MFT074-102207-09	11	12	13	7	9	52	45.7	25.0	9.51E+01	99.999769%
C+	90E+04					9.00E+05	45.7	1.0	4.11E+07	

Micro 2									MS2 2 Hour 4.0 LPM (3.5 LPM sampled)	
Filter code	raw results (larger volume plating 5mL/petri)					total	d.l.	# platings	PFU total	% Reduction
MFT074-102207-01	6	3	4	1	2	16	45.7	25.0	2.92E+01	99.999840%
MFT074-102207-02	20	18	20	16	20	94	45.7	25.0	1.72E+02	99.999060%
MFT074-102207-03	4	2	3	1	1	11	45.7	25.0	2.01E+01	99.999890%
MFT074-102207-04	7	9	5	2	10	33	45.7	25.0	6.03E+01	99.999670%
MFT074-102207-05	2	5	0	3	1	11	45.7	25.0	2.01E+01	99.999890%
MFT074-102207-06	16	15	4	11	11	57	45.7	25.0	1.04E+02	99.999430%
MFT074-102207-07	7	7	6	13	10	43	45.7	25.0	7.86E+01	99.999570%
MFT074-102207-08	31	26	10	18	21	106	45.7	25.0	1.94E+02	99.998940%
MFT074-102207-09	14	9	10	12	10	55	45.7	25.0	1.01E+02	99.999450%
C+	40E+04					4.00E+05	45.7	1.0	1.83E+07	

Micro 2									MS2 3 Hour 4.0 LPM (3.5 LPM sampled)	
Filter code	raw results (larger volume plating 5mL/petri)					total	d.l.	# platings	PFU total	% Reduction
MFT074-102207-01	13	10	17	8	8	56	45.7	25.0	1.02E+02	99.999585%
MFT074-102207-02	54	75	33	48	59	269	45.7	25.0	4.92E+02	99.998007%
MFT074-102207-03	4	11	10	3	3	31	45.7	25.0	5.67E+01	99.999770%
MFT074-102207-04	11	20	21	14	11	77	45.7	25.0	1.41E+02	99.999430%
MFT074-102207-05	6	12	13	11	5	47	45.7	25.0	8.59E+01	99.999652%
MFT074-102207-06	8	23	22	17	18	88	45.7	25.0	1.61E+02	99.999348%
MFT074-102207-07	17	25	9	18	18	87	45.7	25.0	1.59E+02	99.999356%
MFT074-102207-08	49	47	63	53	51	263	45.7	25.0	4.81E+02	99.998052%
MFT074-102207-09	23	35	34	38	29	159	45.7	25.0	2.91E+02	99.998822%
C+	540000					5.40E+05	45.7	1.0	2.47E+07	

Experiment No M07-0453: Biocidal air filtration membrane project:
Purpose: Testing Triosynated meltblown/Triosynated HEPA composite in presence of soil loading agent (dust 25% pressure drop)
Challenge: MS2 coliphage at 20ºC ± 5ºC and 50% ± 15% RH a 4.0 LPM for 3 hours of filtration
Date:2007/10/22

Micro 2

									MS2 1 Hour 4.0 LPM (3.5 LPM sampled)	
Filter code	raw results (larger volume plating 5mL/petri)					total	d.l.	# platings	PFU total	% Reduction
MFT074-102207-10	1	3	3	2	0	9	45.7	25.0	1.65E+01	99.999953%
MFT074-102207-11	4	3	8	5	6	26	45.7	25.0	4.75E+01	99.999863%
MFT074-102207-12	7	1	7	0	5	20	45.7	25.0	3.66E+01	99.999895%
MFT074-102207-13	4	3	5	5	1	18	45.7	25.0	3.29E+01	99.999905%
MFT074-102207-14	6	4	2	2	5	19	45.7	25.0	3.47E+01	99.999900%
MFT074-102207-15	4	6	11	7	4	32	45.7	25.0	5.85E+01	99.999832%
MFT074-102207-16	5	17	17	12	136	187	45.7	25.0	3.42E+02	99.999016%
MFT074-102207-17	10	18	17	18	20	83	45.7	25.0	1.52E+02	99.999563%
MFT074-102207-18	0	1	6	8	4	19	45.7	25.0	3.47E+01	99.999900%
C+	76E+04					7.60E+05	45.7	1.0	3.47E+07	

Micro 2

									MS2 2 Hour 4.0 LPM (3.5 LPM sampled)	
Filter code	raw results (larger volume plating 5mL/petri)					total	d.l.	# platings	PFU total	% Reduction
MFT074-102207-10	0	0	1	2	2	5	45.7	25.0	9.14E+00	99.999979%
MFT074-102207-11	9	7	7	3	2	28	45.7	25.0	5.12E+01	99.999882%
MFT074-102207-12	6	5	3	3	2	19	45.7	25.0	3.47E+01	99.999920%
MFT074-102207-13	5	3	2	1	1	12	45.7	25.0	2.19E+01	99.999949%
MFT074-102207-14	4	6	6	7	10	33	45.7	25.0	6.03E+01	99.999861%
MFT074-102207-15	4	4	4	4	1	17	45.7	25.0	3.11E+01	99.999928%
MFT074-102207-16	5	7	9	13	19	53	45.7	25.0	9.69E+01	99.999777%
MFT074-102207-17	9	11	13	15	16	64	45.7	25.0	1.17E+02	99.999731%
MFT074-102207-18	34	34	43	45	53	209	45.7	25.0	3.82E+02	99.999120%
C+	95E+04					9.50E+05	45.7	1.0	4.34E+07	

Micro 2

									MS2 3 Hour 4.0 LPM (3.5 LPM sampled)	
Filter code	raw results (larger volume plating 5mL/petri)					total	d.l.	# platings	PFU total	% Reduction
MFT074-102207-10	4	9	9	10	12	44	45.7	25.0	8.04E+01	99.999938%
MFT074-102207-11	21	25	20	20	19	105	45.7	25.0	1.92E+02	99.999851%
MFT074-102207-12	21	23	31	35	37	147	45.7	25.0	2.69E+02	99.999791%
MFT074-102207-13	30	28	24	20	18	120	45.7	25.0	2.19E+02	99.999830%
MFT074-102207-14	47	41	40	38	30	196	45.7	25.0	3.58E+02	99.999722%
MFT074-102207-15	16	24	26	28	28	122	45.7	25.0	2.23E+02	99.999827%
MFT074-102207-16	62	63	67	70	75	337	45.7	25.0	6.16E+02	99.999522%
MFT074-102207-17	47	56	61	64	72	300	45.7	25.0	5.48E+02	99.999574%
MFT074-102207-18	22	37	38	51	52	200	45.7	25.0	3.66E+02	99.999716%
C+	282E+04					2.82E+06	45.7	1.0	1.29E+08	

Experiment No M07-0454: AATCC 100

Purpose: Evaluating the antiviral efficacy of Triosynated meltblown/Triosynated HEPA composite

Challenge: MS2 coliphage by contact time during 0 minute, 15 minutes, 30 minutes, 60 minutes & 24 hours

Date:2007/10/23

Micro 2								MS2	
Filter code	Contact time	raw results			total	d.l.	vol plated	PFU total	% Reduction
MFTEXP-102307-01	0 min	520E+02			52000	10.0	1.0	5.20E+05	5.20E+05
MFTEXP-102307-02	0 min	63E+03			63000	10.0	1.0	6.30E+05	
MFTEXP-102307-03	0 min	41E+03			41000	10.0	1.0	4.10E+05	
MFTEXP-102307-04	15 min	2			2	10.0	1.0	2.00E+01	99.996154%
MFTEXP-102307-05	15 min	0			0	10.0	1.0	<1.00E+01	>99.998077%
MFTEXP-102307-06	15 min	0			0	10.0	1.0	<1.00E+01	>99.998077%
MFTEXP-102307-07	30 min	1			1	10.0	1.0	1.00E+01	99.998077%
MFTEXP-102307-08	30 min	1			1	10.0	1.0	1.00E+01	99.998077%
MFTEXP-102307-09	30 min	0			0	10.0	1.0	<1.00E+01	>99.998077%
MFTEXP-102307-10	60 min	0			0	10.0	1.0	<1.00E+01	>99.998077%
MFTEXP-102307-11	60 min	0			0	10.0	1.0	<1.00E+01	>99.998077%
MFTEXP-102307-12	60 min	1			1	10.0	1.0	1.00E+01	99.998077%
MFTEXP-102307-13	24 hours	0			0	10.0	1.0	<1.00E+01	>99.998077%
MFTEXP-102307-14	24 hours	0			0	10.0	1.0	<1.00E+01	>99.998077%
MFTEXP-102307-15	24 hours	0			0	10.0	1.0	<1.00E+01	>99.998077%

Micro 2								MS2	
Filter code	Contact time	raw results			total	d.l.	vol plated	PFU total	% Reduction
MFTEXP-102307-16	0 min	94E+02			9400	10.0	1.0	9.40E+04	81.923077%
MFTEXP-102307-17	0 min	157E+02			15700	10.0	1.0	1.57E+05	69.807692%
MFTEXP-102307-18	0 min	105E+02			10500	10.0	1.0	1.05E+05	79.807692%
MFTEXP-102307-19	15 min	25E+01			250	10.0	1.0	2.50E+03	99.519231%
MFTEXP-102307-20	15 min	140			140	10.0	1.0	1.40E+03	99.730769%
MFTEXP-102307-21	15 min	172			172	10.0	1.0	1.72E+03	99.669231%
MFTEXP-102307-22	30 min	26			26	10.0	1.0	2.60E+02	99.950000%
MFTEXP-102307-23	30 min	26			26	10.0	1.0	2.60E+02	99.950000%
MFTEXP-102307-24	30 min	11			11	10.0	1.0	1.10E+02	99.978846%
MFTEXP-102307-25	60 min	0			0	10.0	1.0	<1.00E+01	>99.998077%
MFTEXP-102307-26	60 min	1			1	10.0	1.0	1.00E+01	99.998077%
MFTEXP-102307-27	60 min	1			1	10.0	1.0	1.00E+01	99.998077%
MFTEXP-102307-28	24 hours	0	0	0	0	10.0	3.0	<3.33E+00	>99.999359%
MFTEXP-102307-29	24 hours	0	0	0	0	10.0	3.0	<3.33E+00	>99.999359%
MFTEXP-102307-30	24 hours	0	0	0	0	10.0	3.0	<3.33E+00	>99.999359%

Experiment No M07-0455: AATCC 100

Purpose: Evaluating the antibacterial efficacy of Triosynated meltblown/Triosynated HEPA composite

Challenge: *Staphylococcus aureus* by contact time during 0 minute, 15 minutes, 30 minutes, 60 minutes & 24 hours

Date:2007/10/23

Micro 2								*S. aureus*	
Filter code	Contact time	raw results			total	d.l.	vol plated	CFU total	% Reduction
MFTEXP-102307-31	0 min	33E+02			3300	10.0	0.2	1.65E+05	1.05E+05
MFTEXP-102307-32	0 min	488			488	10.0	0.2	2.44E+04	
MFTEXP-102307-33	0 min	251E+01			2510	10.0	0.2	1.26E+05	
MFTEXP-102307-34	15 min	41E+01			410	10.0	0.2	2.05E+04	80.469990%
MFTEXP-102307-35	15 min	32E+01			320	10.0	0.2	1.60E+04	84.757066%
MFTEXP-102307-36	15 min	46E+01			460	10.0	0.2	2.30E+04	78.088282%
MFTEXP-102307-37	30 min	121E+01			1210	10.0	0.2	6.05E+04	42.362655%
MFTEXP-102307-38	30 min	298E+01			2980	10.0	0.2	1.49E+05	0.000000%
MFTEXP-102307-39	30 min	173E+01			1730	10.0	0.2	8.65E+04	17.592887%
MFTEXP-102307-40	60 min	0			0	10.0	0.2	<5.00E+01	>99.952366%
MFTEXP-102307-41	60 min	99E+01			990	10.0	0.2	4.95E+04	52.842172%
MFTEXP-102307-42	60 min	27E+01			270	10.0	0.2	1.35E+04	87.138774%
MFTEXP-102307-43	24 hours	0			0	10.0	0.2	<5.00E+01	>99.952366%
MFTEXP-102307-44	24 hours	0			0	10.0	0.2	<5.00E+01	>99.952366%
MFTEXP-102307-45	24 hours	0			0	10.0	0.2	<5.00E+01	>99.952366%

Micro 2								*S. aureus*	
Filter code	Contact time	raw results			total	d.l.	vol plated	CFU total	% Reduction
MFTEXP-102307-46	0 min	166			166	10.0	0.2	8.30E+03	92.092728%
MFTEXP-102307-47	0 min	138E+01			1380	10.0	0.2	6.90E+04	34.264846%
MFTEXP-102307-48	0 min	113E+01			1130	10.0	0.2	5.65E+04	46.173388%
MFTEXP-102307-49	15 min	0			0	10.0	0.2	<5.00E+01	>99.952366%
MFTEXP-102307-50	15 min	2			2	10.0	0.2	1.00E+02	99.904732%
MFTEXP-102307-51	15 min	16			16	10.0	0.2	8.00E+02	99.237853%
MFTEXP-102307-52	30 min	0	0		0	10.0	0.4	<2.50E+01	>99.976183%
MFTEXP-102307-53	30 min	0	0		0	10.0	0.4	<2.50E+01	>99.976183%
MFTEXP-102307-54	30 min	0	0		0	10.0	0.4	<2.50E+01	>99.976183%
MFTEXP-102307-55	60 min	0	0		0	10.0	0.4	<2.50E+01	>99.976183%
MFTEXP-102307-56	60 min	0	0		0	10.0	0.4	<2.50E+01	>99.976183%
MFTEXP-102307-57	60 min	0	0		0	10.0	0.4	<2.50E+01	>99.976183%
MFTEXP-102307-58	24 hours	0	0	0	0	10.0	0.6	<1.67E+01	>99.984122%
MFTEXP-102307-59	24 hours	0	0	0	0	10.0	0.6	<1.67E+01	>99.984122%
MFTEXP-102307-60	24 hours	0	0	0	0	10.0	0.6	<1.67E+01	>99.984122%

Experiment No M07-0459: Biocidal air filtration membrane project:
Purpose: Testing Triosynated meltblown/Triosynated HEPA composite in presence of soil loading agent (dust 50% pressure drop)
Challenge: MS2 coliphage at 20ºC ± 5ºC and 50% ± 15% RH a 4.0 LPM for 3 hours of filtration
Date:2007/10/24

