Studies on chemical composition of dried and dehydrated ripe mango cv Alphonso slices as affected by packaging material

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ABSTRACT

The present investigations were carried out at the Department of Horticulture, College of Agriculture, Dapoli, Dist Ratnagiri, Maharashtra. Osmotic dehydrated and dried mango slices were prepared from ripe fruits. During storage period, moisture, total soluble solids, reducing and total sugars of dehydrated ripe mango slices of all treatments were found to be increased and acidity, ascorbic acid and β-carotene to be decreased. Moisture and reducing and total sugars were found highest during the nine months of storage period in treatment ie slices prepared by steeping them in 70°B sugar solution containing 0.1 per cent KMS + 0.2 per cent ascorbic acid + 1 per cent citric acid + cabinet drying.

Keywords: Mango slices; osmotic dehydration; packaging materials; KMS; HDPE; ambient temperature

INTRODUCTION

Osmotic dehydration is an approach which involves two stages: first stage is removal of water using concentrated sugar syrup as osmotic agent and second stage is dehydration in air circulation where moisture percentage is reduced to about 10 per cent. At present ripe mangoes are supplied to the defense forces mainly in the form of canned slices in sugar syrup and due to high cost of cans, the canned slices become expensive and the bulk weight is another disadvantage (Jayaraman et al 1976). Thus there is a need to develop newer products which are light in weight and can be eaten directly without any preparation. The present investigations were therefore undertaken to study effect of dehydration of ripe mango slices using different sugar syrup treatments.

MATERIAL and METHODS

Mature fruits of cv Alphonso were obtained from the Department of Horticulture, Konkan Krishi Vidyapeeth, Dapoli, Maharashtra. Fruits were ripened at ambient temperature. Firm ripe fruits were washed, peeled and cut into slices. The slices were steeped in sugar solution as per treatments. Slices to steeping ratio was kept at 1:1 and stepping was done for 24 h. The slices were drained thoroughly over sieve and drained slices were dehydrated in cabinet drier at 55°C and control slices in sunlight till constant weight was observed. The dried slices were packed in 100, 200, 300 and 400 gauge HDPE bags and stored for 9 months at ambient temperature. The chemical properties were determined according to the method described by Ranganna (1986). The sugars were determined by the method described by Lane and Eynon (1923).

RESULTS and DISCUSSION

The results obtained are presented in Table 1.

Moisture: The moisture content at 9 months storage was found to be maximum in treatment T_6 (5.56%) and was significantly higher than other treatments. Packaging material P_1 (100 gauge) recorded maximum moisture content (4.83%) which was found to be significantly superior over the rest. The interaction effects were found to be significant at 9 months storage. The gain in moisture of slices may be attributed to moisture absorption from the atmosphere. Sagar et al (1999) and Amitabh and Tomar (2000) reported similar results in case of ripe mango slices.

Table 1. Effect of packaging material on chemical composition of dehydrated ripe mango slices during storage at ambient temperature (pooled data)

Treatment	Initial value	Moisture (%)					Initial value	TSS (°B)					Initial value	Acidity (%)				
		P_1	P_2	P_3	P_4	Mean		P_1	P_2	P_3	P_4	Mean		P_1	P_2	P_3	P_4	Mean
T_1	3.20	4.80	4.76	4.74	4.72	4.76	33.38	36.22	36.25	36.28	36.30	36.26	0.98	0.58	0.57	0.56	0.54	0.56
T_2	3.10	4.70	4.68	4.66	4.63	4.67	41.25	44.26	44.29	44.31	44.34	44.30	0.82	0.67	0.65	0.64	0.62	0.64
T_3	3.08	4.63	4.60	4.58	4.56	4.59	48.27	51.36	51.39	51.40	51.42	51.39	0.98	0.70	0.69	0.66	0.63	0.67
T_4	3.04	4.53	4.50	4.48	4.45	4.49	53.24	55.46	55.49	55.51	55.54	55.50	1.00	0.74	0.72	0.71	0.68	0.71
T_5	3.02	4.42	4.41	4.39	4.36	4.40	57.86	60.56	60.59	60.62	60.64	60.60	1.02	0.81	0.79	0.76	0.74	0.77
T_6	3.89	5.64	5.58	5.54	5.51	5.56	21.56	22.91	22.94	22.96	22.78	26.65	0.49	0.29	0.29	0.28	0.27	0.28
T_7	3.26	4.88	4.83	4.78	4.75	4.81	24.46	26.53	26.55	26.75	26.62	25.74	0.52	0.31	0.31	0.30	0.30	0.30
T_8	3.38	5.06	5.01	4.96	4.93	4.99	23.49	26.11	26.13	26.15	26.18	26.14	0.45	0.30	0.29	0.29	0.28	0.29
Mean	-	4.83	4.79	4.76	4.74	-	-	40.43	40.45	40.49	40.52	-	-	0.55	0.54	0.52	0.51	-

