Studies on changes in chemical constituents of raw mango powder (Amchur) during storage

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ABSTRACT

Study was done on changes taking place in chemical constituents of raw mango powder (Amchur) during storage in the post-harvest technology laboratory of the horticulture section of Dr Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Maharashtra. The biochemical analysis of nutritional values viz acidity, ascorbic acid, starch and beta-carotene were carried out and were found to be decreased during a period of 9 months and the moisture, total soluble solids, reducing sugar and total sugar were found to be increased.

Keywords: Amchur; drying; dehydration; blanching; ambient temperature

INTRODUCTION

Raw green mangoes are mainly used in the processing of pickles, chutneys and dehydrated powder (Amchur). Raw mango is known to possess good amount of citric and mallic acid along with other nutrients (Rao et al 2012). Dry mango powder also known as Amchur is a fruity spice used to add citrusy flavour to various Indian foods. It is a special Indian spice that is made by grinding dried mango slices. The powder is known to attract the acidic and spicy flavour of the unripe mango and extend it in all the curries and chutneys in Indian cuisines. Amchur is recognized at national level by ISI as one of the spices and condiments listed in the IS specification. Dehydration of raw mangoes for preparation of Amchur was studied in detail by number of workers (Dabhade and Khedkar 1980c, Goyal et al 2006, Mehta and Tomar 1982). Packaging of Amchur is done in friction top tins or poly-lined gunny bags. Lot of variation is observed in quality of Amchur prepared in different states of the country with regards to colour, texture and acidity. In the present study an attempt has been made studying changes occurring during storage of Amchur packed in 100, 200, 300 and 400 gauges high density polyethylene.

MATERIAL and METHODS

Seventy five per cent mature mango fruits of cv Alphonso were obtained from Department of Horticulture, Konkan Krishi Vidyapeeth, Dapoli, Maharashtra during 2008 and 2009. The fruits were washed, peeled and cut lengthwise into slices of 1.5 cm. The slices were treated as per the treatments, dried/dehydrated and powdered by grinding, sieved and packed in 100, 200, 300 and 400 gauge HDPE bags of 8 cm x 8 cm size and stored at ambient temperature. These were analyzed for acidity, starch, ascorbic acid and beta-carotene at three months interval during storage period of nine months. The experiment was laid out in FCRD with 14 main treatments, four sub-treatments and three replications.

The main treatments were T_1 (Blanching slices for 5 min + 5 min dip in 0.5% KMS + sun drying), T_2 (Blanching slices for 5 min + 5 min dip in 1.0% KMS+ sun drying), T_3 (Blanching slices for 5 min + 5 min dip in 1.5% KMS + sun drying), T_4 (Blanching slices for 5 min + 5 min dip in 0.5% KMS + cabinet drying), T_5 (Blanching slices for 5 min + 5 min dip in 1.0% KMS + cabinet drying), T_6 (Blanching slices for 5 min + 5 min dip in 1.5% KMS + cabinet drying), T_7 [Slices dip in 0.5% KMS for 5 min + sun drying (no blanching)], T_8

[Slices dip in 0.1% KMS for 5 min + sun drying (no blanching)], T_9 [Slices dip in 1.5% KMS for 5 min + sun drying (no blanching)], T_{10} [Slices dip in 0.5% KMS for 5 min + cabinet drying (no blanching)], T_{11} Slices dip in 1.0% KMS for 5 min + cabinet drying (no blanching)], T_{12} (Slices dip in 1.5% KMS for 5 min + cabinet drying), T_{13} [No blanching + no KMS + sun drying (control)], T_{14} [No blanching + no KMS + cabinet drying (control)] and four sub-treatments were P_1 (100 gauge polyethylene), P_2 (200 gauge polyethylene), P_3 (300 gauge polyethylene), P_4 (400 gauge polyethylene).

RESULTS and DISCUSSION

The data on changes in moisture, TSS, acidity, reducing sugar, total sugar, ascorbic acid, starch and beta-carotene of Amchur during storage are presented in Table 1.

