FURTHER STUDIES ON PACKAGING AND STORAGE OF SOME COMPOUNDED SOUP POWDERS

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ABSTRACT

Laminated aluminium foil has been found to be the best packaging material for storage of compounded soup powders under tropical conditions. At 25°C, shelf life of soup powders with medium moisture (3·5—5·5 per cent) and packed in plain sanitary cans is about 8 months which may be extended to about one year in laminated aluminium foil bags. Shelf life is better in low moisture packs compared with medium or high moisture packs.

INTRODUCTION

Packaging and storage studies on compounded soup powders containing single bases like tomato, carrot, potato, beans, peas, chicken or mutton have already been reported from this Institute[1]. Further work has resulted in the formulation of four recipes (chicken, split bean, cauliflower and mixed vegetable soup powders) in which two or more bases have been used. Onion soup powder has been compounded from a single base. The present paper deals with investigations on the packaging and storage of these products.

MATERIALS AND METHODS

Chicken, potato, carrot, pea, cabbage, cauliflower, split field beans, onion and tomato were dehydrated as described in Table 1. Soup powders were compounded using minus 60 mesh bases as per recipes given in Table 2. For storage studies, effect of different packaging materials like 300 and 500 gauge polyethylene, polycell, double M.S.T., cellophane* glassine (inside) and waxed paper (outside) combination, laminated heat sealable aluminium foil† and sanitary plain cans; two storage conditions (*i*) 25°C and 75 per cent R. H. and (*ii*) 37°C and 92 per cent R. H.; and three moisture levels (low —2 to 3 per cent, medium —3·5 to 5·5 per cent and high —6 to 7·5 per cent) were studied. Samples in glass bottles stored at 0°C served as control. About 60 gms. and 120 gms. of material were packaged in flexible films and plain cans respectively. Periodic examination for moisture pick-up, free fatty acids, ascorbic acid, β-carotene and organoleptic quality was made during storage. Methods employed were the same as reported earlier[1]. Free fatty acids (F. F. A.) were determined by A.O.A.C. method[2] and expressed as percentage oleic acid.

RESULTS AND DISCUSSION

1. *Equilibrium relative humidity*—The equilibrium moisture contents at 25°C of soup powders at different relative humidities are shown in Figure I. It is seen that in onion soup powder, the critical moisture content is 4·5 per cent corresponding to 40 per cent E. R. H., while in the others the respective values are 6—6·5 per cent and 53—60 per cent. The lower critical moisture content in the case of onion soup powder was

* Double layer moisture-proof heat-sealable transparent cellulose film.

† 450 gauge laminate of aluminium foil/paper/aluminium foil with a heat-sealable coating inside ("R" type of laminate).