Micro 2									MS2 1 Hour 4.0 LPM (3.5 LPM sampled)	
Filter code	raw results (larger volume plating 5mL/petri)					total	d.l.	# platings	PFU total	% Reduction
MFT074-102407-01	23	24	29	32	41	149	45.7	25.0	2.72E+02	99.999736%
MFT074-102407-02	23	23	17	16	16	95	45.7	25.0	1.74E+02	99.999832%
MFT074-102407-03	11	15	16	18	32	92	45.7	25.0	1.68E+02	99.999837%
MFT074-102407-04	26	27	28	30	34	145	45.7	25.0	2.65E+02	99.999743%
MFT074-102407-05	17	15	15	13	9	69	45.7	25.0	1.26E+02	99.999878%
MFT074-102407-06	27	21	16	29	23	116	45.7	25.0	2.12E+02	99.999795%
MFT074-102407-07	47	30	40	41	41	199	45.7	25.0	3.64E+02	99.999648%
MFT074-102407-08	66	75	71	91	81	384	45.7	25.0	7.02E+02	99.999320%
MFT074-102407-09	47	73	58	56	52	286	45.7	25.0	5.23E+02	99.999494%
C+	226E+04					2.26E+06	45.7	1.0	1.03E+08	

Micro 2									MS2 2 Hour 4.0 LPM (3.5 LPM sampled)	
Filter code	raw results (larger volume plating 5mL/petri)					total	d.l.	# platings	PFU total	% Reduction
MFT074-102407-01	39	42	42	42	47	212	45.7	25.0	3.88E+02	99.999669%
MFT074-102407-02	43	44	57	64	35	243	45.7	25.0	4.44E+02	99.999620%
MFT074-102407-03	41	46	34	41	42	204	45.7	25.0	3.73E+02	99.999681%
MFT074-102407-04	45	65	56	58	54	278	45.7	25.0	5.08E+02	99.999566%
MFT074-102407-05	57	45	60	50	41	253	45.7	25.0	4.62E+02	99.999605%
MFT074-102407-06	21	25	40	40	56	182	45.7	25.0	3.33E+02	99.999716%
MFT074-102407-07	77	69	59	91	70	366	45.7	25.0	6.69E+02	99.999428%
MFT074-102407-08	72	64	82	82	60	360	45.7	25.0	6.58E+02	99.999438%
MFT074-102407-09	94	68	139	132	142	575	45.7	25.0	1.05E+03	99.999102%
C+	256E+04					2.56E+06	45.7	1.0	1.17E+08	

Micro 2									MS2 3 Hour 4.0 LPM (3.5 LPM sampled)	
Filter code	raw results (larger volume plating 5mL/petri)					total	d.l.	# platings	PFU total	% Reduction
MFT074-102407-01	50	34	47	46	48	225	45.7	25.0	4.11E+02	99.999852%
MFT074-102407-02	62	62	45	40	36	245	45.7	25.0	4.48E+02	99.999839%
MFT074-102407-03	67	86	100	102	98	453	45.7	25.0	8.28E+02	99.999703%
MFT074-102407-04	64	79	55	62	53	313	45.7	25.0	5.72E+02	99.999795%
MFT074-102407-05	60	42	37	61	64	264	45.7	25.0	4.83E+02	99.999827%
MFT074-102407-06	42	51	78	54	77	302	45.7	25.0	5.52E+02	99.999802%
MFT074-102407-07	107	106	86	79	82	460	45.7	25.0	8.41E+02	99.999698%
MFT074-102407-08	92	90	68	110	92	452	45.7	25.0	8.26E+02	99.999704%
MFT074-102407-09	136	114	164	118	77	609	45.7	25.0	1.11E+03	99.999601%
C+	6100000					6.10E+06	45.7	1.0	2.79E+08	

Experiment No M07-0460: Biocidal air filtration membrane project:
Purpose: Testing Triosynated meltblown/Triosynated HEPA composite in presence of soil loading agent (dust 50% pressure drop)
Challenge: MS2 coliphage at 20ºC ± 5ºC and 50% ± 15% RH a 4.0 LPM for 3 hours of filtration
Date:2007/10/24

Micro 2									MS2 1 Hour 4.0 LPM (3.5 LPM sampled)	
Filter code	raw results (larger volume plating 5mL/petri)					total	d.l.	# platings	PFU total	% Reduction
MFT074-102407-10	34	34	39	41		148	45.7	20.0	3.38E+02	99.999863%
MFT074-102407-11	33	19	30	31	27	140	45.7	25.0	2.56E+02	99.999896%
MFT074-102407-12	103	90	80	98	76	447	45.7	25.0	8.17E+02	99.999669%
MFT074-102407-13	103	122	94	92	108	519	45.7	25.0	9.49E+02	99.999616%
MFT074-102407-14	45	46	40	38	38	207	45.7	25.0	3.78E+02	99.999847%
MFT074-102407-15					158	158	45.7	5.0	1.44E+03	99.999415%
MFT074-102407-16	140	143	102	142	121	648	45.7	25.0	1.18E+03	99.999520%
MFT074-102407-17	52	70	100	98	82	402	45.7	25.0	7.35E+02	99.999702%
MFT074-102407-18					456	456	45.7	5.0	4.17E+03	99.998311%
C+	54E+05					5.40E+06	45.7	1.0	2.47E+08	

Micro 2									MS2 2 Hour 4.0 LPM (3.5 LPM sampled)	
Filter code	raw results (larger volume plating 5mL/petri)					total	d.l.	# platings	PFU total	% Reduction
MFT074-102407-10	66	63	58	65	68	320	45.7	25.0	5.85E+02	99.999891%
MFT074-102407-11	51	43	45	47	55	241	45.7	25.0	4.41E+02	99.999918%
MFT074-102407-12	128	121	124	127	118	618	45.7	25.0	1.13E+03	99.999789%
MFT074-102407-13					226	226	45.7	5.0	2.07E+03	99.999614%
MFT074-102407-14	92	89	80	66	100	427	45.7	25.0	7.81E+02	99.999854%
MFT074-102407-15	156					156	45.7	5.0	1.43E+03	99.999733%
MFT074-102407-16	157					157	45.7	5.0	1.43E+03	99.999732%
MFT074-102407-17	339					339	45.7	5.0	3.10E+03	99.999421%
MFT074-102407-18	680					680	45.7	5.0	6.22E+03	99.998838%
C+	117E+05					1.17E+07	45.7	1.0	5.35E+08	

Micro 2									MS2 3 Hour 4.0 LPM (3.5 LPM sampled)	
Filter code	raw results (larger volume plating 5mL/petri)					total	d.l.	# platings	PFU total	% Reduction
MFT074-102407-10	62	79	73	72	87	373	45.7	25.0	6.82E+02	99.999854%
MFT074-102407-11	28	28	37	28	39	160	45.7	25.0	2.92E+02	99.999937%
MFT074-102407-12	144					144	45.7	5.0	1.32E+03	99.999718%
MFT074-102407-13	233					233	45.7	5.0	2.13E+03	99.999543%
MFT074-102407-14	89	107	104	99	97	496	45.7	25.0	9.07E+02	99.999805%
MFT074-102407-15	191					191	45.7	5.0	1.75E+03	99.999625%
MFT074-102407-16	300					300	45.7	5.0	2.74E+03	99.999412%
MFT074-102407-17	218					218	45.7	5.0	1.99E+03	99.999573%
MFT074-102407-18	1004					1004	45.7	5.0	9.18E+03	99.998031%
C+	102E+05					1.02E+07	45.7	1.0	4.66E+08	

Experiment No M07-0462: Biocidal air filtration membrane project:
Purpose: Testing Triosynated meltblown/Triosynated HEPA composite in presence of soil loading agent (dust 75% pressure drop)
Challenge: MS2 coliphage at 20ºC ± 5ºC and 50% ± 15% RH a 4.0 LPM for 3 hours of filtration
Date:2007/10/25

Micro 2									MS2 1 Hour 4.0 LPM (3.5 LPM sampled)	
Filter code	raw results (larger volume plating 5mL/petri)					total	d.l.	# platings	PFU total	% Reduction
MFT074-102507-01	9	10	15	16	23	73	45.7	25.0	1.33E+02	99.999828%
MFT074-102507-02	14	14	9	4	6	47	45.7	25.0	8.59E+01	99.999889%
MFT074-102507-03	79	70	66	62	68	345	45.7	25.0	6.31E+02	99.999188%
MFT074-102507-04	57	65	74	70	72	338	45.7	25.0	6.18E+02	99.999205%
MFT074-102507-05	8	13	7	11	5	44	45.7	25.0	8.04E+01	99.999896%
MFT074-102507-06	80	74	54	57	74	339	45.7	25.0	6.20E+02	99.999202%
MFT074-102507-07	103	106	136	126	118	589	45.7	25.0	1.08E+03	99.998614%
MFT074-102507-08	58	67	63	63	67	318	45.7	25.0	5.81E+02	99.999252%
MFT074-102507-09	37	33	32	34	27	163	45.7	25.0	2.98E+02	99.999616%
C+	170E+04					1.70E+06	45.7	1.0	7.77E+07	

Micro 2									MS2 2 Hour 4.0 LPM (3.5 LPM sampled)	
Filter code	raw results (larger volume plating 5mL/petri)					total	d.l.	# platings	PFU total	% Reduction
MFT074-102507-01	32	25	25	27	16	125	45.7	25.0	2.29E+02	99.999792%
MFT074-102507-02	16	17	22	21	20	96	45.7	25.0	1.75E+02	99.999840%
MFT074-102507-03	46	61	71	73	53	304	45.7	25.0	5.56E+02	99.999493%
MFT074-102507-04	68	80	810	84	88	1130	45.7	25.0	2.07E+03	99.998117%
MFT074-102507-05	23	22	16	32	19	112	45.7	25.0	2.05E+02	99.999813%
MFT074-102507-06	68	86	88	86	73	401	45.7	25.0	7.33E+02	99.999332%
MFT074-102507-07	210					210	45.7	5.0	1.92E+03	99.998250%
MFT074-102507-08	82	104	124	76	68	454	45.7	25.0	8.30E+02	99.999243%
MFT074-102507-09	41	31	31	38	45	186	45.7	25.0	3.40E+02	99.999690%
C+	240E+04					2.40E+06	45.7	1.0	1.10E+08	

Micro 2									MS2 3 Hour 4.0 LPM (3.5 LPM sampled)	
Filter code	raw results (larger volume plating 5mL/petri)					total	d.l.	# platings	PFU total	% Reduction
MFT074-102507-01	34	17	14	20	16	101	45.7	25.0	1.85E+02	99.999921%
MFT074-102507-02	15	10	10	18	12	65	45.7	25.0	1.19E+02	99.999949%
MFT074-102507-03	132	135	110	97	112	586	45.7	25.0	1.07E+03	99.999540%
MFT074-102507-04	85	115	122	109	118	549	45.7	25.0	1.00E+03	99.999569%
MFT074-102507-05	20	14	13	13	12	72	45.7	25.0	1.32E+02	99.999944%
MFT074-102507-06	177					177	45.7	5.0	1.62E+03	99.999306%
MFT074-102507-07	170					170	45.7	5.0	1.55E+03	99.999333%
MFT074-102507-08	70	84	116	111	79	460	45.7	25.0	8.41E+02	99.999639%
MFT074-102507-09	11	28	24	25	28	116	45.7	25.0	2.12E+02	99.999909%
C+	5100000					5.10E+06	45.7	1.0	2.33E+08	

Experiment No M07-0463: Biocidal air filtration membrane project:
Purpose: Testing Triosynated meltblown/Triosynated HEPA composite in presence of soil loading agent (dust 75% pressure drop)
Challenge: MS2 coliphage at 20ºC ± 5ºC and 50% ± 15% RH a 4.0 LPM for 3 hours of filtration
Date:2007/10/25

Micro 2

									MS2 1 Hour 4.0 LPM (3.5 LPM sampled)	
Filter code	raw results (larger volume plating 5mL/petri)					total	d.l.	# platings	PFU total	% Reduction
MFT074-102507-10	4	14	7	8	10	43	45.7	20.0	9.83E+01	99.999951%
MFT074-102507-11	32	24	23	38	43	160	45.7	25.0	2.92E+02	99.999855%
MFT074-102507-12	32	14	15	29	27	117	45.7	25.0	2.14E+02	99.999894%
MFT074-102507-13	55	68	61	52	57	293	45.7	25.0	5.36E+02	99.999734%
MFT074-102507-14	24	37	36	34		131	45.7	20.0	2.99E+02	99.999851%
MFT074-102507-15	14	19	15	18	23	89	45.7	5.0	8.13E+02	99.999595%
MFT074-102507-16	154	132	116	154	96	652	45.7	25.0	1.19E+03	99.999407%
MFT074-102507-17	158	170	111	100	186	725	45.7	25.0	1.33E+03	99.999341%
MFT074-102507-18	44	88	88	60	50	330	45.7	5.0	3.02E+03	99.998500%
C+	44E+05					4.40E+06	45.7	1.0	2.01E+08	

Micro 2

									MS2 2 Hour 4.0 LPM (3.5 LPM sampled)	
Filter code	raw results (larger volume plating 5mL/petri)					total	d.l.	# platings	PFU total	% Reduction
MFT074-102507-10	17	20	20	21	22	100	45.7	25.0	1.83E+02	99.999956%
MFT074-102507-11	49	49	45	44	41	228	45.7	25.0	4.17E+02	99.999900%
MFT074-102507-12	66	55	55	44	50	270	45.7	25.0	4.94E+02	99.999881%
MFT074-102507-13	31	31	34	34	30	160	45.7	25.0	2.92E+02	99.999930%
MFT074-102507-14	58	58	55	50	38	259	45.7	25.0	4.73E+02	99.999886%
MFT074-102507-15	38	45	46	48	53	230	45.7	25.0	4.20E+02	99.999899%
MFT074-102507-16	179					179	45.7	5.0	1.64E+03	99.999607%
MFT074-102507-17	193					193	45.7	5.0	1.76E+03	99.999576%
MFT074-102507-18	119	110	110	109	95	543	45.7	25.0	9.93E+02	99.999761%
C+	91E+05					9.10E+06	45.7	1.0	4.16E+08	