Moisture: Lowest moisture content was reported in treatment T_1 (9.00%) and packaging material P_4 (9.41%) and was found to be best as compared to all other treatments and packaging materials. The reason for lowest moisture content in 400 gauge packaging material could be attributed to more thickness of the polythene. Highest moisture was reported in treatment T_{14} (12.59%) and packaging material P_1 (12.59%). The gain in moisture during storage is attributed to moisture absorption from the atmosphere and permeability of the polythene bags to moisture vapour. Analogus results to present findings are reported by Dhabhade and Khedkar (1980a, 1980b) in Amchur.

TSS: Highest TSS was noticed in treatment T_6 (9.12°B) which was at par with T_5 (9.08°B) and significantly higher over rest of the treatments. Packaging material P_4 recorded the highest TSS (8.26°B). The increase in TSS during storage could be attributed to the conversion of non-reducing sugar into reducing sugar by acids present in the product. However Raorane (2003) recorded no change in TSS of Kokum rind powder prepared from rind of Kokum after preparation of syrup after 8 months storage in glass jars.

Acidity: Acidity decreased in all treatments irrespective of the packaging material at 3, 6 and 9 months storage. Maximum acidity was recorded in T_{13} (13.83%) and was found to be significantly superior over all other treatments. P_4 packaging material recorded highest acidity (11.40%) which was significantly superior over all other packaging materials. Treatment combination $T_{13}P_4$ recorded highest acidity (13.99%). Interaction effects were found significant throughout the storage period. Lowest acidity was recorded by T_1 and packaging material P_1 during the complete storage period. Amchur prepared from treatment T_{13} and packed in P_4 registered highest acidity compared to other treatments and packaging materials which could be due to absence of blanching whereas lowest acidity was recorded by T_1P_4 which could be due to loss of acid during blanching process. The decrease in acidity during storage period could probably be due to disappearance of SO_2 from the Amchur. Similar results were reported by Dabhade and Khedkar (1980a, 1980b) in Amchur.

Reducing sugar and total sugar: At 9 months storage period, maximum reducing sugar was found to be in T_{14} (15.65%) and was significantly superior over all other treatments. The interaction effects were found to be significant. Amchur packed in packaging material P_4 recorded highest reducing sugar (12.13%) and was significantly superior over all other treatments.

Maximum total sugar was reported in treatment T_{14} (26.32%) during nine months storage period. Similarly maximum total sugar was reported in P_4 packaging material (20.97%) which was significantly higher over rest of the packaging materials. The interaction effects were also found to be significant.

Increase in reducing and total sugar during storage could be attributed to more rapid hydrolysis of polysaccharides and their subsequent conversion to sugars. Similar results were reported by Dabhade and Khedkar (1980a, 1980b) in Amchur prepared from cv Totapuri and seedling mango.

Ascorbic acid: Highest ascorbic acid was recorded in T_6 (26.47 mg/100 g) at 9 months storage. Packaging material P_4 recorded highest ascorbic acid (19.62 mg/100 g) at 9 month storage. T_6P_4 recorded highest ascorbic acid (28.44 mg/100 g) at 9 months storage period. Lowest ascorbic acid was noticed in treatment T_{14} and packaging material P_1. Interaction effects were non-significant during 9 months storage period.

The highest content of ascorbic acid in T_6P_4 could be due to the dipping of slices in higher concentration of preservative solution used at the time of blanching and dehydration in cabinet drier which might have prevented loss of ascorbic acid. Loss of ascorbic acid was rather rapid in sun-dried samples which could be attributed to exposure of raw mango

Table 1. Effect of blanching, drying and dehydration on chemical composition of Amchur packed in different gauge packaging material during storage period of nine months