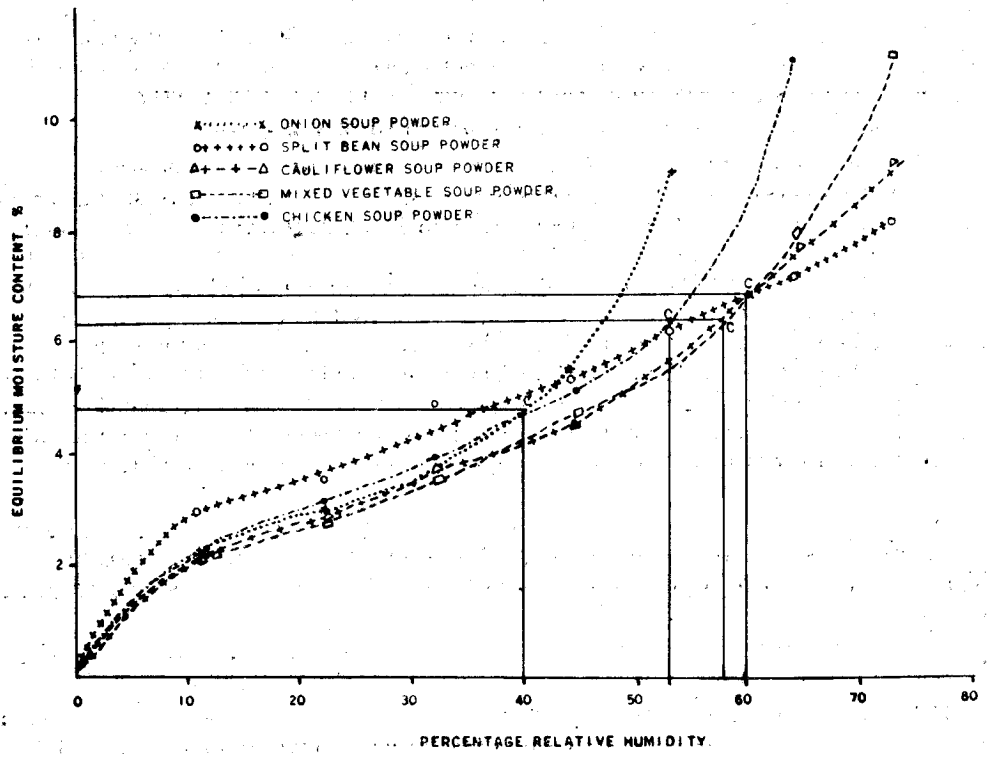

FIG 1—Humidity, moisture, equilibrium curve for chickens, split-bean, cauliflower, mixed vegetables and onion soup powders.

obviously due to the extremely hygroscopic nature of dehydrated onions. Above these moisture levels, the free-flowing characteristics of the soup powders were adversely affected and they tended to form lumps. Therefore, packaging requirements to provide protection against moisture ingress will have to be more stringent in case of onion soup powder than in others. At equilibrium relative humidities ranging from 84 to 93 per cent, mould growth was visible after about 11 days in split bean soup, 18 days in cauliflower, mixed vegetables and chicken soups and 31 days in onion soup powders. Sulphur compounds in onions seem to delay the appearance of mould in the onion soup powder.

2. *Storage studies*—Data regarding changes in moisture, free fatty acids and organoleptic quality of soup powders packed in different flexible films and stored at 37°C—92 per cent R.H. and 25°C—75 per cent R.H. are given in Tables 3 and 4.

(*i*) *Shelf-life in flexible films at 37°C and 92 per cent R. H.*—

It is seen that heat-sealable laminated aluminium foil was the best package up to a storage period of 3 months. Glassine bags enclosed in waxed paper were found to be unsuitable because of poor resistance to moisture ingress and technical difficulties in heat sealing. Split bean soup powder packed in these bags was unacceptable even after one month's storage. 500 and 300 gauge polyethylene and polycell bags were found to impart off flavour to split bean, cauliflower and onion soups and were judged as unacceptable within a month. Cellophane was found to absorb moisture at high humidity and thus lose its dimensional stability during storage and was therefore considered unsuitable.

(*ii*) *Shelf-life in flexible films at 25°C and 75 per cent R. H.*—

Polyethylene of 300 and 500 gauge, polycell or double M. S. T. cellophane may be used for packing soup powders for a period not exceeding 4 months. In laminated aluminium foil the products remained acceptable even at the end of 10 months.

(*iii*) *Comparison of laminated aluminium foil with plain sanitary cans*—

Organoleptic equality of soup powders with medium (3·5 to 5·5%) moisture, packaged in plain cans and examined after 3 months' storage at 37°C and 10 months' storage at 25°C was found to be inferior to the corresponding samples packaged in laminated aluminium foil. The soups in cans developed a distinct off flavour probably due to its contact with the metal surface. Control batches packaged in laminated aluminium foil bags to which strips of tin or aluminium were added also developed the off flavour thus proving that plain metal containers are not quite suitable for this purpose. Laminated aluminium foil bags were free from this defect as the product did not come in contact with aluminium due to the inner lining of heat sealable material. On the other hand at 25°C, soup powders having medium (3·5 to 5·5 per cent) moisture were found to have shelf-life of about 8 months in plain sanitary cans which may be extended to about one year in laminated aluminium foil bags.

It is quite possible that the soup powders may have as long a shelf-life in lacquered cans as in aluminium foil bags. No information is, however, available in the literature on the storage behaviour of soup powders in lacquered cans vis-a-vis plain sanitary cans.

(*iv*) *Storage in plain sanitary cans with low, medium and high moisture levels of soup powders*—

Data regarding organoleptic quality of soup powders with low (2—3%), medium (3·5—5·5%) and high (6—7·5%) moisture levels stored in plain sanitary cans at 37°C and 25°C are given in Tables 5 and 6. Results show that at 37°C the soup powders having high and medium moisture levels were unacceptable at the end of 1—2 months and 2—3 months respectively while in the case of low moisture content the products were in good condition even after 3 months. At a storage temperature of 25°C the shelf-life of products was 4 months for high moisture packs, 6—8 months for medium moisture packs and 10 months for low moisture packs.