Micro 2

									MS2 3 Hour 4.0 LPM (3.5 LPM sampled)	
Filter code	raw results (larger volume plating 5mL/petri)					total	d.l.	# platings	PFU total	% Reduction
MFT074-102507-10	25	28	29	35	36	153	45.7	25.0	2.80E+02	99.999907%
MFT074-102507-11	70	72	72	74	80	368	45.7	25.0	6.73E+02	99.999777%
MFT074-102507-12	46	54	56	57	57	270	45.7	25.0	4.94E+02	99.999836%
MFT074-102507-13	97	105	107	175	148	632	45.7	25.0	1.16E+03	99.999617%
MFT074-102507-14	57	70	71	75	90	363	45.7	25.0	6.64E+02	99.999780%
MFT074-102507-15	38	39	43	53	60	233	45.7	25.0	4.26E+02	99.999859%
MFT074-102507-16	164					164	45.7	5.0	1.50E+03	99.999503%
MFT074-102507-17	286					286	45.7	5.0	2.61E+03	99.999133%
MFT074-102507-18	56	63	68	74	99	360	45.7	25.0	6.58E+02	99.999782%
C+	66E+05					6.60E+06	45.7	1.0	3.02E+08	

Experiment No M07-0464: AATCC 100

Purpose: Comparing the antifungal efficacy of Triosynated meltblown/Triosynated HEPA composite

Challenge: *Aspergillus niger* by contact time during 0 minute and 24 hours

Date:2007/10/25

Micro 2								*Aspergillus niger*	
Filter code	Contact time	raw results			total	d.l.	vol plated	PFU total	% Reduction
MFTEXP-102507-01	0 min	47E+02			4700	10.0	0.2	2.35E+05	2.12E+05
MFTEXP-102507-02	0 min	36E+02			3600	10.0	0.2	1.80E+05	
MFTEXP-102507-03	0 min	44E+02			4400	10.0	0.2	2.20E+05	
MFTEXP-102507-04	24 hours	50E+02			5000	10.0	0.2	2.50E+05	0.000000%
MFTEXP-102507-05	24 hours	189E+01			1890	10.0	0.2	9.45E+04	55.354331%
MFTEXP-102507-06	24 hours	286			286	10.0	0.2	1.43E+04	93.244094%

Micro 2								*Aspergillus niger*	
Filter code	Contact time	raw results			total	d.l.	vol plated	PFU total	% Reduction
MFTEXP-102507-07	0 min	53E+02			5300	10.0	0.2	2.65E+05	0.000000%
MFTEXP-102507-08	0 min	74E+02			7400	10.0	0.2	3.70E+05	0.000000%
MFTEXP-102507-09	0 min	31E+02			3100	10.0	0.2	1.55E+05	26.771654%
MFTEXP-102507-10	24 hours	0			0	10.0	0.2	<5.00E+01	>99.976378%
MFTEXP-102507-11	24 hours	0			0	10.0	0.2	<5.00E+01	>99.976378%
MFTEXP-102507-12	24 hours	0			0	10.0	0.2	<5.00E+01	>99.976378%

Experiment No M07-0465: AATCC 100

Purpose: Evaluating the antibacterial efficacy of Triosynated meltblown/Triosynated HEPA composite
Challenge: *Staphylococcus aureus* by contact time during 0 minute, 15 minutes, 30 minutes, 60 minutes & 24 hours
Date:2007/10/25

Micro 2								*S. aureus*	
Filter code	Contact time	raw results			total	d.l.	vol plated	CFU total	% Reduction
MFTEXP-102507-13	0 min	3888E+01			38880	10.0	0.2	1.94E+06	1.24E+06
MFTEXP-102507-14	0 min	112E+02			11200	10.0	0.2	5.60E+05	
MFTEXP-102507-15	0 min	245E+02			24500	10.0	0.2	1.23E+06	
MFTEXP-102507-16	15 min	61E+02			6100	10.0	0.2	3.05E+05	75.462591%
MFTEXP-102507-17	15 min	24E+02			2400	10.0	0.2	1.20E+05	90.345937%
MFTEXP-102507-18	15 min	73E+02			7300	10.0	0.2	3.65E+05	70.635559%
MFTEXP-102507-19	30 min	140E+02			14000	10.0	0.2	7.00E+05	43.684634%
MFTEXP-102507-20	30 min	1288E+01			12880	10.0	0.2	6.44E+05	48.189863%
MFTEXP-102507-21	30 min	24E+02			2400	10.0	0.2	1.20E+05	90.345937%
MFTEXP-102507-22	60 min	30E+02			3000	10.0	0.2	1.50E+05	87.932422%
MFTEXP-102507-23	60 min	28E+02			2800	10.0	0.2	1.40E+05	88.736927%
MFTEXP-102507-24	60 min	359E+01	0		3590	10.0	0.2	1.80E+05	85.559131%
MFTEXP-102507-25	24 hours	0	0		0	10.0	0.4	<2.50E+01	>99.997989%
MFTEXP-102507-26	24 hours	0	0		0	10.0	0.4	<2.50E+01	>99.997989%
MFTEXP-102507-27	24 hours	0	0		0	10.0	0.4	<2.50E+01	>99.997989%

Micro 2								*S. aureus*	
Filter code	Contact time	raw results			total	d.l.	vol plated	CFU total	% Reduction
MFTEXP-102507-28	0 min	91E+02			9100	10.0	0.2	4.55E+05	63.395012%
MFTEXP-102507-29	0 min	135E+02			13500	10.0	0.2	6.75E+05	45.695897%
MFTEXP-102507-30	0 min	36E+02			3600	10.0	0.2	1.80E+05	85.518906%
MFTEXP-102507-31	15 min	49	128		177	10.0	0.4	4.43E+03	99.644006%
MFTEXP-102507-32	15 min	9	5		14	10.0	0.4	3.50E+02	99.971842%
MFTEXP-102507-33	15 min	27E+01			270	10.0	0.2	1.35E+04	98.913918%
MFTEXP-102507-34	30 min	2	1	1	4	10.0	0.6	6.67E+01	99.994637%
MFTEXP-102507-35	30 min	0	1	2	3	10.0	0.6	5.00E+01	99.995977%
MFTEXP-102507-36	30 min	0	0	0	0	10.0	0.6	<1.67E+01	>99.998659%
MFTEXP-102507-37	60 min	0	0	0	0	10.0	0.6	<1.67E+01	>99.998659%
MFTEXP-102507-38	60 min	0	0	0	0	10.0	0.6	<1.67E+01	>99.998659%
MFTEXP-102507-39	60 min	0	0	0	0	10.0	0.6	<1.67E+01	>99.998659%
MFTEXP-102507-40	24 hours	0	0	0	0	10.0	0.6	<1.67E+01	>99.998659%
MFTEXP-102507-41	24 hours	0	0	0	0	10.0	0.6	<1.67E+01	>99.998659%
MFTEXP-102507-42	24 hours	0	0	0	0	10.0	0.6	<1.67E+01	>99.998659%

Experiment No M07-0466: Biocidal air filtration membrane project:
Purpose: Testing Triosynated meltblown/Triosynated HEPA composite in presence of soil loading agent (dust 100% pressure drop)
Challenge: MS2 coliphage at 20ºC ± 5ºC and 50% ± 15% RH a 4.0 LPM for 3 hours of filtration
Date:2007/10/26

Micro 2									MS2 1 Hour 4.0 LPM (3.5 LPM sampled)	
Filter code	raw results (larger volume plating 5mL/petri)					total	d.l.	# platings	PFU total	% Reduction
MFT074-102607-04	18	22	24	25	28	117	45.7	25.0	2.14E+02	99.999820%
MFT074-102607-05	33	28	24	19	22	126	45.7	25.0	2.30E+02	99.999806%
MFT074-102607-06	124	124	126	139	174	687	45.7	25.0	1.26E+03	99.998943%
MFT074-102607-07	36	36	32	28	27	159	45.7	25.0	2.91E+02	99.999755%
MFT074-102607-08	46	58				104	45.7	10.0	4.75E+02	99.999600%
MFT074-102607-09		5	14	13	13	45	45.7	20.0	1.03E+02	99.999913%
MFT074-102607-10	11	18	20	29	21	99	45.7	25.0	1.81E+02	99.999848%
MFT074-102607-11	43	30	26	25	24	148	45.7	25.0	2.71E+02	99.999772%
MFT074-102607-12	22	34	46	35	35	172	45.7	25.0	3.14E+02	99.999735%
C+	26E+05					2.60E+06	45.7	1.0	1.19E+08	

Micro 2									MS2 2 Hour 4.0 LPM (3.5 LPM sampled)	
Filter code	raw results (larger volume plating 5mL/petri)					total	d.l.	# platings	PFU total	% Reduction
MFT074-102607-04	19	20	24	30	35	128	45.7	25.0	2.34E+02	99.999817%
MFT074-102607-05	31	27	23	23	23	127	45.7	25.0	2.32E+02	99.999819%
MFT074-102607-06	79	93	106	110	125	513	45.7	25.0	9.38E+02	99.999267%
MFT074-102607-07	42	26	23	21	8	120	45.7	25.0	2.19E+02	99.999829%
MFT074-102607-08	41	34	33	32	29	169	45.7	25.0	3.09E+02	99.999759%
MFT074-102607-09	13	11	12	7	7	50	45.7	25.0	9.14E+01	99.999929%
MFT074-102607-10	16	21	30	18	18	103	45.7	25.0	1.88E+02	99.999853%
MFT074-102607-11	44	42	39	35	31	191	45.7	25.0	3.49E+02	99.999727%
MFT074-102607-12	18	22	28	32	40	140	45.7	25.0	2.56E+02	99.999800%
C+	28E+05					2.80E+06	45.7	1.0	1.28E+08	

Micro 2									MS2 3 Hour 4.0 LPM (3.5 LPM sampled)	
Filter code	raw results (larger volume plating 5mL/petri)					total	d.l.	# platings	PFU total	% Reduction
MFT074-102607-04	4	5	6	7	12	34	45.7	25.0	6.22E+01	99.999313%
MFT074-102607-05	9	11	11	12	12	55	45.7	25.0	1.01E+02	99.998889%
MFT074-102607-06	9	13	14	15	16	67	45.7	25.0	1.22E+02	99.998646%
MFT074-102607-07	33	28	25	24	24	134	45.7	25.0	2.45E+02	99.997293%
MFT074-102607-08	8	10	11	14	20	63	45.7	25.0	1.15E+02	99.998727%
MFT074-102607-09	5	5	10	2	1	23	45.7	25.0	4.20E+01	99.999535%
MFT074-102607-10	18	18	11	9	6	62	45.7	25.0	1.13E+02	99.998747%
MFT074-102607-11	16	13	11	10	5	55	45.7	25.0	1.01E+02	99.998889%
MFT074-102607-12	8	9	10	12	12	51	45.7	25.0	9.32E+01	99.998970%
C+	198000					1.98E+05	45.7	1.0	9.05E+06	

Experiment No M07-0466: Biocidal air filtration membrane project:
Purpose: Testing Triosynated meltblown/Triosynated HEPA composite in presence of soil loading agent (dust 100% pressure drop)
Challenge: MS2 coliphage at 20ºC ± 5ºC and 50% ± 15% RH a 4.0 LPM for 3 hours of filtration
Date:2007/10/26

Micro 2									MS2 1 Hour 4.0 LPM (3.5 LPM sampled)	
Filter code	raw results (larger volume plating 5mL/petri)					total	d.l.	# platings	PFU total	% Reduction
MFT074-102607-13	15	21	41	27	27	131	45.7	25.0	2.39E+02	99.999813%
MFT074-102607-14	7	8	11	12	16	54	45.7	25.0	9.87E+01	99.999923%
MFT074-102607-15	17	23	28	25	25	118	45.7	25.0	2.16E+02	99.999831%
MFT074-102607-16	19	19	22	13	10	83	45.7	25.0	1.52E+02	99.999881%
MFT074-102607-17	76	106	108	114	132	536	45.7	25.0	9.80E+02	99.999234%
MFT074-102607-18	51	44	42	40	34	211	45.7	25.0	3.86E+02	99.999699%
MFT074-102607-19	49	70	74	84	85	362	45.7	25.0	6.62E+02	99.999483%
MFT074-102607-20	46	45	42	40	38	211	45.7	25.0	3.86E+02	99.999699%
MFT074-102607-21	194					194	45.7	5.0	1.77E+03	99.998614%
C+	28E+05					2.80E+06	45.7	1.0	1.28E+08	

Micro 2									MS2 2 Hour 4.0 LPM (3.5 LPM sampled)	
Filter code	raw results (larger volume plating 5mL/petri)					total	d.l.	# platings	PFU total	% Reduction
MFT074-102607-13	78	84	102	96	96	456	45.7	25.0	8.34E+02	99.999747%
MFT074-102607-14	54	58	60	72	80	324	45.7	25.0	5.92E+02	99.999820%
MFT074-102607-15	96	106	112	128	128	570	45.7	25.0	1.04E+03	99.999683%
MFT074-102607-16	392					392	45.7	5.0	3.58E+03	99.998911%
MFT074-102607-17	29	29	35	36	40	169	45.7	25.0	3.09E+02	99.999906%
MFT074-102607-18	320					320	45.7	5.0	2.92E+03	99.999111%
MFT074-102607-19	140	124	96	100	100	560	45.7	25.0	1.02E+03	99.999689%
MFT074-102607-20	80	112	124	100	100	516	45.7	25.0	9.43E+02	99.999713%
MFT074-102607-21	312					312	45.7	5.0	2.85E+03	99.999133%
C+	72E+05					7.20E+06	45.7	1.0	3.29E+08	

Micro 2									MS2 3 Hour 4.0 LPM (3.5 LPM sampled)	
Filter code	raw results (larger volume plating 5mL/petri)					total	d.l.	# platings	PFU total	% Reduction
MFT074-102607-13	92	92	104	112	152	552	45.7	25.0	1.01E+03	99.999883%
MFT074-102607-14	42	42	50	37	17	188	45.7	25.0	3.44E+02	99.999960%
MFT074-102607-15	164					164	45.7	5.0	1.50E+03	99.999826%
MFT074-102607-16	40	42	47	50	54	233	45.7	25.0	4.26E+02	99.999950%
MFT074-102607-17	360					360	45.7	5.0	3.29E+03	99.999617%
MFT074-102607-18	78	92	72	64	90	396	45.7	25.0	7.24E+02	99.999916%
MFT074-102607-19	604					604	45.7	5.0	5.52E+03	99.999357%
MFT074-102607-20	112	114	126	142	148	642	45.7	25.0	1.17E+03	99.999863%
MFT074-102607-21	600					600	45.7	5.0	5.48E+03	99.999362%
C+	188E+05					1.88E+07	45.7	1.0	8.59E+08	

