TECHNICAL REPORT
70-8-FL

FACTORS AFFECTING THE QUALITY OF FREEZE-DRIED PEAS

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Foreword

Freeze dried foods have been accepted by consumers due to their superior quality as compared with foods dried by conventional methods. Their use in the Military operational rations is increasing steadily and is expected to continue upward when the Armed Forces Feeding system shifts more towards convenience foods. Availability of freeze dried fruits and vegetables such as peas is not assured all year round due to seasonal production and processing.

This work was undertaken in order to provide data concerning the development of dehydrated food items from frozen commercial products, thus making it possible to procure dehydrated fruits and vegetables needed for military rations at any time of the year.

This work was conducted under Project No. 1J6-62708-D553, Food Processing and Preservation Techniques.

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ABSTRACT

The effects of extended blanching, sulfiting and packaging on the quality of freeze dried peas prepared from commercially frozen products and stored for six months at 100°F. were investigated. Results indicated that acceptable freeze dried peas can be prepared from commercial individually quick frozen (IQF) peas by thawing, slitting, sulfiting, refreezing, freeze drying and packaging in tin cans under vacuum or nitrogen.

INTRODUCTION

The present military purchase document for Peas, Sweet Dehydrated, MIL-P-43453 requires the use of fresh peas for the production of style B (freeze dried) peas. Since the production season of fresh peas is relatively short, procurement of freeze dried peas is closely related to and significantly affected by the seasonal changes of this item.

Information on the use of frozen instead of fresh peas for the production of freeze dried peas is limited, incomplete and inconclusive in regard to the effect of thawing, refreezing, slitting, reblanching, and sulfiting on the quality of the finished product. Therefore this work was carried out in order to determine the effect of such variables on the quality of freeze-dried peas. Hand, et. al. (1954) found that slitting the seed coat of peas prior to dehydration facilitated the drying process and improved the quality of the rehydrated product as measured by rehydration capacity and texture. Pettit (1953) reported that green beans which had been frozen prior to heated-air dehydration were greatly superior in acceptability and rehydration characteristics to non-frozen beans. However, when peas are dehydrated by the prefreeze method they are not materially better than when not prefrozen. Moyer, et. al. (1959) stated that freezing and thawing increases slightly the drying rates of older peas. He also indicated that increasing the blanch increased the rehydration ratio.

EXPERIMENTAL PROCEDURES

Individually quick frozen (IQF) peas were purchased from the local retail market. The peas were thawed, divided into two lots and one lot blanched for 3 minutes in boiling water. This was an extended blanch (the commercially frozen peas had been blanched prior to freezing) in order to assure the inactivation of the peroxidase enzyme before freeze drying. The second lot was not blanched. The seed coat was then mechanically slit at several points in order to facilitate the removal of water during the freeze drying. Slitting also improves rehydration of the freeze dried peas.

One-half of each lot was sulfited by dipping in solution of sodium metabisulfite to yield approximately 400 ppm. All the lots were refrozen at -20°F. and then freeze dried with a platen temperature of 120°F. for 16 hours.

Half of the freeze dried peas for each lot were packed in No. 2-1/2 tin cans under nitrogen and the other half under vacuum. Representative samples of each variable were stored at 40, 70 and 100°F. for a period of six months.

Freeze dried peas were rehydrated by placing them in boiling water (approximately 4/1 ratio water to peas by weight) and allowing to stand for 12 minutes in a covered pan. Additional heat was not applied. Texture of rehydrated peas was measured by means of the Lee-Kramer shear press using the regular cell with 30 seconds down stroke. Rehydration ratio was determined by dividing the rehydrated weight of the peas by the dry weight.

Technological panel evaluations for flavor, texture and color were conducted by 10 trained judges, using a 9-point scale (1= extremely poor; 9= excellent). Overall acceptability of the peas was determined by a consumer panel of 32 judges using a 9-point Hedonic scale (1=dislike extremely; 9= like extremely).

RESULTS AND DISCUSSION

Results of the technological panel ratings, consumer panel ratings, rehydration ratios, and texture as measured by the shear press are shown in Tables 1, 2, 3 and 4, respectively. Analysis of variance of these results are shown in Table 5.

Storage of the peas for 6 months at 100°F. indicates that unextended blanched peas received significantly higher technological ratings than the extended blanched peas. However, there appeared to be no difference when peas were stored at 40°F. or 70°F.

Extended blanching had no significant effect on the acceptance ratings for peas stored 6 months at 100°F. However, peas treated with SO_2 showed higher ratings than the untreated ones. No significant differences were found between peas packaged under nitrogen and those vacuum packaged when stored at 100°F. for 6 months. However, significant differences were shown at lower storage temperatures.

Peas which received extended blanching and SO_2 treatments, and were stored for 6 months at 100°F. exhibited significantly higher rehydration ratios. These treatments did not affect the technological or the acceptance ratings. The various treatments showed no significant effect on texture of peas after storage for 6 months at 100°F.

CONCLUSIONS

Freeze dried peas of acceptable quality meeting the military requirement of storage stability for 6 months at 100°F. can be prepared from commercially frozen IQF peas by thawing, slitting, sulfiting, refreezing, freeze drying and packaging in tin cans under vacuum or nitrogen.

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3. Pettit, L.A., Dehydration of green beans and peas, Activities Report, published by the Research and Development Associates, Food and Container Institute. Vol. 5 No. 1, P-20-22, 1953.