	Moisture	TSS	Acidity
Tr (SE)	0.016	0.008	0.007
$CD_{0.01}$	0.059	0.035	0.025
Pack (SE)	0.011	0.006	0.005
$CD_{0.01}$	0.040	0.022	0.018
Int (SE)	0.033	0.017	0.014
$CD_{0.01}$	0.122	NS	0.054

Table 1. Contd…..

Treatment	Initial value	Reducing sugar (%)					Initial value	Total sugar (%)					Initial value	Ascorbic acid (mg/100 g)				
		P_1	P_2	P_3	P_4	Mean		P_1	P_2	P_3	P_4	Mean		P_1	P_2	P_3	P_4	Mean
T_1	13.10	17.91	18.05	18.18	18.33	18.12	30.05	34.85	34.93	35.04	34.99	34.95	210	132	133	134.66	137.33	134.25
T_2	17.05	21.72	21.87	22.01	22.15	21.94	38.09	43.13	43.25	43.33	43.43	43.28	222	140.66	144.50	146.50	148.50	145.04
T_3	20.50	25.37	25.50	25.66	25.80	25.58	45.26	50.17	50.33	50.43	50.56	50.37	236	150.66	152.33	153.33	155.66	153.12
T_4	22.40	27.39	27.53	27.66	27.79	27.59	50.59	55.61	55.72	55.81	55.76	55.72	249	160.16	162.33	163.66	165.50	162.91
T_5	26.72	31.78	31.92	32.07	32.21	32.00	56.20	61.13	61.36	61.37	61.50	61.32	245	172.0	173.75	176.10	178.56	175.10
T_6	6.62	10.10	10.22	10.34	10.44	10.27	18.15	22.80	22.85	22.94	23.05	22.91	29	8.29	8.44	8.77	8.88	8.59

T_7	10.76	14.80	14.93	15.07	15.21	15.00	22.98	26.59	26.72	26.85	26.98	26.78	42	17.93	18.31	18.70	18.98	18.48
T_8	8.60	12.11	12.23	12.36	12.50	12.30	21.26	25.82	25.91	26.04	26.11	25.97	35	11.00	11.21	11.56	11.74	11.38
Mean	-	20.15	20.28	20.42	20.55	-	-	40.01	40.12	40.23	40.30	-	-	99.09	100.48	101.72	103.14	-

	Reducing sugar	Total sugar	Ascorbic acid
Tr (SE)	0.013	0.024	0.204
$CD_{0.01}$	0.048	0.088	0.756
Pack (SE)	0.009	0.017	0.144
$CD_{0.01}$	0.033	0.063	0.533
Int (SE)	0.027	0.049	0.408
$CD_{0.01}$	NS	NS	1.512

Table 1. Contd.....

Treatment	Initial value	B-carotene (mg/100 g)				
		P_1	P_2	P_3	P_4	Mean
T_1	9,015	6,953	6,963	6,973	6,983	6,968
T_2	9,165	7,023	7,032	7,042	7,052	7,037
T_3	9,253	7,123	7,136	7,147	7,157	7,141
T_4	9,450	7,488	7,498	7,509	7,520	7,504
T_5	9,512	7,567	7,577	7,587	7,599	7,583
T_6	2,890	1,993	2,005	2,016	2,026	2,010
T_7	4,940	3,685	3,695	3,705	3,716	3,700
T_8	3,910	2,755	2,765	2,776	2,788	2,771
Mean	-	5,573	5,584	5,594	5,605	-

Tr (SE): 0.735, $CD_{0.01}$: 2.725; Pack (SE): 0.520, $CD_{0.01}$: 1.928; Int (SE): 1.471, $CD_{0.01}$: NS