Experiment No M07-0468: Biocidal air filtration membrane project:
Purpose: Testing IP2/CP2 stack (Triosynated meltblown/Triosynated HEPA composite) in environmental condition (20°C ± 3°C & 50% ± 15% RH)
Challenge: MS2 coliphage at 20ºC ± 3ºC and 50% ± 15% RH a 31.8 LPM for 6 hours of filtration
Date:2007/10/26
Environmental Condition: 20°C ± 3°C & 50% ± 15% RH

Micro 3														MS2 1 Hour 31.8 LPM	
Filter code	raw results (larger volume plating 5mL/petri)										total	d.l.	# platings	PFU total	% Reduction
MFT074-102607-22	61	61	35	38	39	46	47	50	59	67	503	100.0	50.0	1.01E+03	99.999876%
MFT074-102607-23	34	36	40	41	47	68	66	56	49	48	485	100.0	50.0	9.70E+02	99.999880%
MFT074-102607-24	11	11	2	4	6	8	12	14	19	21	108	100.0	50.0	2.16E+02	99.999973%
MFT071-102607-04	48										48	100.0	1.0	4.80E+03	99.999407%
MFT071-102607-05	440										440	100.0	1.0	4.40E+04	99.994568%
C+	81E+05										8.10E+06	100.0	1.0	8.10E+08	

Micro 3														MS2 2 Hour 31.8 LPM	
Filter code	raw results (larger volume plating 5mL/petri)										total	d.l.	# platings	PFU total	% Reduction
MFT074-102607-22	39	40	44	47	50	51	56	59	62	96	544	100.0	50.0	1.09E+03	99.999758%
MFT074-102607-23	47	70	66	84	58	58	58	76	76	76	669	100.0	50.0	1.34E+03	99.999703%
MFT074-102607-24	12	12	12	10	10	9	11	14	16	30	136	100.0	50.0	2.72E+02	99.999940%
MFT071-102607-04	456										456	100.0	1.0	4.56E+04	99.989867%
MFT071-102607-05	584										584	100.0	1.0	5.84E+04	99.987022%
C+	45E+05										4.50E+06	100.0	1.0	4.50E+08	

Micro 3														MS2 3 Hour 31.8 LPM	
Filter code	raw results (larger volume plating 5mL/petri)										total	d.l.	# platings	PFU total	% Reduction
MFT074-102607-22	148	108	116	128	136	140	144	156	160	164	1400	100.0	50.0	2.80E+03	99.999548%
MFT074-102607-23	58	86	90	70	69	72	80	88	94	98	805	100.0	50.0	1.61E+03	99.999740%
MFT074-102607-24	17	20	21	23	23	22	25	26	30	33	240	100.0	50.0	4.80E+02	99.999923%
MFT071-102607-04	696										696	100.0	1.0	6.96E+04	99.988774%
MFT071-102607-05	616										616	100.0	1.0	6.16E+04	99.990065%
C+	6.20E+06										6200000	100.0	1.0	6.20E+08	

Environmental condition		
Time	Temperature (°C)	Relative Humidity (%)
0	23.5	94.3
15	20.6	44
30	20.5	40
45	20.4	38.1
60	21	50.1
AVG 60	20.625	43.05
75	19.1	50.2
90	18.8	44.7
105	20.1	51.9
120	20.3	55.5
AVG 120	19.6	50.6
135	18.5	57.8
150	19.1	56.6
165	20.5	40.3
180	20.9	50.7
AVG 180	19.8	51.4
AVG	20.3	51.9

Experiment No. V07-0032 AFRL-General Research
Purpose: Task B: Testing Triosynated meltblown/Triosynated HEPA composite against animal virus model
Challenge: Undiluted, purified influenza A/PR/8/34 prep at 20ºC ± 5ºC and 50% ± 15% RH at 4.0 LPM for 3 hours filtration
Date:2007/10/26

Micro 1												INFLUENZA A PR8 1 hour 4.0 LPM	
Filter code	raw results						Total	vol. imp.	vol. pla.	replicats	d.l.	PFU total	% reduction
MFT074-102607-01	0	0	0	0	0	0	0	40	0.3	6.0	22.2	<2.22E+01	>99.987179%
MFT074-102607-02	0	0	0	0	0	0	0	40	0.3	6.0	22.2	<2.22E+01	>99.987179%
MFT074-102607-03	0	0	0	0	0	0	0	40	0.3	6.0	22.2	<2.22E+01	>99.987179%
MFT071-102607-01	0	0	0	0	0	0	0	40	0.3	6.0	22.2	<2.22E+01	>99.987179%
MFT071-102607-02	0	0	0	0	0	0	0	40	0.3	6.0	22.2	<2.22E+01	>99.987179%
MFT071-102607-03	0	0	0	0	0	0	0	40	0.3	6.0	22.2	<2.22E+01	>99.987179%
C+	13E2	13E2					2600	40	0.3	2.0	66.7	1.73E+05	

Micro 1												INFLUENZA A PR8 2 hour 4.0 LPM	
Filter code	raw results						Total	vol. imp.	vol. pla.	replicats	d.l.	PFU total	% reduction
MFT074-102607-01	0	0	0	0	0	0	0	40	0.3	6.0	22.2	<2.22E+01	>99.996970%
MFT074-102607-02	0	0	0	0	0	0	0	40	0.3	6.0	22.2	<2.22E+01	>99.996970%
MFT074-102607-03	0	0	0	0	0	0	0	40	0.3	6.0	22.2	<2.22E+01	>99.996970%
MFT071-102607-01	0	0	0	0	0	0	0	40	0.3	6.0	22.2	<2.22E+01	>99.996970%
MFT071-102607-02	0	0	0	0	0	0	0	40	0.3	6.0	22.2	<2.22E+01	>99.996970%
MFT071-102607-03	0	0	0	0	0	0	0	40	0.3	6.0	22.2	<2.22E+01	>99.996970%
C+	50E2	6E3					11000	40	0.3	2.0	66.7	7.33E+05	

Micro 1												INFLUENZA A PR8 3 hour 4.0 LPM	
Filter code	raw results						Total	vol. imp.	vol. pla.	replicats	d.l.	PFU total	% reduction
MFT074-102607-01	0	0	0	0	0	0	0	40	0.3	6.0	22.2	<2.22E+01	>99.998667%
MFT074-102607-02	0	0	0	0	0	0	0	40	0.3	6.0	22.2	<2.22E+01	>99.998667%
MFT074-102607-03	0	0	0	0	0	0	0	40	0.3	6.0	22.2	<2.22E+01	>99.998667%
MFT071-102607-01	0	0	0	0	0	0	0	40	0.3	6.0	22.2	<2.22E+01	>99.998667%
MFT071-102607-02	0	0	0	0	0	0	0	40	0.3	6.0	22.2	<2.22E+01	>99.998667%
MFT071-102607-03	0	0	0	0	0	0	0	40	0.3	6.0	22.2	<2.22E+01	>99.998667%
C+	13E3	12E3					25000	40	0.3	2.0	66.7	1.67E+06	

Experiment No M07-0470: Biocidal air filtration membrane project:
Purpose: Testing Triosynated meltblown/Triosynated HEPA composite in presence of soil loading agent (smoke)
Challenge: MS2 coliphage at 20ºC ± 5ºC and 50% ± 15% RH a 4.0 LPM for 3 hours of filtration
Date:2007/10/29

Micro 2									MS2 1 Hour 4.0 LPM (3.5 LPM sampled)	
Filter code	raw results (larger volume plating 5mL/petri)					total	d.l.	# platings	PFU total	% Reduction
MFT074-102907-01	100	106	106	139	70	521	45.7	25.0	9.52E+02	99.997977%
MFT074-102907-02					202	202	45.7	5.0	1.85E+03	99.996078%
MFT074-102907-03	200	144	160	142	184	830	45.7	25.0	1.52E+03	99.996777%
MFT074-102907-04	102	176	93			371	45.7	3.0	5.65E+03	99.987994%
MFT074-102907-05	40	53	39			132	45.7	3.0	2.01E+03	99.995728%
MFT074-102907-06	252					252	45.7	5.0	2.30E+03	99.995107%
MFT074-102907-07	236					236	45.7	5.0	2.16E+03	99.995417%
MFT074-102907-08	472					472	45.7	5.0	4.31E+03	99.990835%
MFT074-102907-09	136	132	184	288	260	1000	45.7	25.0	1.83E+03	99.996117%
C+	103E+04					1.03E+06	45.7	1.0	4.71E+07	

Micro 2									MS2 2 Hour 4.0 LPM (3.5 LPM sampled)	
Filter code	raw results (larger volume plating 5mL/petri)					total	d.l.	# platings	PFU total	% Reduction
MFT074-102907-01	108	152	172	144	148	724	45.7	25.0	1.32E+03	99.998890%
MFT074-102907-02					258	258	45.7	5.0	2.36E+03	99.998023%
MFT074-102907-03					204	204	45.7	5.0	1.86E+03	99.998437%
MFT074-102907-04					352	352	45.7	5.0	3.22E+03	99.997303%
MFT074-102907-05	53	43	58	57	45	256	45.7	25.0	4.68E+02	99.999608%
MFT074-102907-06	172					172	45.7	5.0	1.57E+03	99.998682%
MFT074-102907-07	174					174	45.7	5.0	1.59E+03	99.998667%
MFT074-102907-08	320					320	45.7	5.0	2.92E+03	99.997548%
MFT074-102907-09	250					250	45.7	5.0	2.29E+03	99.998084%
C+	261E+04					2.61E+06	45.7	1.0	1.19E+08	

Micro 2									MS2 3 Hour 4.0 LPM (3.5 LPM sampled)	
Filter code	raw results (larger volume plating 5mL/petri)					total	d.l.	# platings	PFU total	% Reduction
MFT074-102907-01	118	128	110	122	100	578	45.7	25.0	1.06E+03	99.997459%
MFT074-102907-02					284	284	45.7	5.0	2.60E+03	99.993758%
MFT074-102907-03	92	80	102	98	85	457	45.7	25.0	8.35E+02	99.997991%
MFT074-102907-04	contam					contam	45.7	1.0	#VALUE!	#VALUE!
MFT074-102907-05	252					252	45.7	5.0	2.30E+03	99.994462%
MFT074-102907-06	250					250	45.7	5.0	2.29E+03	99.994505%
MFT074-102907-07	87	88	104	126	100	505	45.7	25.0	9.23E+02	99.997780%
MFT074-102907-08					308	308	45.7	5.0	2.82E+03	99.993231%
MFT074-102907-09					177	177	45.7	5.0	1.62E+03	99.996110%
C+	910000					9.10E+05	45.7	1.0	4.16E+07	

Experiment No M07-0471: Biocidal air filtration membrane project:
Purpose: Testing Triosynated meltblown/Triosynated HEPA composite in presence of soil loading agent (smoke)
Challenge: MS2 coliphage at 20ºC ± 5ºC and 50% ± 15% RH a 4.0 LPM for 3 hours of filtration
Date:2007/10/29

Micro 2									MS2 1 Hour 4.0 LPM (3.5 LPM sampled)	
Filter code	raw results (larger volume plating 5mL/petri)					total	d.l.	# platings	PFU total	% Reduction
MFT074-102907-10	90	104	117	118	130	559	45.7	25.0	1.02E+03	99.996612%
MFT074-102907-11	81	104	91	77	51	404	45.7	25.0	7.39E+02	99.997552%
MFT074-102907-12	304					304	45.7	5.0	2.78E+03	99.990788%
MFT074-102907-13	212					212	45.7	5.0	1.94E+03	99.993576%
MFT074-102907-14	478					478	45.7	5.0	4.37E+03	99.985515%
MFT074-102907-15	575					575	45.7	5.0	5.26E+03	99.982576%
MFT074-102907-16	153					153	45.7	5.0	1.40E+03	99.995364%
MFT074-102907-17	208					208	45.7	5.0	1.90E+03	99.993697%
MFT074-102907-18	154	126	116	205	134	735	45.7	25.0	1.34E+03	99.995545%
C+	66E+04					6.60E+05	45.7	1.0	3.02E+07	

Micro 2									MS2 2 Hour 4.0 LPM (3.5 LPM sampled)	
Filter code	raw results (larger volume plating 5mL/petri)					total	d.l.	# platings	PFU total	% Reduction
MFT074-102907-10	155					155	45.7	5.0	1.42E+03	99.998724%
MFT074-102907-11	157					157	45.7	5.0	1.43E+03	99.998708%
MFT074-102907-12	419					419	45.7	5.0	3.83E+03	99.996551%
MFT074-102907-13	265					265	45.7	5.0	2.42E+03	99.997819%
MFT074-102907-14	53	61	67	81	92	354	45.7	25.0	6.47E+02	99.999417%
MFT074-102907-15					260	260	45.7	5.0	2.38E+03	99.997860%
MFT074-102907-16	27	21	21	14	15	98	45.7	25.0	1.79E+02	99.999839%
MFT074-102907-17	40	33	53	94	36	256	45.7	25.0	4.68E+02	99.999579%
MFT074-102907-18	48	51	71	61	61	292	45.7	25.0	5.34E+02	99.999519%
C+	243E+04					2.43E+06	45.7	1.0	1.11E+08	

Micro 2									MS2 3 Hour 4.0 LPM (3.5 LPM sampled)	
Filter code	raw results (larger volume plating 5mL/petri)					total	d.l.	# platings	PFU total	% Reduction
MFT074-102907-10	131	186	130	138	136	721	45.7	25.0	1.32E+03	99.998466%
MFT074-102907-11	76	85	81	100	101	443	45.7	25.0	8.10E+02	99.999057%
MFT074-102907-12	315					315	45.7	5.0	2.88E+03	99.996649%
MFT074-102907-13	229					229	45.7	5.0	2.09E+03	99.997564%
MFT074-102907-14	290					290	45.7	5.0	2.65E+03	99.996915%
MFT074-102907-15	539					539	45.7	5.0	4.93E+03	99.994266%
MFT074-102907-16	278					278	45.7	5.0	2.54E+03	99.997043%
MFT074-102907-17	195					195	45.7	5.0	1.78E+03	99.997926%
MFT074-102907-18	166					166	45.7	5.0	1.52E+03	99.998234%
C+	188E+04					1.88E+06	45.7	1.0	8.59E+07	

