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THE APPLICATION OF EULAN WA NEW TO WOOL

G.T. Egglestone and G. Southwell

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ABSTRACT

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Conditions for maximum efficiency of application to wool of the mothproofing compound, Eulan WA new, have been determined. These are that the cloth shall be neutral to slightly acidic, the application bath should have a pH between 4.0 and 7.0 at a temperature of not less than 40°C and that any softening agent used, whether before, during or after application of the Eulan WA new, should be non-ionic in character.

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THE APPLICATION OF EULAN WA NEW TO WOOL

1. INTRODUCTION

Protection of wool goods against keratin-consuming insect pests is important; millions of dollars worth of unprotected goods are destroyed or rendered useless every year.

This fact has prompted the textile industry to try to find acceptable odourless and colourless substances which, when applied to wool, give it permanent protection against pests such as clothes moths and carpet beetles. For many years Mitin FF high conc* and dieldrin had been the mothproofing agents used in treating wool goods for Defence usage, but dieldrin is now no longer used because of environmental problems. However Eulan WA new (a substituted and chlorinated diphenyl ether) has recently become available and approved for use on Defence cloths.

One textile mill producing wool blankets for the Department had problems in achieving satisfactory exhaustion of Eulan WA new on to the blankets. This note describes the work we did to determine possible causes of their problem.

2. EXPERIMENTAL

Eulan WA new was applied to :

- (i) wool cloth, undyed plain woven, 15 warp and weft threads/cm, 225 g/m², wool fineness 23 μ m; and
- (ii) wool tops, undyed, fineness 25 μ m.

In practice Eulan WA new is applied preferably during dyeing at temperatures near boiling point but sometimes as an after treatment at lower

* Information on the composition and sources of supply of the various materials used in this work is given in Appendix 1.

temperatures (1,2); the usual pH of the application bath is in the range 4 to 7. It is common to apply softening agents either before, during or after the Eulan application.

To try to reproduce the various conditions likely to obtain in industry, Eulan WA new was applied to the cloth and tops as listed below, the concentration in the bath unless otherwise stated being such as to leave 1% compound on the wool if exhaustion was complete.

(i) Application at the boil

The required amounts of Eulan WA new and Glauber's salt were added to water baths at 60°C and the pH of the baths set to 1.7 with sulphuric acid, 2.8 with formic acid, 3.5 and 5.7 with acetic acid, and 7.4 with no acid. The wool cloth was entered and the temperature of the bath raised to 100°C over 30 minutes and maintained at 100°C for 45 minutes; the cloth was then removed and dried. One half of the cloth was retained, the other was treated for 30 minutes at 40°C in a bath containing 0.5% on the mass of cloth of Culversoft S75, a quaternary imidazoline compound typical of cationic softening agents commonly used in the industry, removed and dried.

(ii) Application at lower temperatures

Treatments were done at both 25°C and 40°C. Cloths were treated for 5 minutes, one piece in a bath containing 1% Eulan WA and one piece in a bath containing 1% Eulan WA new and 0.5% Culversoft S75. After 10 minutes 1% acetic acid (30% solution) was added to adjust the pH of the bath to 5.7. The cloths were treated for a further 15 minutes and then removed and dried.

To measure the effect of pretreatment with Culversoft S75, cloths were first treated for 30 minutes in a bath at 30°C containing 0.5% Culversoft S75, removed, dried and then treated with 1% Eulan WA new as above.

Because the finishing conditions produce cloths with varying degrees of acidity this series of treatments was done on cloths for which we had previously adjusted pH between 3.5 and 9.2.

Application of an alternative softening agent

Ionic, especially cationic agents are known to affect the adsorption and retention of finishing compounds on wool. Dicrylan WK, a silicone elastomer (3), was therefore considered as a possible alternative to these conventional type softening agents.

Wool tops were treated at 30°C in water baths containing various amounts of Dicrylan WK (refer Table 3) with Phobotone WS catalyst, the pH of the bath being adjusted to 5.0. After 10 minutes Phobotone SN catalyst was added and treatment continued for 10 minutes; the tops were then removed, dried and cured at 125°C for 2 minutes. After curing, the tops were treated in baths at 50°C containing 5% Glauber's salt and either 0.8%, 0.6% or 0.2% Eulan WA new, for 15 minutes. 5% acetic acid (30%) was added and the treatment continued for a further 30 minutes, after which time the tops were removed and dried.

A second series was also done in which the tops were first treated with Eulan WA new and then with Dicrylan WK under the same conditions as just described.

The amounts of Eulan WA new on the variously treated cloths and tops were determined by a quantitative method of analysis supplied by Bayer Australia, which was modified slightly to suit our apparatus. At the time of writing this article the method was classified as "trade confidential".

3. RESULTS AND DISCUSSION

The results of the determinations of Eulan WA new are given in Tables 1-3.

(1) Effect of pH of application bath

It is apparent from the results in Table 1 that increasing acidity reduces the pick-up of Eulan WA new; Bayer Ltd., the manufacturer of the compound, recommends application in the pH range 4.0 to 7.0 and our results confirm that to achieve maximum value this recommendation should be observed. If the bath pH falls much below 4.0, the absorption of Eulan WA new by the wool is substantially decreased. No attempt was made to study the effects of application from even a slightly alkaline bath because of the risk of adverse affects on the wool.

(ii) Effect of cloth pH

The results in Table 2 (application without softening agent) show that as one might expect best exhaustion is obtained when the cloth is in a slightly acidic condition. Alkaline cloths do not pick up Eulan WA new as readily as slightly acid cloths.