Treatment	Initial value	Moisture (%)					Initial value	Total soluble solids (°B)					Initial value	Titratable 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	5.60	10.40	9.50	8.76	7.35	9.00	7.18	8.08	8.13	8.18	8.21	8.15	13.40	10.22	10.29	10.38	10.42	10.33
T_2	5.65	10.62	9.57	8.88	7.74	9.20	7.23	8.11	8.27	8.34	8.38	8.27	13.70	10.34	10.43	10.52	10.63	10.48
T_3	5.82	10.69	9.68	9.01	7.72	9.27	8.05	8.85	8.92	8.97	9.01	8.94	14.58	10.77	10.85	10.91	10.98	10.88
T_4	5.90	11.25	10.28	9.47	7.38	9.60	8.10	8.96	8.99	9.00	9.05	9.00	13.06	10.46	10.58	10.68	10.77	10.63
T_5	6.10	11.43	10.60	9.85	8.33	10.05	8.16	9.01	9.05	9.10	9.15	9.08	13.55	10.13	10.20	10.30	10.37	10.26
T_6	6.50	12.30	11.35	10.70	9.84	11.05	8.20	9.03	9.06	9.15	9.20	9.12	13.65	10.49	10.54	10.61	10.68	10.58
T_7	6.45	12.44	11.75	10.73	9.42	11.08	7.05	7.87	7.93	7.99	8.04	7.96	15.32	11.25	11.34	11.45	11.54	11.39
T_8	6.49	12.28	11.28	10.58	10.25	11.09	7.08	7.78	7.84	7.88	8.00	7.88	15.62	11.64	11.71	11.80	11.90	11.76
T_9	6.56	12.69	11.87	11.27	10.00	11.43	7.10	7.91	8.00	8.04	8.06	8.00	15.70	11.92	11.98	12.07	12.14	12.03
T_{10}	6.68	12.87	11.85	11.40	9.78	11.47	7.12	7.92	7.59	8.00	8.10	7.99	16.80	11.23	11.34	11.44	11.51	11.38
T_{11}	7.12	13.16	12.54	11.69	10.66	11.96	7.14	8.00	8.07	8.08	8.13	8.07	15.03	11.55	11.63	11.71	11.79	11.67
T_{12}	7.16	13.36	12.87	11.82	11.43	11.99	7.16	8.19	8.25	8.30	8.35	8.27	15.14	11.51	11.58	11.70	11.78	11.64
T_{13}	7.22	13.30	12.50	11.48	10.37	12.22	5.68	6.67	6.73	6.78	6.84	6.75	18.66	13.67	13.80	13.89	13.99	13.83
T_{14}	8.12	13.60	12.86	11.53	10.77	12.59	5.75	6.89	6.94	7.02	7.08	6.94	17.81	12.96	13.05	13.13	13.43	13.10
Mean		12.59	10.86	10.18	9.41			8.09	8.15	8.20	8.26			11.17	11.25	11.34	11.40	

	Moisture		Total soluble solids		Titratable acidity	
	SE	$CD_{0.01}$	SE	$CD_{0.01}$	SE	$CD_{0.01}$
Treatment (T)	0.023	0.083	0.034	0.130	0.038	0.138
Packaging (P)	0.012	0.043	0.018	0.072	0.020	0.072
Initial value	0.046	0.167	0.068	NS	0.077	0.302