Table 1. Average Ratings (Technological Panel) of Rehydrated Peas as Affected by Treatments and Storage Temperature

Treatments	Initial	40° F.		70° F.		100° F.	
		3 mo.	6 mo.	3 mo.	6 mo.	3 mo.	6 mo.
Blanched, SO_2, N_2	5.7	5.9	5.1	6.2	5.2	5.5	5.6
Blanched, SO_2, Vac.	5.5	5.9	5.7	5.6	5.1	5.9	5.7
Blanched, N_2	5.1	5.7	5.1	5.3	4.8	5.9	5.1
Blanched, Vac.	5.9	5.7	5.0	5.4	5.0	5.6	5.5
SO_2, N_2	6.2	5.9	5.3	6.1	6.0	6.0	6.6
SO_2, Vac.	6.3	5.7	6.1	5.8	6.5	6.1	6.2
N_2	5.9	5.4	5.7	5.5	5.8	6.8	6.3
Vac.	5.7	6.2	5.4	5.6	6.2	6.0	6.1

Table 2. Average Acceptance Ratings (Consumer Panel) of Rehydrated Peas as Affected by Treatments and Storage Temperature

Treatments	Initial	40°F.		70°F.		100°F.	
		3 mo.	6 mo.	3 mo.	6 mo.	3 mo.	6 mo.
Blanched, SO_2, N_2	5.9	5.8	5.5	5.7	6.4	5.8	6.4
Blanched, SO_2, Vac.	5.8	5.9	5.8	6.2	6.5	6.1	6.4
Blanched, N_2	6.0	5.3	5.5	5.2	5.8	5.3	5.9
Blanched, Vac.	6.1	5.5	5.5	5.5	6.3	5.2	6.2
SO_2, N_2	6.1	6.1	6.3	6.7	6.4	6.0	6.0
SO_2, Vac.	6.2	6.5	5.8	6.6	6.5	6.0	6.7
N_2	6.5	5.9	5.2	6.0	6.2	5.6	5.8
Vac.	5.9	5.9	5.1	6.1	5.9	6.1	6.2

Table 3. Rehydration Ratios $\left(\frac{\text{Rehydrated Weight}}{\text{Dry Weight}}\right)$ of Freeze-Dried Peas as Affected by Treatments and Storage Temperatures

Treatments	Initial	40°F.		70°F.		100°F.	
		3 mo.	5 mo.	3 mo.	5 mo.	3 mo.	5 mo.
Blanched, SO_2, N_2	4.00	3.95	3.60	3.90	3.95	4.05	4.10
Blanched, SO_2, Vac.	3.95	3.95	3.70	3.80	3.70	4.20	4.15
Blanched, N_2	4.10	3.90	3.95	4.10	3.95	3.90	3.95
Blanched, Vac.	3.90	3.80	4.00	4.15	3.95	3.85	3.95
SO_2, N_2	3.80	3.75	3.85	3.90	3.80	3.70	3.75
SO_2, Vac.	3.80	3.70	3.90	4.00	3.90	3.90	3.95
N_2	3.95	3.65	3.60	4.05	3.90	4.00	3.85
Vac.	3.90	3.85	3.65	3.70	3.60	3.80	3.70

Table 4. Texture of Rehydrated Peas as Affected by Treatments and Storage Temperature

Treatments	Initial	40°F.		70°F.		100°F.	
		3 mo.	6 mo.	3 mo.	6 mo.	3 mo.	6 mo.
	Lbs	Lbs	Lbs	Lbs	Lbs	Lbs	Lbs
Blanched, SO_2, N_2	415	425	297	457	358	382	330
Blanched, SO_2, Vac.	400	475	370	445	338	375	327
Blanched, N_2	400	367	326	435	348	380	318
Blanched, Vac.	395	377	327	440	345	390	321
SO_2, N_2	365	367	312	387	293	422	293
SO_2, Vac.	390	[illegible]	295	395	305	392	305
N_2	415	395	372	432	350	450	312
Vac.	405	412	331	435	348	465	318

Table 5. Analysis of Variance Results

Factor	Technological Panel Rating	Consumer Panel Rating	Texture Shear Press	Rehydration Ratio
Treatments (Blanched, SO_2, N_2)	N.S.	N.S.	N.S.	*
Treatment (Blanched, SO_2, Vac.)	N.S.	N.S.	N.S.	*
Treatment (Blanched, N_2)	N.S.	N.S.	N.S.	*
Treatment (Blanched, Vac.)	N.S.	N.S.	N.S.	*
Treatment (SO_2, N_2)	*	*	N.S.	N.S.
Treatment (SO_2, Vac.)	*	*	N.S.	N.S.
Treatment (N_2)	*	*	N.S.	N.S.
Treatment (Vac.)	*	N.S.	N.S.	N.S.
Treatment x Storage Temperature	N.S.	N.S.	N.S.	*
Treatment x Storage Time	N.S.	N.S.	N.S.	N.S.
Storage Time x Storage Temperature	N.S.	*	N.S.	N.S.

* = $P > 0.05$ N.S. = Not significant at $P > 0.05$

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Frozen foods	9		7		7	
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Military rations	4				4	
Blanching			6			
Sulfiting	8		6			
Packaging	8		6			
Quality			7			
Thawing	8					
Slitting	8					
Freezing	8					
Nitrogen	10					
Vacuum	10					