(iii) Effect of softening agents

It was suspected that cationic softening agents would interfere with the pick-up of Eulan by the wool and the results in Tables 1 and 2 confirm this. It seems not to matter whether the cationic agent is used as a pre-treatment or an after-treatment, or is included in the same bath as the Eulan; in every case the amount of the compound on the cloth is reduced by up to one-half.

The silicone compound, Dicrylan WK, applied either before or after the Eulan (it cannot be included in the mothproofing bath) affects the uptake and retention of Eulan WA new to a less extent especially as an after-treatment (see Table 3). Best results are obtained when the silicone is applied as an after-treatment.

Anionic compounds are not used as softening agents for wool but it could be expected that any ionic compound would adversely affect the amount of Eulan WA new retained by wool.

(iv) Effect of temperature of application

It is customary with most dyeing-type processing on wool to operate at temperatures near boiling; the manufacturer's recommendations for Eulan WA new do however suggest that application may be done at a temperature as low as 40°C. The results in Tables 1 and 2 show that bath temperature even down to 25°C has little effect if any on the amount of Eulan WA new taken up by the wool.

The summation of the results is that pH of the application bath and choice of softening agent are the two most important factors that may affect the uptake of Eulan WA new by wool. The temperature of the bath does not appear to be critical although it may determine the rate of pick-up and perhaps also the uniformity of the treatment.

4. CONCLUSION

It is concluded that maximum efficiency of application of Eulan WA new to wool will be obtained under the following conditions :

- (i) pH of application bath to be between 4.0 and 7.0;
- (ii) temperature of bath to be not less than 25°C but preferably not less than 40°C as recommended by the manufacturer;
- (iii) softening agents used as pre- or after-treatment or in the application bath preferably not to be ionic in character;
- (iv) wool being treated to be neutral to slightly acidic, but certainly not alkaline.

5. REFERENCES

1. Bayer Australia Ltd. (1963). Application of Eulan WA new. Technical Information Bulletin No. LE911e/Fa.
2. Langheinrich, K. (1973). Mothproofing with Eulan. Bayer Farben Revue, Special Edition No. 8.
3. Ciba-Geigy Ltd. (1975). Dicrylan WK. Technical Information Bulletin No. 6071.

T A B L E 1

EFFECT OF pH AND AFTERTREATMENT WITH CULVERSOFT S75
ON THE DETERMINATION OF EULAN WA NEW
WHEN APPLIED AT 100°C

Sample Number	Percentage Eulan WA new determined	pH of bath
1	0.9	7.4
1A	0.5	
2	0.9	5.7
2A	0.6	
3	0.8	3.5
3A	0.6	
4	0.7	2.8
4A	0.4	
5	0.4	1.7
5A	0.3	

Samples marked with the letter "A" have been after-treated using 0.5% cationic softening agent - Culversoft S75.

T A B L E 2

EFFECT OF FABRIC pH AND TEMPERATURE

ON THE UPTAKE OF EULAN WA NEW

Application		Percentage Eulan WA new determined			
Method	Temperature	pH/3.5	7.4	8.3	9.2
Eulan WA new acetic acid 30%	40°C	0.8	0.9	0.6	0.3
	25°C	0.7	0.9	0.3	0.3
Eulan WA new acetic acid 30% Culversoft S75	40°C	0.7	0.4	0.4	0.2
	25°C	0.5	0.4	0.3	0.4
<u>Pretreated with Culversoft S75</u> <u>Then treated with Eulan WA new acetic acid 30%</u>	40°C	0.6	0.6	0.5	0.4
	25°C	0.7	0.7	0.5	0.6

T A B L E 3

EFFECT OF SILICONE ELASTOMER ON THE DETERMINATION

OF EULAN WA NEW

Percent Eulan WA new applied	Percent Eulan WA new determined					
	Dicrylan WK applied as a pretreatment			Dicrylan WK applied as an aftertreatment		
	4.0	2.0	1.0	4.0	2.0	1.0
0.8	0.5	0.5	0.8	0.7	0.8	0.7
0.6	0.5	0.5	0.6	0.5	0.5	0.4
0.2	0.1	0.1	0.1	0.3	0.3	0.3

(1) The amount of Eulan WA new determined to be present on the wool tops prior to aftertreating with Dicrylan WK was 0.8%, 0.6% and 0.2% respectively.

APPENDIX 1

MATERIALS

<u>Trade Name</u>	<u>Material</u>	<u>Supplier</u>
Culversoft S75	Quaternary imidazoline compound	Steetley Chemicals Pty. Ltd.
Dicrylan WK	Modified non-ionic polysiloxane	Ciba-Geigy Australia Ltd.
Dieldrin	Mixture of 85% hexachloroepoxy-octahydro-endo,exo-dimethano-naphthalene, 15% insecticidally active chlorinated hydrocarbons	Shell Chemical (Aust.) Pty. Ltd.
Eulan WA new	Substituted chlorinated diphenyl ether	Bayer Australia Ltd.
Glauber's salt	Sodium sulphate decahydrate	A.E. Walker Ltd.
Mitin FF high conc	Chlorinated diphenyl urea derivative	Ciba-Geigy Australia Ltd.
Phobotone SN	Stannous dibutyl dilaurate	Ciba-Geigy Australia Ltd.
Phobotone WS	Low molecular weight hydrogen siloxane emulsion	Ciba-Geigy Australia Ltd.

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