Experiment No M07-0472: AATCC 100

Purpose: Comparing the sporicidal efficacy of Triosynated meltblown/Triosynated HEPA composite

Challenge: *Baciullus atrophaeus* spores by contact time during 0 minute and 24 hours

Date:2007/10/29

Micro 2								*B. atrophaeus* spores	
Filter code	Contact time	raw results			total	d.l.	vol plated	PFU total	% Reduction
MFTEXP-102907-01	0 min	445E+02			44500	10.0	0.2	2.23E+06	1.20E+06
MFTEXP-102907-02	0 min	211E+02			21100	10.0	0.2	1.06E+06	
MFTEXP-102907-03	0 min	62E+02			6200	10.0	0.2	3.10E+05	
MFTEXP-102907-04	24 hours	286E+01			2860	10.0	0.2	1.43E+05	88.050139%
MFTEXP-102907-05	24 hours	252E+01			2520	10.0	0.2	1.26E+05	89.470752%
MFTEXP-102907-06	24 hours	17E+01			170	10.0	0.2	8.50E+03	99.289694%

Micro 2								*B. atrophaeus* spores	
Filter code	Contact time	raw results			total	d.l.	vol plated	PFU total	% Reduction
MFTEXP-102907-07	0 min	231E+02			23100	10.0	0.2	1.16E+06	3.481894%
MFTEXP-102907-08	0 min	44E+03			44000	10.0	0.2	2.20E+06	0.000000%
MFTEXP-102907-09	0 min	46E+03			46000	10.0	0.2	2.30E+06	0.000000%
MFTEXP-102907-10	24 hours	207E+01			2070	10.0	0.2	1.04E+05	91.350975%
MFTEXP-102907-11	24 hours	24E+01			240	10.0	0.2	1.20E+04	98.997214%
MFTEXP-102907-12	24 hours	54E+01			540	10.0	0.2	2.70E+04	97.743733%

Experiment No M07-0473: AATCC 100

Purpose: Evaluating the antiviral efficacy of Triosynated meltblown/Triosynated HEPA composite

Challenge: MS2 coliphage by contact time during 0 minute, 15 minutes, 30 minutes, 60 minutes & 24 hours

Date:2007/10/29

Micro 2								MS2	
Filter code	Contact time	raw results			total	d.l.	vol plated	PFU total	% Reduction
MFTEXP-102907-13	0 min	31E+03			31000	10.0	1.0	3.10E+05	1.76E+06
MFTEXP-102907-14	0 min	50E+03			50000	10.0	1.0	5.00E+05	
MFTEXP-102907-15	0 min	446E+03			446000	10.0	1.0	4.46E+06	
MFTEXP-102907-16	15 min	0			0	10.0	1.0	<1.00E+01	>99.999431%
MFTEXP-102907-17	15 min	0			0	10.0	1.0	<1.00E+01	>99.999431%
MFTEXP-102907-18	15 min	0			0	10.0	1.0	<1.00E+01	>99.999431%
MFTEXP-102907-19	30 min	1			1	10.0	1.0	1.00E+01	99.999431%
MFTEXP-102907-20	30 min	1			1	10.0	1.0	1.00E+01	99.999431%
MFTEXP-102907-21	30 min	0			0	10.0	1.0	<1.00E+01	>99.999431%
MFTEXP-102907-22	60 min	11			11	10.0	1.0	1.10E+02	99.993738%
MFTEXP-102907-23	60 min	0			0	10.0	1.0	<1.00E+01	>99.999431%
MFTEXP-102907-24	60 min	0			0	10.0	1.0	<1.00E+01	>99.999431%
MFTEXP-102907-25	24 hours	0	0		0	10.0	2.0	<5.00E+00	>99.999715%
MFTEXP-102907-26	24 hours	0	0		0	10.0	2.0	<5.00E+00	>99.999715%
MFTEXP-102907-27	24 hours	0	0		0	10.0	2.0	<5.00E+00	>99.999715%

Micro 2								MS2	
Filter code	Contact time	raw results			total	d.l.	vol plated	PFU total	% Reduction
MFTEXP-102907-28	0 min	25E+02			2500	10.0	1.0	2.50E+04	98.576850%
MFTEXP-102907-29	0 min	284E+02			28400	10.0	1.0	2.84E+05	83.833017%
MFTEXP-102907-30	0 min	26E+03			26000	10.0	1.0	2.60E+05	85.199241%
MFTEXP-102907-31	15 min	183			183	10.0	1.0	1.83E+03	99.895825%
MFTEXP-102907-32	15 min	173			173	10.0	1.0	1.73E+03	99.901518%
MFTEXP-102907-33	15 min	270			270	10.0	1.0	2.70E+03	99.846300%
MFTEXP-102907-34	30 min	26	43	86	155	10.0	3.0	5.17E+02	99.970588%
MFTEXP-102907-35	30 min	23	67	38	128	10.0	3.0	4.27E+02	99.975712%
MFTEXP-102907-36	30 min	56	51	114	221	10.0	3.0	7.37E+02	99.958065%
MFTEXP-102907-37	60 min	18	17	35	70	10.0	3.0	2.33E+02	99.986717%
MFTEXP-102907-38	60 min	56	28	46	130	10.0	3.0	4.33E+02	99.975332%
MFTEXP-102907-39	60 min	43	41	117	201	10.0	3.0	6.70E+02	99.961860%
MFTEXP-102907-40	24 hours	0	0	0	0	10.0	3.0	<3.33E+00	>99.999810%
MFTEXP-102907-41	24 hours	0	0	0	0	10.0	3.0	<3.33E+00	>99.999810%
MFTEXP-102907-42	24 hours	0	0	0	0	10.0	3.0	<3.33E+00	>99.999810%

Experiment No M07-0476: Biocidal air filtration membrane project:
Purpose: Testing IP2/CP2 stack (Triosynated meltblown/Triosynated HEPA composite) in environmental condition (20°C ± 3°C & 50% ± 15% RH)
Challenge: MS2 coliphage at 20ºC ± 3ºC and 50% ± 15% RH a 31.8 LPM for 6 hours of filtration
Date:2007/10/29
Environmental Condition: 20°C ± 3°C & 50% ± 15% RH

Micro 3														MS2 1 Hour 31.8 LPM	
Filter code	raw results (larger volume plating 5mL/petri)										total	d.l.	# platings	PFU total	% Reduction
MFT074-102907-19	24	39	47	38	29	76	64	52	36	21	426	100.0	50.0	8.52E+02	99.999733%
MFT074-102907-20	44	61	41	68	72	70	50	68	52	54	580	100.0	50.0	1.16E+03	99.999636%
MFT074-102907-21	96	92	70	92	108	76	86	110	104	94	928	100.0	50.0	1.86E+03	99.999418%
MFT071-102907-01	772										772	100.0	1.0	7.72E+04	99.975799%
MFT071-102907-02	324										324	100.0	1.0	3.24E+04	99.989843%
C+	319E+04										3.19E+06	100.0	1.0	3.19E+08	

Micro 3														MS2 2 Hour 31.8 LPM	
Filter code	raw results (larger volume plating 5mL/petri)										total	d.l.	# platings	PFU total	% Reduction
MFT074-102907-19	33	52	72	51	49	50	41	78	37	91	554	100.0	50.0	1.11E+03	99.999652%
MFT074-102907-20	15	31	22	16	12	20	23	27	27	27	220	100.0	50.0	4.40E+02	99.999862%
MFT074-102907-21	68	62	58	81	64	84	48	91	72	87	715	100.0	50.0	1.43E+03	99.999550%
MFT071-102907-01	356										356	100.0	1.0	3.56E+04	99.988805%
MFT071-102907-02	120	148	108	156	84	228	132	148	112	160	1396	100.0	10.0	1.40E+04	99.995610%
C+	318E+04										3.18E+06	100.0	1.0	3.18E+08	

Micro 3														MS2 3 Hour 31.8 LPM	
Filter code	raw results (larger volume plating 5mL/petri)										total	d.l.	# platings	PFU total	% Reduction
MFT074-102907-19	78	95	112	34	47	69	72	72	101	67	747	100.0	50.0	1.49E+03	99.999425%
MFT074-102907-20	50	42	70	67	40	54	87	37	77	99	623	100.0	50.0	1.25E+03	99.999521%
MFT074-102907-21	40	85	27	38	51	71	63	43	89	79	586	100.0	50.0	1.17E+03	99.999549%
MFT071-102907-01	756										756	100.0	1.0	7.56E+04	99.970923%
MFT071-102907-02	360										360	100.0	1.0	3.60E+04	99.986154%
C+	26E+05										2.60E+06	100.0	1.0	2.60E+08	

Environmental condition		
Time	Temperature (°C)	Relative Humidity (%)
0	21.1	61.3
15	20.9	51.5
30	19.4	55.4
45	18.2	54
60	19.5	46.3
AVG 60	19.5	51.8
75	21.1	48.9
90	20.9	53.4
105	20.9	61.9
120	19	55.9
AVG 120	20.5	55.0
135	20.5	34.7
150	21	35.6
165		
180	21.6	54.4
AVG 180	21.0	41.6
AVG	20.3	51.1

Experiment No M07-0477: AATCC 100

Purpose: Evaluating the antiviral efficacy of Triosynated meltblown/Triosynated HEPA composite

Challenge: MS2 coliphage by contact time during 0 minute, 15 minutes, 30 minutes, 60 minutes & 24 hours

Date:2007/10/30

Micro 2								MS2	
Filter code	Contact time	raw results			total	d.l.	vol plated	PFU total	% Reduction
MFTEXP-103007-49	0 min	34E+03			34000	10.0	1.0	3.40E+05	2.95E+05
MFTEXP-103007-50	0 min	176E+02			17600	10.0	1.0	1.76E+05	
MFTEXP-103007-51	0 min	37E+03			37000	10.0	1.0	3.70E+05	
MFTEXP-103007-52	15 min	10			10	10.0	1.0	1.00E+02	99.966140%
MFTEXP-103007-53	15 min	1			1	10.0	1.0	1.00E+01	99.996614%
MFTEXP-103007-54	15 min	6			6	10.0	1.0	6.00E+01	99.979684%
MFTEXP-103007-55	30 min	1			1	10.0	1.0	1.00E+01	99.996614%
MFTEXP-103007-56	30 min	3			3	10.0	1.0	3.00E+01	99.989842%
MFTEXP-103007-57	30 min	1			1	10.0	1.0	1.00E+01	99.996614%
MFTEXP-103007-58	60 min	0			0	10.0	1.0	<1.00E+01	>99.996614%
MFTEXP-103007-59	60 min	5			5	10.0	1.0	5.00E+01	99.983070%
MFTEXP-103007-60	60 min	2			2	10.0	1.0	2.00E+01	99.993228%
MFTEXP-103007-61	24 hours	0	0		0	10.0	2.0	<5.00E+00	>99.998307%
MFTEXP-103007-62	24 hours	0	0		0	10.0	2.0	<5.00E+00	>99.998307%
MFTEXP-103007-63	24 hours	0	0		0	10.0	2.0	<5.00E+00	>99.998307%

Micro 2								MS2	
Filter code	Contact time	raw results			total	d.l.	vol plated	PFU total	% Reduction
MFTEXP-103007-64	0 min	34E+03			34000	10.0	1.0	3.40E+05	0.000000%
MFTEXP-103007-65	0 min	56E+03			56000	10.0	1.0	5.60E+05	-89.616253%
MFTEXP-103007-66	0 min	288E+03			288000	10.0	1.0	2.88E+06	0.000000%
MFTEXP-103007-67	15 min	63	119		182	10.0	2.0	9.10E+02	99.691874%
MFTEXP-103007-68	15 min	20	10		30	10.0	2.0	1.50E+02	99.949210%
MFTEXP-103007-69	15 min	3	1	0	4	10.0	3.0	1.33E+01	99.995485%
MFTEXP-103007-70	30 min	29	19	19	67	10.0	3.0	2.23E+02	99.924379%
MFTEXP-103007-71	30 min	45	90	70	205	10.0	3.0	6.83E+02	99.768623%
MFTEXP-103007-72	30 min	3	3	1	7	10.0	3.0	2.33E+01	99.992099%
MFTEXP-103007-73	60 min	2	2	0	4	10.0	3.0	1.33E+01	99.995485%
MFTEXP-103007-74	60 min	0	0	1	1	10.0	3.0	3.33E+00	99.998871%
MFTEXP-103007-75	60 min	3	2	4	9	10.0	3.0	3.00E+01	99.989842%
MFTEXP-103007-76	24 hours	0	0	0	0	10.0	3.0	<3.33E+00	>99.998871%
MFTEXP-103007-77	24 hours	0	0	0	0	10.0	3.0	<3.33E+00	>99.998871%
MFTEXP-103007-78	24 hours	0	0	0	0	10.0	3.0	<3.33E+00	>99.998871%

Experiment No M07-0483: AATCC 100

Purpose: Evaluating the antiviral efficacy of Triosynated meltblown

Challenge: MS2 coliphage by contact time during 0 minute, 15 minutes, 30 minutes, 60 minutes & 24 hours

Date:2007/11/01

Micro 2								MS2	
Filter code	Contact time	raw results			total	d.l.	vol plated	PFU total	% Reduction
MFT004-110107-01	0 min	588E+03			588000	10.0	1.0	5.88E+06	6.00E+06
MFT004-110107-02	0 min	656E+03			656000	10.0	1.0	6.56E+06	
MFT004-110107-03	0 min	556E+03			556000	10.0	1.0	5.56E+06	
MFT004-110107-04	15 min	392E+02			39200	10.0	1.0	3.92E+05	93.466667%
MFT004-110107-05	15 min	54E+01			540	10.0	1.0	5.40E+03	99.910000%
MFT004-110107-06	15 min	66E+02			6600	10.0	1.0	6.60E+04	98.900000%
MFT004-110107-07	30 min	35E+01			350	10.0	1.0	3.50E+03	99.941667%
MFT004-110107-08	30 min	2E+01			20	10.0	1.0	2.00E+02	99.996667%
MFT004-110107-09	30 min	73E+01			730	10.0	1.0	7.30E+03	99.878333%
MFT004-110107-10	60 min	1E+01			10	10.0	1.0	1.00E+02	99.998333%
MFT004-110107-11	60 min	2E+01			20	10.0	1.0	2.00E+02	99.996667%
MFT004-110107-12	60 min	25E+02			2500	10.0	1.0	2.50E+04	99.583333%
MFT004-110107-13	24 hours	0			0	10.0	2.0	<1.00E+01	>99.999917%
MFT004-110107-14	24 hours	0			0	10.0	2.0	<1.00E+01	>99.999917%
MFT004-110107-15	24 hours	0			0	10.0	2.0	<1.00E+01	>99.999917%