Even though free fatty acids increased considerably during storage, organoleptic quality was not much affected, probably due to the dominant flavour of spices in the soup powders.

For prolonged storage under tropical conditions, the best results may be obtained by packaging the soup powders at a moisture level of about 3 per cent in laminated aluminium foil bags.

(*v*) *Retention of sulphur dioxide, ascorbic acid and β-carotene during storage*—

Data regarding retention of sulphur dioxide, ascorbic acid and β-carotene given in Table 7 show that retention during storage of SO_2 is fairly good, of ascorbic acid rather poor (except in mixed vegetable soup containing low moisture) and of β-carotene fairly good. In general, the retention is better in low moisture packs when compared with high moisture packs.

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TABLE I
METHODS OF DEHYDRATION OF BASES

Base	Pretreatment	Tray loading		Drying conditions		Drying ratio	
		Main drier	Through flow			Unprepared	Prepared
1. Chicken ..	Cooked at 240°F for about 30 minutes deboned and minced along with concentrated gravy after decanting its fatty layer.	5-6 Kg/sqm.	25-30 Kg/sqm.	Cross flow drier ..	85°C—1 hr 70°C—1 hr	6 : 1	2·5 : 1
				Through flow drier	60°C—1 hr		
2. Potato ..	Steamed 1/8″ thick peeled potato slices for 3-4 minutes and soaked for 10 minutes in 0·125% Kms. solution using about 0·5 Kg. solution per Kg.	—do—	—do—	Cross flow drier ..	85°C—1 hr 80°C—1 hr 70°C—1 hr	7 : 1	5 : 1
				Through flow drier	60°C—3 hrs		
3. Carrot ..	As above but steamed for 8-10 minutes and used 0·25% Kms. solution.	—do—	—do—	Cross flow drier ..	85°C—1 hr 80°C—1 hr 70°C—1 hr	18 : 1	16 : 1
				Through flow drier	60°C—5 hrs		
4. Pea ..	Green pea seeds soaked in 2% sodium carbonate solution for 30 mins. washed well in water and blanched in boiling water containing 0·4% Kms., 0·1% Mg O and 0·1 $NaHCO_3$ for 3 mins.	—do—	—do—	Cross flow drier ..	85°C—½ hr 80°C—½ hr 70°C—2 hrs	10 : 1	4 : 1
				Through flow driver	60°C—4 hrs		
5. Cabbage ..	After removing outer leaves and cores, 3/16″ thick shreds are steamed for 5-10 minutes and steeped for 10 mins. in 0·25% Kms. solution using about 0·5 Kg. solution for Kg. of shreds.	—do—	—do—	Cross flow drier ..	85°C—1 hr 80°C—1 hr 70°C—1 hr	18 : 1	15 : 1
				Through flow drier	60°C—4 hrs		
6. Cauliflower	Stalks covering leaves and stems were removed, flowers were broken apart, cut into small pieces, steamed for 5-7 mins. and steeped for 10 mins. in 0·125% Kms. solution, using 0·5 Kg. solution for Kg. of flowers.	—do—	—do—	Cross flow drier ..	85°C—1 hr 80°C—1 hr 70°C—1 hr	35 : 1	18 : 1
				Through flow drier	60°C—4 hrs		
7. Split field bean	Field bean seeds were deskinned by boiling in 1% $NaHCO_3$ for 5-7 mins. and rubbing the skin under spray of water. They were blanched as in case of green peas.	—do—	—do—	Cross flow drier ..	85°C—½ hr 80°C—½ hr 70°C—2 hrs	10 : 1	4 : 1
				Through flow driver	60°C—4 hrs		
8. Onion ..	Outer dry leaves were removed by trimming and peeling and pieces cut into 1/8″ thick slices.	—do—	—do—	Cross flow drier ..	70°C—3 hrs	10 : 1	8 : 1
				Through flow drier	60°C—4 hrs		
9. Tomato ..	Washed, cut into 3/16″ thick slices and sprayed with 0·25% Kms. solution, using 0·5 Kg solution per Kg. of slices.	—do—	—do—	Cross flow drier ..	85°C—1 hr 80°C—1 hr 70°C—1 hr	16 : 1	14 : 1
				Through flow drier	60°C— 5 hrs		

