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Effect of different concentrations of Potassium metabisulphite and drying methods on Physico-chemical properties of Amchur

SD Patil, Laxmipriya Swain and PL Deshmukh

Abstract
The present experiment entitled "Effect of different concentrations of potassium metabisulphite and drying methods on physico-chemical properties and quality of amchur during storage" was conducted at Department of Horticulture, College of Agriculture, Dhule.

Amchur was prepared from immature, sound, disease free unripe fruits of local cultivars. Selected fruits were peeled and sliced. Slices were further blanched for 5 minutes and dipped in different levels of Potassium metabisulphite (KMS) solution, whereas in some treatments slices were neither dipped in Potassium metabisulphite (KMS) solution nor blanched. The treated slices were dried in sunlight and in cabinet drier at 55 ± 5 0C. Dried slices were immediately ground. Finally prepared raw mango powder (Amchur) was packed in high density polyethylene bags and stored at ambient temperature for a period of nine months.

Results revealed that treatment T_1 (Blanching slices for 5 minutes + 5 minutes dip in 0.5% Potassium metabisulphite + sun drying) had noted lowest moisture content (5.95%, 3.98% and 1.62%), T_4 (No blanching + No Potassium metabisulphite + sun drying) recorded maximum acidity (25.39 %, 23.35 % and 21.62%), T_1 (Blanching slices for 5 min + 5 min dip in 0.5% Potassium metabisulphite + Sun drying) found minimum total soluble solids content (6.51, 6.72 and 6.89^{0}B), T_4 (No blanching + No Potassium metabisulphite + Sun drying) showed lowest ascorbic content (81.25, 76.44, 68.99 mg 100 g^{-1}) and starch content (9.41, 7.81 and 6.18 %), while lowest Total sugar content (9.48, 10.40 and 11.44 %) was noted in T_1 (Blanching slices for 5 min + 5 min dip in 0.5% Potassium metabisulphite + Sun drying) at 3, 6 and 9 months respectively during storage of Amchur. at 3, 6 and 9 moths respectively.

From the present experiment considering physico-chemical properties and organoleptic qualities, it was concluded Treatment T_7 (Blanching slices for 5 minutes + 5 min dip in 1.5% Potassium metabisulphite + cabinet drying and packaging in 400 gauge HDPE) was found to be best for preparation of Amchur.

Keywords: *Amchur*, potassium metabisulphite, cabinet drying. Physicochemical, organoleptic

Introduction
Mango (*Mangifera indica* L.) is known as "King of Tropical Fruit" as owing its high palatability, excellent taste & exemplary nutritive value, in India mango occupies the top position with an annual production of about ten million tones, which accounts for about 65% of the total world production i.e. 14.63 million Tones. Mango is a climacteric fruit, ripen quite rapidly after harvest. Disease problems, sensitivity to low temperature storage and perishable nature of the fruit limit the transport of fresh fruit from the site of harvest to distance destinations. These losses can be minimized by utilizing green fruits for making pickle, chutney or as a sundried acidifying condiment i.e., Amchur, whereas ripe fruit is used for preserve, jam, sauces etc.

Amchur is a dehydrated product made from raw green mangoes. Traditionally Amchur is an Indian spice made from raw green mangoes that are cut, sun-dried, and pounded into powder. Generally, Amchur is used as an acidulent in place of tamarind especially in North Indian states. On approximate basis from a tree of mango an amount of un-ripen fruits used for amchur receives income of Rs. 16,000 to 18,000/- whereas the income of Rs. 9,000 to 10,000 is received from ripe mango fruits. As mentioned earlier, amchur is traditionally prepared by drying peeled green mangoes in the sun. The traditional method of preparation of dried mango is unhygienic and the quality of the product depends up on the elements of nature.

The Amchur is available either as whole or ground to powder. Sometimes amchur is seasoned with turmeric (Cole, 1925).

Amchur is also sold as dried mango slices, which practically fits the category. Also the category of powdered spices is commonly found to contain starch, common salt and saw dust. The manual states soap stone or earthy materials, starch and foreign resin to be the common adulterants found in Amchur.