T_1: Steeping of slices in 30°B sugar solution containing 0.1% KMS + 0.2% ascorbic acid + 1% citric acid + cabinet drying, T_2: Steeping of slices in 40°B sugar solution containing 0.1% KMS + 0.2% ascorbic acid + 1% citric acid + cabinet drying, T_3: Steeping of slices in 50°B sugar solution containing 0.1% KMS + 0.2% ascorbic acid + 1% citric acid cabinet drying, T_4: Steeping of slices in 60°B sugar solution containing 0.1% KMS + 0.2% ascorbic acid + 1% citric acid + cabinet drying, T_5: Steeping of slices in 70°B sugar solution containing 0.1% KMS + 0.2% ascorbic acid + 1% citric acid + cabinet drying, T_6: Only sun drying of ripe mango slices, T_7: Only cabinet drying of ripe mango slices, T_8: Only solar drying of ripe mango slices, P_1: 100 gauge high density polyethylene, $P_{2:}$ 200 gauge high density polyethylene, $P_{3:}$ 300 gauge high density polyethylene, P_4: 400 gauge high density polyethylene

Total soluble solids: Highest TSS was observed in treatment T_5 (60.60°B) at 9 months storage. Packaging material P_4 recorded maximum TSS (40.52°B) and was significantly superior over the rest. Highest TSS noticed in slices could be due to more strength of syrup. The increase in TSS during storage can be attributed to conversion of non-reducing sugar into reducing sugar by the acids present in the product. Similar results are reported by Manjrekar (2005) in cashew apple candy.

Acidity: Highest acidity was observed in treatment T_5 (0.77%) at a month storage and was significantly superior over rest of the treatments. Packaging material P_1 recorded highest acidity (0.55%) at 9 months storage. Treatment combination T_5P_1 recorded highest acidity (0.81%) at 9 months and was significantly superior over the rest. The highest acidity in T_5 could be due to citric acid added to syrup at the time of steeping of slices. Decrease in acidity in storage period may be due to disappearance of SO_2 from the slices. Identical results to the present findings were reported by Sagar et al (1999) and Amitabh and Tomar (2000).

Reducing sugar: Highest reducing sugar was registered in treatment T_5 (32.00%) in 9 months which was significantly superior over all other treatments. Packaging material P_4 recorded highest reducing sugar (20.55%) at 9 months which was significantly superior over the rest. Increase in reducing sugar during storage might be due to increase in non-reducing sugar to reducing sugar caused by acids present in dehydrated products. These results are in line with the findings of Amitabh and Tomar (2000).

Total sugar: At 9 months storage maximum total sugar was registered by treatment T_5 (61.32%) and was significantly superior over all other treatments. Packaging material P_4 recorded highest total sugar (40.30%) at 9 months storage. Increase in total sugar during storage could be attributed to more rapid hydrolysis of polysaccharides and their subsequent inversion to reducing sugar. Similar findings are reported by Sagar et al (1999).

Ascorbic acid: Highest content of ascorbic acid was observed in treatment T_5 (175.10 mg/100 g) which was significantly superior over other treatments. Packaging material P_4 recorded highest ascorbic acid (103.14 mg/100 g). Treatment combination T_5P_4 registered maximum ascorbic acid (178.56 mg/100 g) which was significant over the rest. The highest ascorbic acid noticed in the slices can be attributed to the high level of SO_2 and greater protection caused by packaging material. Analogous results to present findings are reported by Sagar et al (1999).

β-carotene: Maximum β-carotene was registered in treatment T_5 (7,583 mg/100 g) at 9 months storage. Packaging material P_4 recorded highest total carotenoids (5,605 mg/100 g) at 9 months storage and was significantly superior than others. This could be due to temperature and light effect on pigments. The main cause of carotene degradation could be oxidation and further stimulation by presence of light, enzymes and co-oxidation of carotene which might have later isomerased to mutachrone. Sagar and Khurdiya (1996) and Sagar and Kumar (2009) reported similar results.

CONCLUSION

During the storage period, moisture, TSS, reducing and total sugars of dehydrated ripe mango slices of all treatments were found to increase whereas acidity, ascorbic acid and β-carotene were found to decrease. Maximum moisture, TSS, acidity, reducing and total sugars, ascorbic acid and β-carotene were found in slices prepared by stepping slices in treatment consisting of 70°B sugar solution containing 0.1 per cent KMS + 0.2 per cent ascorbic acid + 1 per cent citric acid + cabinet drying which was found to be best and remained palatable during nine months period of storage which were packed in 400 gauge high density polyethylene as compared to other treatments under study.

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