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	4.89	9.12	9.41	9.58	9.82	9.48	13.34	18.64	18.78	18.87	18.67	18.74	44.20	12.93	13.81	14.20	15.00	13.99
T_2	5.10	9.22	9.40	9.61	9.83	9.51	13.39	18.89	18.96	19.09	19.13	19.02	47.06	15.11	16.46	17.40	19.20	17.04
T_3	5.24	9.65	9.75	9.87	9.94	9.78	13.45	18.98	19.06	19.14	19.23	19.10	47.90	15.98	17.20	17.51	19.23	17.46
T_4	6.30	10.18	10.32	10.38	10.43	10.33	14.24	19.41	19.38	19.46	19.51	19.35	55.40	20.00	21.26	22.20	21.86	21.32
T_5	6.38	10.48	10.53	10.58	10.61	10.55	14.39	19.37	19.46	19.52	19.59	19.48	61.52	21.18	22.50	23.35	25.08	23.05
T_6	6.76	10.65	10.76	10.86	10.96	10.81	14.51	19.32	19.52	19.64	19.74	19.58	62.50	24.50	25.63	27.30	28.44	26.47
T_7	8.20	12.20	12.28	12.32	12.40	12.30	15.00	19.85	19.93	20.01	20.08	19.84	40.65	12.60	13.80	15.20	15.80	14.35
T_8	8.24	12.43	12.49	12.59	12.65	12.54	15.26	19.96	20.00	20.28	20.33	20.14	41.50	13.23	14.22	15.23	17.40	15.01
T_9	8.31	12.79	12.83	12.88	12.91	12.85	15.32	20.10	20.21	20.29	20.38	20.25	42.70	14.05	15.00	16.20	17.46	15.66
T_{10}	8.76	12.96	12.98	13.01	13.06	13.00	15.94	20.87	20.95	21.08	21.17	21.02	49.10	17.10	18.48	20.46	20.83	19.22
T_{11}	9.22	13.13	13.23	13.28	13.34	13.24	16.02	21.15	21.24	21.35	21.42	21.29	52.65	18.60	19.91	21.40	22.60	20.63
T_{12}	9.24	13.44	13.59	13.69	13.76	13.62	16.12	21.17	21.28	21.38	21.58	21.35	53.40	19.20	20.40	21.40	22.41	21.81
T_{13}	12.05	13.90	13.99	14.17	14.34	14.10	20.01	25.93	26.11	26.18	26.28	26.12	36.65	11.24	12.00	12.75	14.40	12.59
T_{14}	12.29	15.44	15.63	15.74	15.77	15.65	21.15	26.15	26.23	26.39	26.49	26.32	50.00	12.40	13.40	14.80	15.21	13.95
Mean		11.82	11.94	12.04	12.13			20.70	20.79	20.90	20.97			16.50	17.43	18.52	19.62	

	Reducing sugar		Total sugar		Ascorbic acid	
	SE	$CD_{0.01}$	SE	$CD_{0.01}$	SE	$CD_{0.01}$
Treatment (T)	0.009	0.032	0.015	0.054	0.149	0.542
Packaging (P)	0.005	0.018	0.084	0.033	0.080	0.291
Initial value	0.019	0.069	0.031	0.112	0.299	NS

Table 1. Contd…..

Treatment	Initial value	Starch (%)					Initial value	Beta-carotene (mg/100 g)				
		P_1	P_2	P_3	P_4	Mean		P_1	P_2	P_3	P_4	Mean
T_1	25.98	20.62	20.79	20.92	21.07	20.85	515	262	263	265	269	261
T_2	26.92	21.37	21.44	21.53	21.62	21.49	522	263	266	268	271	265
T_3	28.12	21.79	22.21	22.35	22.42	22.19	528	265	268	270	274	268
T_4	27.32	22.43	22.50	22.83	22.93	22.67	545	269	274	274	279	273
T_5	27.87	22.63	22.75	22.87	22.96	22.80	553	275	279	281	285	280
T_6	28.65	23.13	23.56	23.68	23.81	23.54	572	282	285	288	291	287

T_7	21.42	16.07	16.18	16.26	16.40	16.22	422	250	252	255	257	252
T_8	23.36	17.21	17.32	17.47	17.63	17.41	428	252	254	257	250	250
T_9	24.01	18.99	19.17	19.29	19.40	19.21	437	255	257	260	252	252
T_{10}	24.88	19.78	19.97	20.09	20.26	20.02	462	255	259	260	263	259
T_{11}	25.46	20.06	20.21	20.34	20.47	20.27	467	258	260	253	258	258
T_{12}	26.48	20.19	20.27	20.56	20.66	20.42	479	261	263	267	270	265
T_{13}	20.09	15.14	15.25	15.41	15.58	15.34	348	146	142	145	148	144
T_{14}	20.61	15.73	15.72	15.87	16.02	15.84	415	149	151	155	158	152
Mean		19.65	19.80	19.95	20.29			246	248	250	254	

	Starch		Beta-carotene	
	SE	$CD_{0.01}$	SE	$CD_{0.01}$
Treatment (T)	0.035	0.127	0.316	1.150
Packaging (P)	0.019	0.069	0.169	0.615
Initial value	0.071	0.281	0.632	NS