TABLE 2

SOUP POWDER RECIPES

Raw materials/ Soup component	Chicken soup	Split bean soup	Cauliflower soup	Mixed veg. soup	Onion soup
	Kg.	Kg.	Kg.	Kg.	Kg.
Chicken	150	..	..	..	..
Potato	300	300	300	300	..
Carrot	75	..	..	75	..
Pea	75	..	75	75	..
Cabbage	75	..	75	150	..
Cauliflower	..	..	75	75	..
Cauliflower powder	..	..	75	..	..
Split field bean	..	300	..	..	..
Split field bean powder	..	150	..	..	..
Onion	..	..	..	..	800
Tomato	75	..	..	75	..
Corn Starch	150	150	120	150	..
Skim milk powder	150	150	120	150	..
Hydrogenated groundnut oil	150	150	120	150	240
Common salt	300	300	240	300	320
Mixed spices	22·5	22·5	18	22·5	24
M. S. G.	15	15	12	15	16
Sugar	..	..	..	..	80
Caramel	..	..	..	..	32

TABLE

CHANGES IN MOISTURE, FREE FATTY ACIDS AND ORGANOLEPTIC QUALITY OF SAMPLES

Storage period in months		One			
Soup Powder	Packaging material	Moisture %	F.F.A. %	Organoleptic score on the reconstituted sample	
				Colour	Flavour
Chicken soup powder	Initial	4·14	4·98	5	5
	Poly cell	7·97	21·7	3	2
	Double M.S.T. Cellophane ..	22·14	23·5	3	2
	Aluminium foil	4·23	15·8	5	5
Split bean soup powder	Initial	4·76	6·22	5	5
	Polyethylene 500 gauge ..	5·93	30·5	..	..
	Polyethylene 300 gauge ..	6·00	31·2	4	1
	Poly cell	7·04	33·9	4	1
	Double M. S. T. Cellophane ..	12·86	39·5	3	2
	Aluminium foil	4·84	26·3	3	3·5
Cauliflower soup powder	Initial	3·53	4·24	5	5
	Polyethylene 500 gauge ..	4·25	22·5	4	1
	Polyethylene 300 gauge ..	4·70	25·2	4	1
	Poly cell	5·58	27·5	3	1
	Double M. S. T. Cellophane ..	10·35	33·9	3	3·5
	Aluminium foil	3·23	19·4	5	5
Mixed vegetable soup powder	Initial	3·67	5·40	5	5
	Poly cell	7·47	30·6	3	2
	Double M.S.T. Cellophane ..	12·87	34·4	3	3·5
	Aluminium foil	3·79	20·5	5	5
Onion soup powder	Initial	4·02	3·13	5	5
	Polyethylene 500 gauge ..	5·25	10·1	4	1
	Polyethylene 300 gauge ..	5·43	10·6	4	1
	Poly cell	6·52	11·24	3	3·5
	Double M. S. T. Cellophane ..	9·22	11·44	3	3·5
	Aluminium foil	4·03	9·94	5	5

Organoleptic

Colour	
Like control	5
Slightly more brown than control	4
Brown	3
Deep brown	2
Almost black	1

3

PACKED IN DIFFERENT FLEXIBLE FILMS (STORED AT 37°C AND 92 PER CENT R. H.)

Two				Three			
Moisture %	F.F.A. %	Organoleptic score on the reconstituted sample		Moisture %	F.F.A. %	Organoleptic score on the reconstituted sample	
		Colour	Flavour			Colour	Flavour
..	..	..	..	..	..	..	..
11·47	..	2	1	..	..	..	..
28·15	..	2	1	..	..	..	..
4·30	25·1	4	3·5	4·35	26·2	3	3·5
..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	..
9·1	37·9	2	1	..	..	..	..
21·36	42·7	2	1	..	..	..	..
5·04	32·1	4	5	5·18	38·6	3	3·5
..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	..
31·3	54·2	2	1	..	..	..	..
3·27	27·9	4	5	3·37	32·9	3	3·5
..	..	..	..	..	..	..	..
8·27	..	2	1	..	..	..	..
16·97	..	2	1	..	..	..	..
3·74	29·2	4	5	3·76	32·9	3	3·5
..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	..
8·22	15·9	2	2	13·64	..	1	1
17·30	18·8	2	2	..	..	1	1
4·07	12·6	4	5	4·02	14·6	3	3·5