Micro 2								MS2	
Filter code	Contact time	raw results			total	d.l.	vol plated	PFU total	% Reduction
MFT001-110107-01	0 min	83E+03			83000	10.0	1.0	8.30E+05	86.166667%
MFT001-110107-02	0 min	118E+03			118000	10.0	1.0	1.18E+06	80.333333%
MFT001-110107-03	0 min	166E+03			166000	10.0	1.0	1.66E+06	72.333333%
MFT001-110107-04	15 min	11			11	10.0	1.0	1.10E+02	99.998167%
MFT001-110107-05	15 min	2			2	10.0	1.0	2.00E+01	99.999667%
MFT001-110107-06	15 min	2			2	10.0	1.0	2.00E+01	99.999667%
MFT001-110107-07	30 min	7	1		8	10.0	2.0	4.00E+01	99.999333%
MFT001-110107-08	30 min	0	0		0	10.0	2.0	<5.00E+00	>99.999917%
MFT001-110107-09	30 min	0	0		0	10.0	2.0	<5.00E+00	>99.999917%
MFT001-110107-10	60 min	4	0	2	6	10.0	3.0	2.00E+01	99.999667%
MFT001-110107-11	60 min	4	0	3	7	10.0	3.0	2.33E+01	99.999611%
MFT001-110107-12	60 min	1	2	2	5	10.0	3.0	1.67E+01	99.999722%
MFT001-110107-13	24 hours	0	0	0	0	10.0	3.0	<3.33E+00	>99.999944%
MFT001-110107-14	24 hours	0	0	0	0	10.0	3.0	<3.33E+00	>99.999944%
MFT001-110107-15	24 hours	0	0	0	0	10.0	3.0	<3.33E+00	>99.999944%

Experiment No M07-0495: AATCC 100

Purpose: Evaluating the antiviral efficacy of Triosynated meltblown

Challenge: MS2 coliphage by contact time during 0 minute, 15 minutes, 30 minutes, 60 minutes & 24 hours

Date:2007/11/12

Micro 2								MS2	
Filter code	Contact time	raw results			total	d.l.	vol plated	PFU total	% Reduction
MFT004-111207-01	0 min	231E+02			23100	10.0	1.0	2.31E+05	3.32E+05
MFT004-111207-02	0 min	266E+02			26600	10.0	1.0	2.66E+05	
MFT004-111207-03	0 min	50E+03			50000	10.0	1.0	5.00E+05	
MFT004-111207-04	15 min	96E+01			960	10.0	1.0	9.60E+03	97.111334%
MFT004-111207-05	15 min	99E+02			9900	10.0	1.0	9.90E+04	70.210632%
MFT004-111207-06	15 min	139E+01			1390	10.0	1.0	1.39E+04	95.817452%
MFT004-111207-07	30 min	164			164	10.0	1.0	1.64E+03	99.506520%
MFT004-111207-08	30 min	27E+01			270	10.0	1.0	2.70E+03	99.187563%
MFT004-111207-09	30 min	37			37	10.0	1.0	3.70E+02	99.888666%
MFT004-111207-10	60 min	36			36	10.0	1.0	3.60E+02	99.891675%
MFT004-111207-11	60 min	58			58	10.0	1.0	5.80E+02	99.825476%
MFT004-111207-12	60 min	128			128	10.0	1.0	1.28E+03	99.614845%
MFT004-111207-13	24 hours	0	0	0	0	10.0	3.0	<3.33E+00	>99.998997%
MFT004-111207-14	24 hours	0	0	0	0	10.0	3.0	<3.33E+00	>99.998997%
MFT004-111207-15	24 hours	0	0	0	0	10.0	3.0	<3.33E+00	>99.998997%

Micro 2								MS2	
Filter code	Contact time	raw results			total	d.l.	vol plated	PFU total	% Reduction
MFT001-111207-01	0 min	124E+02			12400	10.0	1.0	1.24E+05	62.688064%
MFT001-111207-02	0 min	133E+02			13300	10.0	1.0	1.33E+05	59.979940%
MFT001-111207-03	0 min	70E+01			700	10.0	1.0	7.00E+03	97.893681%
MFT001-111207-04	15 min	0	0		0	10.0	2.0	<5.00E+00	>99.998495%
MFT001-111207-05	15 min	1	0		1	10.0	2.0	5.00E+00	99.998495%
MFT001-111207-06	15 min	2	0		2	10.0	2.0	1.00E+01	99.996991%
MFT001-111207-07	30 min	0	0		0	10.0	2.0	<5.00E+00	>99.998495%
MFT001-111207-08	30 min	0	0		0	10.0	2.0	<5.00E+00	>99.998495%
MFT001-111207-09	30 min	0	0		0	10.0	2.0	<5.00E+00	>99.998495%
MFT001-111207-10	60 min	0	0	0	0	10.0	3.0	<3.33E+00	>99.998997%
MFT001-111207-11	60 min	1	0	0	1	10.0	3.0	3.33E+00	99.998997%
MFT001-111207-12	60 min	0	0	0	0	10.0	3.0	<3.33E+00	>99.998997%
MFT001-111207-13	24 hours	0	0	0	0	10.0	3.0	<3.33E+00	>99.998997%
MFT001-111207-14	24 hours	0	0	0	0	10.0	3.0	<3.33E+00	>99.998997%
MFT001-111207-15	24 hours	0	0	0	0	10.0	3.0	<3.33E+00	>99.998997%

17 ANNEX 9: CHEMISTRY/TOXICOLOGY RESULTS

Table 1: Amount of Iodine liberated from 100cm^2 swatches of 20-XP containing 10gsm of Triosyn T50 and HEPA glass fiber with 50gsm Triosyn (200-400um) (Oct 2005 Lydall production) and 100gsm KJ carbon backing at a flow of 31.8 LPM at environmental conditions of 20°C ± 3°C and a relative humidity of 50% ± 15%

Time point (min)	Sample #1 (mg/m^3)	Sample #2 (mg/m^3)	Sample #3 (mg/m^3)	Sample #4 (mg/m^3)	Sample #5 (mg/m^3)	Sample #6 (mg/m^3)
15	0.0154	0.0149	0.0135	0.0226	0.0262	0.0648
30	0.0263	0.0248	0.0152	0.0241	0.0383	0.0946
45	0.0299	0.0260	0.0170	0.0254	0.0465	0.1029
60	0.0322	0.0300	0.0200	0.0298	0.0517	0.1149
75	0.0315	0.0278	0.0213	0.0254	0.0443	0.0905
90	0.0285	0.0266	0.0218	0.0268	0.0432	0.0907
105	0.0296	0.0273	0.0232	0.0289	0.0449	0.0922
120	0.0312	0.0301	0.0240	0.0280	0.0480	0.0860
135	0.0330	0.0294	0.0224	0.0292	0.0402	0.0814
150	0.0333	0.0300	0.0212	0.0260	0.0382	0.0772
165	0.0326	0.0301	0.0221	0.0325	0.0485	0.0780
180	0.0383	0.0343	0.0272	0.0280	0.0440	0.0847

Table 2: Amount of Iodine liberated from 100cm^2 swatches of 20-XP containing 10gsm of Triosyn T50 and HEPA glass fiber with 50gsm Triosyn (200-400um) (Oct 2005 Lydall production) and 100gsm KJ carbon backing at a flow of 31.8 LPM at environmental conditions of 30°C ± 3°C and a relative humidity of 85% ± 15%

Time point (min)	Sample #1 (mg/m^3)	Sample #2 (mg/m^3)	Sample #3 (mg/m^3)	Sample #4 (mg/m^3)	Sample #5 (mg/m^3)	Sample #6 (mg/m^3)
15	0.0177	0.0151	0.0193	0.0363	0.0353	0.0748
30	0.0210	0.0187	0.0273	0.0278	0.0339	0.1026
45	0.0242	0.0160	0.0363	0.0165	0.0224	0.0839
60	0.0298	0.0237	0.0400	0.0176	0.0250	0.0812
75	0.0354	0.0219	0.0409	0.0208	0.0281	0.0673
90	0.0322	0.0195	0.0418	0.0205	0.0310	0.0692
105	0.0354	0.0201	0.0492	0.0219	0.0293	0.0591
120	0.0556	0.0221	0.0531	0.0235	0.0337	0.0767
135	0.0316	0.0247	0.0444	0.0228	0.0360	0.0806
150	0.0367	0.0252	0.0455	0.0250	0.0348	0.0803
165	0.0354	0.0279	0.0480	0.0253	0.0348	0.0855
180	0.0400	0.0305	0.0503	0.0252	0.0388	0.0849

Table 3: Amount of Iodine liberated from 100cm^2 swatches of 20-XP containing 10gsm of Triosyn T50 and HEPA glass fiber with 50gsm Triosyn (200-400um) (Oct 2005 Lydall production) and 100gsm KJ carbon backing at a flow of 31.8 LPM at environmental conditions of 30°C ± 3°C and a relative humidity of 30% ± 15%

Time point (min)	Sample #1 (mg/m^3)	Sample #2 (mg/m^3)	Sample #3 (mg/m^3)	Sample #4 (mg/m^3)	Sample #5 (mg/m^3)	Sample #6 (mg/m^3)
15	0.0087	0.0107	0.0052	0.0175	0.0529	0.0707
30	0.0184	0.0291	0.0191	0.0247	0.0916	0.0876
45	0.0266	0.0403	0.0316	0.0279	0.1104	0.0890
60	0.0269	0.0424	0.0373	0.0299	0.1089	0.0862
75	0.0292	0.0415	0.0318	0.0297	0.1037	0.0788
90	0.0259	0.0377	0.0334	0.0306	0.1036	0.0795
105	0.0263	0.0370	0.0319	0.0311	0.0937	0.0763
120	0.0265	0.0395	0.0344	0.0306	0.1043	0.0752
135	0.0240	0.0367	0.0318	0.0299	0.0934	0.0724
150	0.0245	0.0346	0.0302	0.0318	0.0906	0.0758
165	0.0248	0.0331	0.0293	0.0288	0.0829	0.0704
180	0.0265	0.0337	0.0302	0.0311	0.0888	0.0772

Table 4: Amount of Iodine liberated from 100cm^2 swatches of 20-XP containing 10gsm of Triosyn T50 and HEPA glass fiber with 50gsm Triosyn (200-400um) (Oct 2005 Lydall production) and 100gsm KJ carbon backing at a flow of 31.8 LPM at environmental conditions of 5°C ± 3°C and a relative humidity of 75% ± 15%

Time point (min)	Sample #1 (mg/m^3)	Sample #2 (mg/m^3)	Sample #3 (mg/m^3)	Sample #4 (mg/m^3)	Sample #5 (mg/m^3)	Sample #6 (mg/m^3)
15	0.0131	0.0124	0.0375	0.0226	0.0113	0.0253
30	0.0213	0.0223	0.0506	0.0376	0.0139	0.0338
45	0.0195	0.0214	0.0455	0.0421	0.0142	0.0422
60	0.0204	0.0229	0.0551	0.0438	0.0163	0.0431
75	0.0190	0.0227	0.0493	0.0452	0.0160	0.0459
90	0.0193	0.0221	0.0460	0.0024	0.0151	0.0434
105	0.0199	0.0215	0.0444	0.0417	0.0148	0.0404
120	0.0196	0.0240	0.0475	0.0459	0.0163	0.0447
135	0.0184	0.0211	0.0422	0.0447	0.0161	0.0442
150	0.0190	0.0215	0.0428	0.0439	0.0179	0.0445
165	0.0205	0.0205	0.0417	0.0468	0.0161	0.0456
180	0.0210	0.0227	0.0460	0.0489	0.0187	0.0484

Table 5: Amount of Iodine liberated from 100cm^2 swatches of 20-XP containing 10gsm of Triosyn T50 and HEPA glass fiber with 50gsm Triosyn (200-400um) (Oct 2005 Lydall production) and no carbon at a flow of 31.8 LPM at environmental conditions of 20°C ± 3°C and a relative humidity of 50% ± 15%

Time point (min)	Sample #1 (mg/m^3)	Sample #2 (mg/m^3)	Sample #3 (mg/m^3)	Sample #4 (mg/m^3)	Sample #5 (mg/m^3)	Sample #6 (mg/m^3)
15	1.5794	1.2379	1.7854	1.3856	1.7535	1.7767
30	2.0785	1.4574	1.9543	1.5969	1.9799	1.9169
45	1.8620	1.3008	1.5953	1.3141	1.8632	1.7239
60	1.7220	1.2617	1.4698	1.2560	1.7060	1.5902
75	1.6588	1.2080	1.3967	1.2267	1.6431	1.5423
90	1.5621	1.1720	1.3530	1.1494	1.5693	1.4607
105	1.4896	1.1248	1.3160	1.1114	1.5250	1.4074
120	1.4369	1.1145	1.2327	1.2593	1.4794	1.3612
135	1.4647	1.0665	1.3065	1.0772	1.4215	1.3343
150	1.5206	1.0517	1.3089	1.0139	1.3421	1.2625
165	1.4389	1.0038	1.2753	1.0226	1.3310	1.2574
180	1.5032	1.1577	1.3478	1.1082	1.4544	1.3526

Table 6: Amount of Iodine liberated from 100cm^2 swatches of 20-XP containing 10gsm of Triosyn T50 and HEPA glass fiber with 50gsm Triosyn (200-400um) (Oct 2005 Lydall production) and no carbon at a flow of 31.8 LPM at environmental conditions of 30°C ± 3°C and a relative humidity of 85% ± 15%