T_1: Blanching slices for 5 min + 5 min dip in 0.5% KMS + sun drying, T_2: Blanching slices for 5 min + 5 min dip in 1.0% KMS + sun drying, T_3: Blanching slices for 5 min + 5 min dip in 1.5% KMS + sun drying, T_4: Blanching slices for 5 min + 5 min dip in 0.5% KMS + cabinet drying, T_5: Blanching slices for 5 min + 5 min dip in 1.0% KMS + cabinet drying, T_6: Blanching slices for 5 min + 5 min dip in 1.5% KMS + cabinet drying, T_7: Slices dip in 0.5% KMS for 5 min + sun drying (no blanching), T_8: Slices dip in 0.1% KMS for 5 min + sun drying (no blanching), T_9: Slices dip in 1.5% KMS for 5 min + sun drying (no blanching), T_{10}: Slices dip in 0.5% KMS for 5 min + cabinet drying (no blanching), T_{11}: Slices dip in 1.0% KMS for 5 min + cabinet drying (no blanching), T_{12}: Slices dip in 1.5% KMS for 5 min + cabinet drying, T_{13}: No blanching + no KMS + sun drying (control), T_{14}: No blanching + no KMS + cabinet drying (control), P_1: 100 gauge polyethylene, P_2: 200 gauge polyethylene, P_3: 300 gauge polyethylene, P_4: 400 gauge polyethylene

slices to sunlight. Similar results have been reported by Dhabade and Khedkar (1980a, 1980b).

Starch: Maximum starch was observed in T_6 (23.54%) at 9 months storage and was significantly superior over all other treatments. With regards to packaging material highest starch content was noticed in P_4 (20.29%) in 9 months storage. Interaction effects were found to be significant. Treatment combination T_6P_4 (23.81%) recorded maximum starch content. The high starch in T_6P_4 could be due to dipping of slices in higher concentration of preservative solution and dehydration in cabinet drier which helped to reduce the loss of starch. Loss in content of starch was slightly more in sun-dried samples which could be attributed to the exposure of raw mango slices to sunlight. Decrease in starch could be ascribed to the hydrolysis of starch. Similar results were reported by Dhabade and Khedkar (1980a, 1980b) in Amchur prepared from cv Totapuri and seedling mango.

Beta-carotene: Maximum beta-carotene was noticed in T_6 (287 mg/100 g) at 9 months storage and packaging material P_4 (254 mg/100 g) and was significantly superior over all other treatments. Treatment combination T_6P_4 (291 mg/100 g) recorded highest beta-carotene. The highest content of beta-carotene could be due to the dipping of slices in the higher concentration of preservative solution and dehydration in drier which preserved the carotene. Loss of beta-carotene was more in sun-dried samples which could be due to exposure of raw slices to sunlight. The decrease in beta-carotene during storage may be due to temperature and light effect on pigments. Similar observations were reported by Vijayanand et al (2001) in mango chunks.

CONCLUSION

Moisture content of Amchur was found to be high in control whereas it was low in Amchur prepared by blanching slices for five minutes + five minutes dip in 0.5 per cent KMS + sun drying. Maximum TSS, ascorbic acid, starch and beta-carotene was observed in Amchur prepared by blanching slices for five minutes + five minutes dip in 1.5 per cent KMS + cabinet drying and lowest in Amchur prepared by no blanching + no

KMS + cabinet drying (control) whereas lowest ascorbic acid, starch, beta-carotene were noticed in Amchur prepared without blanching + no KMS + sundrying (control). Acidity was found to be highest in Amchur prepared without blanching + no KMS + sun drying (control) and lowest was seen in Amchur prepared by blanching slices for 5 minutes + 5 minutes dip in 0.5 per cent KMS + sun drying. Reducing and total sugar was found to be maximum in Amchur prepared without blanching + no KMS + cabinet drying (control) and minimum in treatment comprising blanching slices for 5 minutes + 5 minutes dip in 0.5 per cent KMS + sun drying.

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