score

Flavour	
Like control	5
Fairly strong	4
Weak	3
Very weak	2
No flavour	1

TABLE

CHANGES IN MOISTURE, FREE FATTY ACIDS AND ORGANOLEPTIC QUALITY OF SOUP POWDERS PACKED IN DIF

Storage period in Months		Two				Four			
Soup powder	Packaging material	Moisture %	F.F.A. %	Organoleptic score on the reconstituted sample: Colour	Flavour	Moisture %	F.F.A. %	Organoleptic score on the reconstituted sample: Colour	Flavour
Chicken soup powder	Initial	4·14	4·98	5	5	..	..	..	..
	Poly cell	5·67	16·5	4	3·5	6·29	22·3	3	2
	Double M.S.T. Cellophane	8·0	22·4	4	3·5	7·57	49·7	4	3·5
	Al. foil	4·14	14·6	5	5	4·14	16·4	5	5
Split bean soup powder	Initial	4·76	6·22	5	5	..	..	..	..
	Polythylene 500 gauge	5·25	24·1	4	3·5	5·41	27·4	4	3·5
	Polyethylene 300 gauge	5·67	26·8	4	3·5	5·50	31·8	4	3·5
	Poly cell	5·86	26·9	4	3·5	5·96	33·0	4	3·5
	Double M.S.T. Cellophane	7·16	33·8	4	3·5	6·39	36·9	4	3·5
	Al. foil	4·76	22·0	5	5	4·76	29·2	4	5
Cauliflower soup powder	Initial	3·23	4·24	5	5	..	..	..	..
	Polyethylene 500 gauge	3·76	19·1	4	3·5	4·06	26·0	4	3·5
	Poylethylene 300 gauge	3·98	20·0	4	3·5	4·45	31·8	4	3·5
	Poly cell	5·58	20·7	4	3·5	4·95	31·5	4	3·5
	Double M.S.T. Callophane	5·46	25·0	4	3·5	6·03	39·7	3	2
	Al. foil	3·23	16·4	5	5	3·23	20·9	5	5
Mixed vegetable soup powder	Initial	3·67	5·4	5	5	..	..	..	..
	Poly cell	5·03	19·2	4	3·5	6·07	33·1	3	2
	Double M.S.T. Cellophane	5·6	21·6	3	2	8·04	37·9	2	1
	Al. foil	3·67	14·3	5	5	3·73	20·9	5	5
Onion soup powder	Initial	4·02	3·13	5	5	..	..	..	..
	Polyethylene 500 gauge	4·47	7·53	4	3·5	4·82	10·2	3	2
	Polyethylene 300 gauge	4·65	7·24	4	3·5	4·90	10·7	3	2
	Poly cell	4·77	7·41	4	3·5	5·92	11·8	4	3·5
	Double M.S.T. Cellophane	5·54	7·94	4	3·5	6·41	12·2	4	3·5
	Al. foil	4·05	6·90	5	5	4·06	9·62	5	5

Colour	Organoleptic
Like control	5
Slightly more brown than control	4
Brown	3
Deep brown	2
Almost black	1

4

FERENT FLEXIBLE FILMS STORED AT 25°C AND 75 PER CENT R. H.