Time point (min)	Sample #1 (mg/m^3)	Sample #2 (mg/m^3)	Sample #3 (mg/m^3)	Sample #4 (mg/m^3)	Sample #5 (mg/m^3)	Sample #6 (mg/m^3)
15	2.0462	2.0023	1.8147	2.2968	2.2975	2.1605
30	2.1660	2.1242	1.8613	2.2972	2.1391	2.3087
45	2.1982	2.1097	1.9239	2.4108	2.0228	2.2613
60	2.0666	2.1173	1.8087	2.4694	2.2024	2.2642
75	2.0232	1.9729	1.8473	2.2345	1.9901	2.2273
90	2.0352	2.0015	1.8279	2.3104	2.0539	2.1543
105	1.9668	1.9101	1.6926	2.1991	1.8751	2.0252
120	1.9012	1.8725	1.7126	2.1081	1.9189	2.0083
135	1.8763	1.8164	1.6619	2.0678	1.8415	1.9709
150	1.8105	1.7460	1.6080	1.9689	1.7655	1.8077
165	1.7417	1.6280	1.5123	1.8575	1.7057	1.7339
180	1.8066	1.6515	1.5502	1.9111	1.7585	1.8109

Table 7: Amount of Iodine liberated from 100cm^2 swatches of 20-XP containing 10gsm of Triosyn T50 and HEPA glass fiber with 50gsm Triosyn (200-400um) (Oct 2005 Lydall production) and no carbon at a flow of 31.8 LPM at environmental conditions of 30°C ± 3°C and a relative humidity of 30% ± 15%

Time point (min)	Sample #1 (mg/m^3)	Sample #2 (mg/m^3)	Sample #3 (mg/m^3)	Sample #4 (mg/m^3)	Sample #5 (mg/m^3)	Sample #6 (mg/m^3)
15	2.5111	2.9968	2.9073	3.2678	2.9119	2.8661
30	2.2924	2.7945	2.6381	3.1007	2.9980	2.7798
45	2.1341	2.6666	2.6086	2.9053	2.8397	2.5513
60	2.1426	2.6855	2.5847	2.9078	2.8186	2.5591
75	2.0504	2.5367	2.3990	2.8767	2.8284	2.4796
90	2.1796	2.9702	2.5597	2.7542	2.7904	2.4878
105	1.9747	2.5925	2.3794	2.6748	2.6465	2.3238
120	1.8504	2.6033	2.2172	2.4875	2.4363	2.2052
135	1.7854	2.3191	2.1649	2.4006	2.3532	2.0462
150	1.5873	2.2978	2.0391	2.2185	2.2061	1.9790
165	1.5184	2.2134	1.9501	2.1376	2.0821	1.7685
180	1.5831	2.2076	2.0247	2.2072	2.0584	1.9301

Table 8: Amount of Iodine liberated from 100cm^2 swatches of 20-XP containing 10gsm of Triosyn T50 and HEPA glass fiber with 50gsm Triosyn (200-400um) (Oct 2005 Lydall production) and no carbon at a flow of 31.8 LPM at environmental conditions of 5°C ± 3°C and a relative humidity of 75% ± 15%

Time point (min)	Sample #1 (mg/m^3)	Sample #2 (mg/m^3)	Sample #3 (mg/m^3)	Sample #4 (mg/m^3)	Sample #5 (mg/m^3)	Sample #6 (mg/m^3)
15	0.8527	1.4675	1.0258	1.1412	1.1158	1.1482
30	1.0574	1.5696	1.2979	1.3363	1.1905	1.3572
45	1.0776	1.5371	1.2387	1.3114	1.2447	1.3706
60	0.9786	1.3978	1.1418	1.1835	1.1367	1.2691
75	0.9053	1.3041	1.0404	1.0906	1.0395	1.1857
90	0.8353	1.2438	0.9751	1.0359	0.9865	1.1588
105	0.8481	1.2510	0.9899	1.1407	1.0203	1.2406
120	0.8167	1.1547	0.9587	1.0095	0.9774	1.1556
135	0.7420	1.0786	0.8588	0.9278	0.8780	1.0330
150	0.6961	1.0076	0.7862	0.8889	0.8237	0.9952
165	0.6846	0.9638	0.7671	0.8389	0.7879	0.9518
180	0.7650	1.0505	0.8487	0.9381	0.8833	1.0828

Table 9: Amount of Iodine liberated from 100cm^2 swatches of 20-XP containing 10gsm of Triosyn T50 and HEPA glass fiber with 50gsm Triosyn (200-400um) (Oct 2005 Lydall production) and 100gsm KJ carbon backing at a flow of 31.8 LPM at ambient environmental conditions. Swatches were loaded with 23mg of **DOP** prior to testing

Time point (min)	Sample #1 (mg/m^3)	Sample #2 (mg/m^3)	Sample #3 (mg/m^3)	Sample #4 (mg/m^3)	Sample #5 (mg/m^3)	Sample #6 (mg/m^3)	Sample #7 (mg/m^3)	Sample #8 (mg/m^3)	Sample #9 (mg/m^3)	Sample #10 (mg/m^3)	Sample #11 (mg/m^3)	Sample #12 (mg/m^3)
15	0.0142	0.0146	0.0113	0.0445	0.0193	0.0148	0.0168	0.0178	0.0278	0.0117	0.0241	0.0137
30	0.0263	0.0231	0.0167	0.0704	0.0286	0.0245	0.0343	0.0267	0.0460	0.0181	0.0436	0.0250
45	0.0380	0.0264	0.0204	0.0731	0.0317	0.0286	0.0376	0.0309	0.0514	0.0205	0.0480	0.0292
60	0.0343	0.0270	0.0322	0.0757	0.0320	0.0287	0.0368	0.0306	0.0480	0.0214	0.0494	0.0265
75	0.0379	0.0322	0.0243	0.0800	0.0359	0.0347	0.0424	0.0331	0.0499	0.0211	0.0510	0.0285
90	0.0513	0.0309	0.0261	0.0837	0.0376	0.0412	0.0440	0.0356	0.0520	0.0237	0.0553	0.0296
105	0.0407	0.0398	0.0321	0.0818	0.0384	0.0404	0.0447	0.0368	0.0546	0.0250	0.0559	0.0301
120	0.0441	0.0306	0.0266	0.0755	0.0376	0.0396	0.0407	0.0318	0.0485	0.0226	0.0507	0.0284
135	0.0975	0.0345	0.0298	0.0797	0.0399	0.0401	0.0450	0.0351	0.0520	0.0232	0.0557	0.0307
150	0.0452	0.0567	0.0303	0.0769	0.0381	0.0424	0.0324	0.0596	0.0221	0.0184	0.0561	0.0430
165	0.0384	0.0317	0.0282	0.0813	0.0365	0.0385	0.0414	0.0352	0.0494	0.0232	0.0564	0.0312
180	0.0462	0.0424	0.0366	0.0831	0.0454	0.0464	0.0481	0.0409	0.0589	0.0259	0.0682	0.0346

Table 10: Amount of Iodine liberated from 100cm2 swatches of 20-XP containing 10gsm of Triosyn T50 and HEPA glass fiber with 50gsm Triosyn (200-400um) (Oct 2005 Lydall production) and 100gsm KJ carbon backing at a flow of 31.8 LPM at ambient environmental conditions. Swatches were not loaded with DOP prior to testing

Time point (min)	Sample #1 (mg/m^3)	Sample #2 (mg/m^3)	Sample #3 (mg/m^3)	Sample #4 (mg/m^3)	Sample #5 (mg/m^3)	Sample #6 (mg/m^3)
15	0.0178	0.0154	0.0108	0.0480	0.0107	0.0096
30	0.0286	0.0233	0.0169	0.0639	0.0162	0.0148
45	0.0348	0.0279	0.0251	0.0689	0.0203	0.0152
60	0.0363	0.0274	0.0247	0.0659	0.0192	0.0149
75	0.0402	0.0293	0.0013	0.0683	0.0203	0.0161
90	0.0420	0.0646	0.0290	0.0701	0.0211	0.0175
105	0.0395	0.0354	0.0308	0.0717	0.0230	0.0178
120	0.0376	0.0328	0.0277	0.0683	0.0206	0.0154
135	0.0405	0.0366	0.0316	0.0698	0.0223	0.0182
150	0.0413	0.0367	0.0319	0.0408	0.0517	0.0242
165	0.0380	0.0332	0.0278	0.0642	0.0223	0.0173
180	0.0487	0.0424	0.0344	0.0639	0.0251	0.0228

Table 11: Amount of Iodine liberated from 12.57cm^2 swatches of 20-XP containing 10gsm of Triosyn T50 and HEPA glass fiber with 50gsm Triosyn (200-400um) (Oct 2005 Lydall production) and 100gsm KJ carbon backing at a flow of 4 LPM at ambient environmental conditions. Swatches were loaded with **+25% DP** prior to testing

Time point (min)	Sample #1 (mg/m^3)	Sample #2 (mg/m^3)	Sample #3 (mg/m^3)	Sample #4 (mg/m^3)	Sample #5 (mg/m^3)	Sample #6 (mg/m^3)	Sample #7 (mg/m^3)	Sample #8 (mg/m^3)	Sample #9 (mg/m^3)	Sample #10 (mg/m^3)	Sample #11 (mg/m^3)	Sample #12 (mg/m^3)
15	0.0759	0.0577	0.0347	0.0123	0.0300	0.0418	0.0829	0.1064	0.0272	0.0846	0.0472	0.0323
30	0.1203	0.1044	0.0699	0.0224	0.0641	0.0611	0.1131	0.1440	0.0632	0.1125	0.0672	0.0619
45	0.1270	0.1047	0.0782	0.0251	0.0772	0.0588	0.1208	0.1485	0.1127	0.1121	0.0806	0.0788
60	0.1270	0.1011	0.0789	0.0258	0.0766	0.0583	0.1182	0.1371	0.0748	0.1094	0.0753	0.0935
75	0.1373	0.1292	0.0746	0.0304	0.0489	0.0710	0.1122	0.1126	0.0817	0.1066	0.0763	0.1306
90	0.1420	0.1301	0.0763	0.0338	0.0413	0.0778	0.1100	0.1017	0.1148	0.1078	0.0755	0.1359
105	0.1448	0.1220	0.0740	0.0369	0.0404	0.0857	0.1079	0.1014	0.0792	0.1023	0.0747	0.1354
120	0.1376	0.1093	0.0776	0.0339	0.0331	0.0548	0.1012	0.0986	0.0766	0.0996	0.0705	0.1252
135	0.1316	0.0988	0.0841	0.0313	0.0441	0.0542	0.1050	0.0987	0.0811	0.0948	0.0687	0.1260
150	0.1236	0.0895	0.0808	0.0282	0.0634	0.0619	0.1023	0.1073	0.1127	0.0943	0.0665	0.1134
165	0.1148	0.0845	0.0756	0.0254	0.0630	0.0670	0.1143	0.1081	0.0723	0.1061	0.0708	0.1078
180	0.1176	0.0805	0.0430	0.0193	0.0557	0.0501	0.0998	0.0931	0.0881	0.0857	0.0609	0.1101

Table 12: Amount of Iodine liberated from 12.57cm^2 swatches of 20-XP containing 10gsm of Triosyn T50 and HEPA glass fiber with 50gsm Triosyn (200-400um) (Oct 2005 Lydall production) and 100gsm KJ carbon backing at a flow of 4 LPM at ambient environmental conditions. Swatches were **NOT DUST LOADED** prior to testing

Time point (min)	Sample #1 (mg/m^3)	Sample #2 (mg/m^3)	Sample #3 (mg/m^3)	Sample #4 (mg/m^3)	Sample #5 (mg/m^3)	Sample #6 (mg/m^3)
15	0.0891	0.0240	0.0242	0.0357	0.0382	0.0491
30	0.0873	0.0311	0.0318	0.0459	0.0642	0.0750
45	0.0862	0.0336	0.0349	0.0569	0.0683	0.0785
60	0.0782	0.0339	0.0340	0.0580	0.0624	0.0797
75	0.0859	0.0557	0.0370	0.0600	0.0646	0.0673
90	0.0913	0.0693	0.0390	0.0577	0.0605	0.0623
105	0.0926	0.0770	0.0399	0.0616	0.0559	0.0638
120	0.0877	0.0729	0.0377	0.0569	0.0502	0.0658
135	0.0793	0.0695	0.0357	0.0609	0.0306	0.0714
150	0.0706	0.0644	0.0381	0.0496	0.0248	0.0705
165	0.0644	0.0590	0.0385	0.0516	0.0320	0.0667
180	0.0607	0.0594	0.0274	0.0532	0.0403	0.0814

Table 13: Amount of Iodine liberated from 12.57cm^2 swatches of 20-XP containing 10gsm of Triosyn T50 and HEPA glass fiber with 50gsm Triosyn (200-400um) (Oct 2005 Lydall production) and 100gsm KJ carbon backing at a flow of 4 LPM at ambient environmental conditions. Swatches were loaded with **+50% DP** prior to testing

Time point (min)	Sample #1 (mg/m^3)	Sample #2 (mg/m^3)	Sample #3 (mg/m^3)	Sample #4 (mg/m^3)	Sample #5 (mg/m^3)	Sample #6 (mg/m^3)	Sample #7 (mg/m^3)	Sample #8 (mg/m^3)	Sample #9 (mg/m^3)	Sample #10 (mg/m^3)	Sample #11 (mg/m^3)	Sample #12 (mg/m^3)
15	0.0148	0.0032	0.0318	0.0133	0.0214	0.0191	0.0207	0.0323	0.0173	0.0100	0.0202	0.0114
30	0.0312	0.1528	0.0356	0.0222	0.0496	0.0372	0.0434	0.0632	0.0224	0.0202	0.0432	0.0542
45	0.0407	0.8803	0.0335	0.0249	0.0635	0.0470	0.0555	0.0854	0.0289	0.0262	0.0515	0.0275
60	0.0429	0.3531	0.0368	0.0272	0.0659	0.0484	0.0624	0.0753	0.0285	0.0265	0.0550	0.0272
75	0.0449	0.3077	0.0378	0.0283	0.0710	0.0571	0.0613	0.1111	0.0323	0.0158	0.0637	0.0284
90	0.0496	0.0795	0.0454	0.0341	0.0806	0.0653	0.0741	0.1199	0.0331	0.0162	0.0679	0.0304
105	0.0551	0.1340	0.0487	0.0380	0.0371	0.0685	0.0723	0.1201	0.0318	0.0151	0.0747	0.0290
120	0.0519	0.0711	0.0455	0.0379	0.0797	0.0640	0.0616	0.1147	0.0282	0.0196	0.0676	0.0314
135	0.0558	0.0783	0.0498	0.0416	0.0850	0.0662	0.0659	0.1332	0.0323	0.0264	0.0748	0.0352
150	0.0515	0.0526	0.0500	0.0431	0.0873	0.0671	0.0636	0.1146	0.0344	0.0344	0.0800	0.0439
165	0.0527	0.0505	0.0436	0.0432	0.0885	0.0696	0.0605	0.1141	0.0321	0.0314	0.0734	0.0440
180	0.0665	0.0557	0.0512	0.0510	0.1019	0.0856	0.0636	0.1081	0.0306	0.0350	0.0742	0.0451

Table 14: Amount of Iodine liberated from 12.57cm^2 swatches of 20-XP containing 10gsm of Triosyn T50 and HEPA glass fiber with 50gsm Triosyn (200-400um) (Oct 2005 Lydall production) and 100gsm KJ carbon backing at a flow of 4 LPM at ambient environmental conditions. Swatches were **NOT DUST LOADED** prior to testing

Time point (min)	Sample #1 (mg/m^3)	Sample #2 (mg/m^3)	Sample #3 (mg/m^3)	Sample #4 (mg/m^3)	Sample #5 (mg/m^3)	Sample #6 (mg/m^3)
15	0.0181	0.0223	0.0236	0.0134	0.0195	0.0043
30	0.0370	0.0421	0.0458	0.0478	0.0366	0.0058
45	0.0446	0.0517	0.0527	0.0335	0.0456	0.0089
60	0.0493	0.0529	0.0549	0.0341	0.0478	0.0087
75	0.0660	0.0562	0.0678	0.0334	0.0605	0.0114
90	0.0742	0.0638	0.0733	0.0376	0.0644	0.0124
105	0.0783	0.0648	0.0760	0.0360	0.0523	0.0140
120	0.0717	0.0592	0.0625	0.0348	0.0467	0.0112
135	0.0689	0.0623	0.0743	0.0412	0.0473	0.0135
150	0.0656	0.0621	0.0549	0.0430	0.0478	0.0189
165	0.0685	0.0621	0.0755	0.0435	0.0461	0.0161
180	0.0754	0.0702	0.0836	0.0425	0.0516	0.0203

Table 15: Amount of Iodine liberated from 12.57cm^2 swatches of 20-XP containing 10gsm of Triosyn T50 and HEPA glass fiber with 50gsm Triosyn (200-400um) (Oct 2005 Lydall production) and 100gsm KJ carbon backing at a flow of 4 LPM at ambient environmental conditions. Swatches were loaded with **+75% DP** prior to testing

Time point (min)	Sample #1 (mg/m^3)	Sample #2 (mg/m^3)	Sample #3 (mg/m^3)	Sample #4 (mg/m^3)	Sample #5 (mg/m^3)	Sample #6 (mg/m^3)	Sample #7 (mg/m^3)	Sample #8 (mg/m^3)	Sample #9 (mg/m^3)	Sample #10 (mg/m^3)	Sample #11 (mg/m^3)	Sample #12 (mg/m^3)
15	0.0262	0.0276	0.0048	0.0076	0.0253	0.0144	0.0786	0.0509	0.0628	0.0274	0.0351	0.0816
30	0.3140	0.0463	0.0100	0.0121	0.0443	0.0159	0.1208	0.0788	0.0802	0.0193	0.0462	0.0997
45	0.1701	0.0565	0.0153	0.0112	0.0555	0.0175	0.1279	0.0905	0.0820	0.0179	0.0552	0.1194
60	0.2118	0.0581	0.0187	0.0145	0.0589	0.0169	0.1541	0.0930	0.0822	0.0187	0.0592	0.1036
75	0.2534	0.0627	0.0216	0.0106	0.0722	0.0167	0.1266	0.0871	0.0683	0.0164	0.0550	0.1058
90	0.2657	0.0659	0.0255	0.0117	0.0766	0.0162	0.1236	0.0878	0.0589	0.0136	0.0581	0.1087
105	0.2780	0.0679	0.0282	0.0107	0.0809	0.0167	0.1245	0.0871	0.0595	0.0124	0.0578	0.1045
120	0.0723	0.0654	0.0263	0.0159	0.0604	0.0165	0.1208	0.0871	0.0574	0.0121	0.0586	0.1049
135	0.1450	0.0707	0.0300	0.0153	0.0423	0.0164	0.1100	0.0850	0.0700	0.0126	0.0593	0.0952
150	0.1191	0.0677	0.0294	0.0201	0.0388	0.0158	0.1035	0.0823	0.0729	0.0123	0.0589	0.0893
165	0.0868	0.0589	0.0257	0.0139	0.0304	0.0143	0.0998	0.0821	0.0725	0.0129	0.0612	0.0897
180	0.0759	0.0656	0.0274	0.0173	0.0552	0.0193	0.1106	0.0915	0.0823	0.0144	0.0675	0.0963

Table 16: Amount of Iodine liberated from 12.57cm^2 swatches of 20-XP containing 10gsm of Triosyn T50 and HEPA glass fiber with 50gsm Triosyn (200-400um) (Oct 2005 Lydall production) and 100gsm KJ carbon backing at a flow of 4 LPM at ambient environmental conditions. Swatches were **NOT DUST LOADED** prior to testing

Time point (min)	Sample #1 (mg/m^3)	Sample #2 (mg/m^3)	Sample #3 (mg/m^3)	Sample #4 (mg/m^3)	Sample #5 (mg/m^3)	Sample #6 (mg/m^3)
15	0.0089	0.0103	0.0142	0.0136	0.0102	0.0434
30	0.0141	0.0177	0.0322	0.0294	0.0188	0.0925
45	0.0167	0.0235	0.0447	0.0374	0.0214	0.0954
60	0.0173	0.0267	0.0515	0.0443	0.0242	0.1037
75	0.0207	0.0282	0.0758	0.0303	0.0225	0.0832
90	0.0216	0.0314	0.0860	0.0273	0.0281	0.0866
105	0.0233	0.0342	0.0926	0.0262	0.0251	0.0825
120	0.0218	0.0316	0.0906	0.0259	0.0259	0.0806
135	0.0248	0.0314	0.0990	0.0369	0.0268	0.0885
150	0.0244	0.0320	0.0967	0.0423	0.0268	0.0880
165	0.0224	0.0276	0.0843	0.0440	0.0950	0.0265
180	0.0166	0.0330	0.0926	0.0499	0.1040	0.0297

Table 17: Amount of Iodine liberated from 12.57cm^2 swatches of 20-XP containing 10gsm of Triosyn T50 and HEPA glass fiber with 50gsm Triosyn (200-400um) (Oct 2005 Lydall production) and 100gsm KJ carbon backing at a flow of 4 LPM at ambient environmental conditions. Swatches were loaded with **+100% DP** prior to testing

Time point (min)	Sample #1 (mg/m^3)	Sample #2 (mg/m^3)	Sample #3 (mg/m^3)	Sample #4 (mg/m^3)	Sample #5 (mg/m^3)	Sample #6 (mg/m^3)	Sample #7 (mg/m^3)	Sample #8 (mg/m^3)	Sample #9 (mg/m^3)	Sample #10 (mg/m^3)	Sample #11 (mg/m^3)	Sample #12 (mg/m^3)
15	0.0107	0.0173	0.0042	0.0064	0.0113	0.0110	0.0339	0.0525	0.0056	0.0213	0.0101	0.0116
30	0.0103	0.0315	0.0012	0.0026	0.0115	0.0203	0.0422	0.0697	0.0110	0.0272	0.0094	0.0174
45	0.0166	0.0443	0.0014	0.0033	0.0177	0.0245	0.0497	0.0766	0.0157	0.0305	0.0137	0.0257
60	0.0227	0.0438	0.0022	0.0045	0.0227	0.0305	0.0497	0.0862	0.0208	0.0343	0.0126	0.0330
75	0.0239	0.1063	0.0017	0.0048	0.0256	0.0325	0.0469	0.0825	0.0224	0.0248	0.0131	0.0341
90	0.0284	0.0505	0.0022	0.0062	0.0304	0.0383	0.0450	0.0831	0.0230	0.0212	0.0135	0.0373
105	0.0315	0.0497	0.0023	0.0051	0.0333	0.0392	0.0463	0.0825	0.0284	0.0193	0.0140	0.0441
120	0.0334	0.0519	0.0026	0.0061	0.0351	0.0411	0.0497	0.0847	0.0290	0.0199	0.0139	0.0410
135	0.0337	0.0513	0.0023	0.0078	0.0334	0.0383	0.0444	0.0767	0.0298	0.0191	0.0131	0.0415
150	0.0311	0.0544	0.0022	0.0098	0.0320	0.0361	0.0457	0.0872	0.0305	0.0190	0.0128	0.0436
165	0.0292	0.0426	0.0017	0.0135	0.0341	0.0358	0.0457	0.0819	0.0329	0.0187	0.0113	0.0442
180	0.0318	0.0485	0.0016	0.0148	0.0362	0.0408	0.0474	0.0918	0.0359	0.0207	0.0139	0.0503

Table 18: Amount of Iodine liberated from 12.57cm^2 swatches of 20-XP containing 10gsm of Triosyn T50 and HEPA glass fiber with 50gsm Triosyn (200-400um) (Oct 2005 Lydall production) and 100gsm KJ carbon backing at a flow of 4 LPM at ambient environmental conditions. Swatches were **NOT DUST LOADED** prior to testing

Time point (min)	Sample #1 (mg/m^3)	Sample #2 (mg/m^3)	Sample #3 (mg/m^3)	Sample #4 (mg/m^3)	Sample #5 (mg/m^3)	Sample #6 (mg/m^3)
15	0.0221	0.0124	0.0251	0.0307	0.0363	0.0313
30	0.0295	0.0181	0.0411	0.0324	0.0429	0.0198
45	0.0411	0.0262	0.0487	0.0330	0.0477	0.0218
60	0.0521	0.0331	0.0665	0.0338	0.0532	0.0197
75	0.0528	0.0330	0.0690	0.0342	0.0585	0.0194
90	0.0632	0.0390	0.0760	0.0336	0.0621	0.0189
105	0.0682	0.0415	0.0820	0.0353	0.0664	0.0208
120	0.0705	0.0447	0.0743	0.0342	0.0672	0.0186
135	0.0615	0.0412	0.0817	0.0344	0.0654	0.0173
150	0.0550	0.0365	0.0742	0.0330	0.0680	0.0165
165	0.0522	0.0357	0.0723	0.0333	0.0683	0.0163
180	0.0551	0.0477	0.0841	0.0377	0.0760	0.0195

Table 19: Amount of Iodine liberated from 12.57cm^2 swatches of 20-XP containing 10gsm of Triosyn T50 and HEPA glass fiber with 50gsm Triosyn (200-400um) (Oct 2005 Lydall production) and 100gsm KJ carbon backing at a flow of 4 LPM at ambient environmental conditions. Swatches were loaded with smoke from one cigarette prior to testing

Time point (min)	Sample #1 (mg/m^3)	Sample #2 (mg/m^3)	Sample #3 (mg/m^3)	Sample #4 (mg/m^3)	Sample #5 (mg/m^3)	Sample #6 (mg/m^3)	Sample #7 (mg/m^3)	Sample #8 (mg/m^3)	Sample #9 (mg/m^3)	Sample #10 (mg/m^3)	Sample #11 (mg/m^3)	Sample #12 (mg/m^3)
15	0.0071	0.0017	0.0047	0.0516	0.0042	0.0029	0.0096	0.0208	0.0049	0.0055	0.0047	0.0044
30	0.0125	0.0023	0.0084	0.0875	0.0059	0.0042	0.0098	0.0205	0.0033	0.0074	0.0070	0.0073
45	0.0140	0.0024	0.0092	0.1084	0.0059	0.0047	0.0107	0.0270	0.0032	0.0099	0.0095	0.0094
60	0.0163	0.0028	0.0100	0.1154	0.0065	0.0059	0.0112	0.0316	0.0033	0.0118	0.0117	0.0101
75	0.0168	0.0026	0.0079	0.1217	0.0056	0.0063	0.0134	0.0329	0.0033	0.0132	0.0101	0.0075
90	0.0179	0.0023	0.0095	0.1378	0.0037	0.0081	0.0163	0.0357	0.0035	0.0150	0.0084	0.0204
105	0.0187	0.0023	0.0104	0.1504	0.0040	0.0090	0.0170	0.0371	0.0044	0.0161	0.0077	0.0197
120	0.0195	0.0026	0.0109	0.1542	0.0037	0.0090	0.0181	0.0467	0.0043	0.0164	0.0079	0.0194
135	0.0204	0.0063	0.0117	0.1476	0.0039	0.0093	0.0170	0.0378	0.0039	0.0178	0.0098	0.0219
150	0.0205	0.0050	0.0146	0.1339	0.0054	0.0095	0.0181	0.0406	0.0041	0.0261	0.0134	0.0288
165	0.0231	0.0034	0.0154	0.1261	0.0068	0.0101	0.0198	0.0425	0.0043	0.0192	0.0160	0.0113
180	0.0259	0.0080	0.0198	0.1047	0.0095	0.0125	0.0243	0.0509	0.0060	0.0233	0.0191	0.0133

Table 20: Amount of Iodine liberated from 12.57cm^2 swatches of 20-XP containing 10gsm of Triosyn T50 and HEPA glass fiber with 50gsm Triosyn (200-400um) (Oct 2005 Lydall production) and 100gsm KJ carbon backing at a flow of 4 LPM at ambient environmental conditions. Swatches were **NOT SMOKE LOADED** prior to testing

Time point (min)	Sample #1 (mg/m^3)	Sample #2 (mg/m^3)	Sample #3 (mg/m^3)	Sample #4 (mg/m^3)	Sample #5 (mg/m^3)	Sample #6 (mg/m^3)
15	0.0114	0.0021	0.0060	0.0179	0.0104	0.0034
30	0.0181	0.0035	0.0079	0.0187	0.0182	0.0026
45	0.0210	0.0035	0.0101	0.0242	0.0241	0.0034
60	0.0258	0.0046	0.0113	0.0264	0.0290	0.0045
75	0.0280	0.0049	0.0112	0.0259	0.0299	0.0039
90	0.0283	0.0059	0.0135	0.0214	0.0325	0.0037
105	0.0306	0.0058	0.0145	0.0214	0.0334	0.0029
120	0.0320	0.0065	0.0160	0.0200	0.0340	0.0036
135	0.0300	0.0080	0.0123	0.0229	0.0328	0.0060
150	0.0284	0.0073	0.0145	0.0296	0.0342	0.0110
165	0.0289	0.0087	0.0147	0.0329	0.0374	0.0133
180	0.0346	0.0132	0.0182	0.0409	0.0423	0.0169