Six				Eight				Ten			
% Moisture	% F.F.A.	Organoleptic score on the reconstituted sample		% Moisture	% F.F.A.	Organoleptic score on the reconstituted sample		% Moisture	% F.F.A.	Organoleptic score on the reconstituted sample	
		Colour	Flavour			Colour	Flavour			Colour	Flavour
..	..	..	..	..	..	..	..	..	..	..	..
6·86	31·7	3	2	7·54	36·1	2	1	..	..	..	..
7·89	64·2	3	2	8·75	..	2	1	..	..	..	..
4·35	20·6	5	5	4·28	26·0	5	5	4·2	27·2	4	3·5
..	..	..	..	..	..	..	..	..	..	..	..
5·68	45·8	3	..	..	..	..	..	..	..	..	..
5·96	44·8	3	1	..	..	..	..	..	..	..	..
6·46	45·6	3	2	7·26	55·8	2	1	..	..	..	..
7·26	56·8	2	1	..	..	..	..	..	..	..	..
4·76	40·5	4	3·5	4·76	44·9	3	3·5	4·8	47·1	2·5	3·5
..	..	..	..	..	..	..	..	..	..	..	..
4·45	34·4	3	2	4·58	..	2	1	..	..	..	..
4·77	39·7	3	2	4·73	..	2	1	..	..	..	..
5·72	35·8	2	1	..	..	..	..	..	..	..	..
7·22	39·8	2	1	..	..	..	..	..	.		
3·34	25·3	4	3·5	3·24	22·1	4	3·5	3·38	26·1	4	
..	..	..	..	..	..	..	..	..	..	..	..
6·35	35·2	2	1	..	..	..	..	..	..	..	..
..	..		..	..	..	..	..	..	..	..	..
3·73	23·3	5	5	3·73	28·5	4	3·5	3·87	31·8	4	3·5
..	..	..	..	..	..	..	..	..	..	..	..
5·20	13·4	3	2	5·43	15·6	2	1	..	..	..	..
5·36	15·1	3	2	6·16	17·3	2	1	..	..	..	..
6·63	14·6	2	1	..	..	..	..	..	..	..	..
7·14	15·1	1	..	..		..	..	..	..	..	..
4·05	11·2	5	4·08	14.1	4	3·5	4·4	15·1	15·1	4	3·5

score

Flavour	
Like control	5
Fairly strong	4
Weak	3
Very weak	2
No flavour	1

TABLE 5

ORGANOLEPTIC QUALITY OF SOUP POWDERS STORED AT 37°C R. H. IN PLAIN SANITARY CANS AT LOW, MEDIUM AND HIGH MOISTURE LEVELS

Storage period in months		One			Two			Three		
Soup Powders	Moisture level	F.F.A.	Organoleptic score on the reconstituted sample		F.F.A.	Organoleptic score on the reconstituted sample		F.F.A.	Organoleptic score on the reconstituted sample	
			Colour	Flavour		Colour	Flavour		Colour	Flavour
Chicken soup Powder	2·74 (low)	10·3	4	3·5	13·9	4	3·5	19·4	3	2
	4·14 (medium)	14·8	3	2	..	3	1	..	..	..
	7·20 (high)	22·6	2	1	..	..	..	..	..	..
Split bean soup powder	2·74 (low)	16·8	5	5	22·3	4	5	21·9	3	3·5
	4·76 (medium)	27·8	4	3·5	41·1	3	3·5	43·2	2	1
	6·24 (high)	41·8	3	2	43·2	2	1	..	..	..
Cauliflower soup powder	2·8 (low)	14·7	5	5	16·1	3	3·5	18·7	3	3·5
	5·35 (medium)	26·7	4	3·5	36·6	2	1	..	..	..
	6·78 (high)	38·0	2	1	..	..	..	..	..	..
Mixed vegetable soup powder	2·41 (low)	13·3	5	5	20·3	4	3·5	28·7	3	3·5
	3·67 (medium)	14·7	4	3·5	22·5	3	2	34·4	2	1
	6·55 (high)	23·9	3	2	..	2	1	..	..	..
Onion soup powder	2·4 (low)	10·1	5	5	10·6	4	3·5	12·5	3	3·5
	4·02 (medium)	10·3	4	3·5	12·1	3	3·5	14·2	3	3

Organoleptic score

Colour		Flavour	
Like control	5	Like control	5
Slightly more brown than control	4	Fairly strong	4
Brown	3	Weak	3
Deep brown	2	Very weak	2
Almost black	1	No flavour	1

TABLE 6

ORGANOLEPTIC EQUALITY OF SOUP POWDERS STORED AT 25 °C IN PLAIN SANITARY CANS AT LOW, MEDIUM AND HIGH MOISTURE LEVELS

Soup powder	Moisture level	Storage period in months: Two — F.F.A. %	Two — Organoleptic score on the reconstituted sample: Colour	Two — Flavour	Four — F.F.A. %	Four — Colour	Four — Flavour	Six — F.F.A. %	Six — Colour	Six — Flavour	Eight — F.F.A. %	Eight — Colour	Eight — Flavour	Ten — F.F.A. %	Ten — Colour	Ten — Flavour
Chicken soup powder	2·74 (low) ..	8·5	5	5	13·3	5	5	17·3	5	5	17·8	5	5	18·5	4	3·5
	4·14 (medium)	13·4	5	5	23·2	4	3·5	26·9	3	2	28·4	3	2	28·7	3	2
	7·20 (high) ..	21·9	4	3	43·3	3	2	..	2	1	..	..	..	..	..	..
Split bean soup powder	2·74 (low) ..	18·9	5	5	24·2	5	5	26·8	5	5	31·5	4	3·5	35·8	3·5	3·5
	4·76 (medium)	21·4	5	5	28·2	5	5	33·7	4	3·5	42·9	3	2	51·2	2	1
	6·24 (high) ..	32·5	4	3.5	37·4	4	3·5	61·7	2	1	..	..	..	..	..	..
Cauliflower soup powder	2·80 (low) ..	10·4	5	5	12·7	5	5	15·1	4	3·5	17·46	4	3·5	19·32	4	3
	5·35 (medium)	25·0	5	5	33·1	4	3·5	37·9	3	2	42·6	3	2	44·3	3	2
	6·78 (high) ..	30·3	4	3·5	41·6	3	2	47·6	2	1	..	..	..	..	..	..
Mixed vegetable soup powder	2·41 (low) ..	8·5	5	5	13·3	5	5	17·3	5	5	28·2	4	3·5	28·8	4	3·5
	3·67 (medium)	13·4	5	5	23·2	4	3·5	26·9	3	2	31·2	3	2	31·9	3	2
	6·55 (high) ..	21·9	4	3·5	43·3	3	2	..	2	1	..	..	..	..	..	..
Onion soup powder	2·4 (low) ..	7·21	5	5	8·53	5	5	9·8	4	3·5	11·3	4	3·5	12·1	4	3·5
	4·02 (medium) ..	6·80	5	5	9·73	4	3·5	11·3	3	2	12·2	2	1	..	..	..

Organoleptic score

Colour		Flavour	
Like control	5	Like control	5
Slightly more brown than control ..	4	Fairly strong	4
		Weak	3
Brown	3	Very weak	2
Deep brown	2	No flavour	1
Almost black	1		

Table 7

Retention of SO_2, ascorbic acid and β-carotene in soup powders stored in aluminium foil bags and plain sanitary cans at 25°C and 37°C at different moisture levels

Soup powder	Container	Retention %						
		2 months at 25°C		10 months at 25°C			2 months at 37°C	
		Ascorbic acid	β-carotene	SO_2	Ascorbic acid	β-carotene	Ascorbic acid	β-carotene
		Initial values—SO_2—558 ppm, Ascobric acid 26·54 mg% and β-carotene—1·120 mg %						
	Aluminium foil bags	47·1	100·0	71·7	20·0	51·1	34·7	98·2
Chicken Cans	Low moisture	59·5	100·0	69·9	27·1	60·5	37·7	89·3
	Medium moisture	41·1	87·5	45·2	0·0	17·6	28·3	84·8
	High moisture	37·3	79·5	..	..	..	20·7	71·4
		Initial values—SO_2—343 ppm, Ascorbic acid 8·60 mg % and β-carotene—0·172 mg %						
Split Bean	Aluminium foil bags	62·1	52·3	97·6	28·2	34·3	32·0	52·3
Cans	Low moisture	77·5	52·3	87·8	25·4	20·4	29·1	52·3
	Medium moisture	47·7	52·3	78·1	24·8	11·6	23·3	46·5
	High moisture	38·8	52·3	..	..	..	14·5	46·5
		Initial values—SO_2—515 ppm, Ascorbic acid 34·50 mg % and β-carotene 0·048 mg %						
Cauli-Flower—	Aluminium foil bags	60·6	97·9	65·0	20·7	74·4	49·3	93·8
Cans	Low moisture	94·2	93·8	36·9	40·7	83·4	60·5	72·9
	Medium moisture	56·3	89·6	19·4	14·2	79·2	26·1	52·1
	High moisture	35·7	83·4	..	..	..	18·1	62·5
		Initial values—SO_2—515 ppm, Ascorbic acid 35·96 mg % and β-carotene 0·891 mg %						
	Aluminium foil bags	69·5	98·8	52·0	9·7	55·0	33·7	97·6
Mixed Vegetable—								
Cans	Low moisture	84·0	101·0	39·0	77·8	27·6	51·5	101·0
	Medium moisture	55·6	100·4	32·3	0·0	27·1	36·4	100·4
	High moisture	33·4	91·1	..	..	..	18·1	91·1