However, refinements are made in the preparation of amchur and machineries are also developed to make quality amchur powder. No doubt, selection of raw material and its further handling by adopting standard procedure is very important. However, selection of right type of mango genotype or cultivar is perhaps most important for successful production of quality amchur than any other criteria's. Unfortunately, no information is available on the genotypes suitable for making amchur, unlike pickles from mango. The genotypes available locally are used to make amchur which results in wide variation in quality of amchur. Moreover, the dropped immature mangoes are sundried for preparation of amchur. Further, sun drying takes 16-18 hrs for complete drying (Teotia and Pruthi, 1987) [9]. That results into poor quality amchur.

Amchur provides an excellent outlet for the economic utilization of fallen marketable surplus green fruits; moreover there is no risk of stealing of fruits by stress passers, pedestrians or thefts. Within a very short period income is generated from amchur. Employment is also generated for rural community in their village itself. In order to prepare the quality amchur by using different concentrations of preservatives, sun and cabinet drying as well as packaging in HDPE material along with storability is utmost important to study.

Material and Methods

Amchur was prepared from local cultivar by selecting 75% immature, sound, disease free unripe fruits. Selected fruits were peeled and sliced. Slices were further blanched for 5 minutes and dipped in different concentration of Potassium metabisulphite (KMS) solution *viz*., 0.5 %, 1 %, 1.5 % for 5 minutes, whereas in some treatments slices were neither dipped in Potassium metabisulphite (KMS) solution nor blanched. The treated slices were dried in sunlight and in cabinet drier at 55 ± 5 0C. Dried slices were immediately ground. Finally prepared raw mango powder (Amchur) was packed in high density polyethylene (HDPE) bags of 100, 200, 300 and 400 gauge having 8 x 8 cm size and stored at ambient temperature for a period of nine months.

Amchur was chemically analyzed at initial stage and after 3, 6 and 9 months of storage for different characters *viz.*, Moisture (AOAC 1990) [1], PH, acidity % (Ranganna 2002) [6], Ascorbic acid (mg/100g) (AOAC 1990) [1], Total sugar (%) (Yemm & Willis 1954) [10], reducing sugar (%) and starch (%) (Ranganna 1986) [7] & organoleptic quality. The result were analysed statistically by Factorial completely randomized design with 32 treatment combinations and replicated twice. It was also evaluated for their organoleptic qualities *viz*, colour, flavour and texture by a panel of experts based on 9 point Hedonic scale at initial stage and at an interval of 3, 6 and 9 months after storage and overall acceptability was determined.

Table 1: The Treatment of details

Treatment No.	Treatment details
Main treatments (Blanching, Dipping & Drying)	
T_1	Blanching slices for 5 minutes + 5 minutes dip in 0.5% KMS + sun drying
T_2	Blanching slices for 5 minutes + 5 minutes dip in 1.0 % KMS + sun drying
T_3	Blanching slices for 5 minutes + 5 minutes dip in 1.5 % KMS + sun drying
T_4	No blanching + no KMS + sun drying (Control).
T_5	Blanching slices for 5 minutes + 5 minutes dip in 0.5 % KMS + cabinet drying (550C ± 50C).
T_6	Blanching slices for 5 minutes + 5 minutes dip in 1.0 % KMS + cabinet drying (550C ± 50C).
T_7	Blanching slices for 5 minutes +5 minutes dip in 1.5 % KMS + cabinet drying (550C ± 50C).
T_8	No blanching + no KMS + cabinet drying (Control).
Sub Treatments (Packaging)	
P_1	100 gauge High Density Polyethylene (HDPE) transparent bags of 8 x 8 cm size
P_2	200 gauge High Density Polyethylene (HDPE) transparent bags of 8 x 8 cm size
P_3	300 gauge High Density Polyethylene (HDPE) transparent bags of 8 x 8 cm size
P_4	400 gauge High Density Polyethylene (HDPE) transparent bags of 8 x 8 cm size

Result and Discussion

Moisture content by amchur during storage was found decreased in all treatments over initial values. Maximum moisture percent (8.64 %, 6.38 % and 4.67 % during 3, 6 and 9 month respectively) observed in treatment T_8 i.e., control and lowest (5.95 %, 3.98 % and 1.62 % at 3, 6 and 9 month respectively) in T_1 (Blanching slices for 5 min + 5 min dip in 0.5% Potassium metabisulphite + sun drying). Whereas in packaging material P_4 (400 gauge polyethylene bag) account for highest (7.48 %, 5.51 % and 3.34 % during 3, 6 and 9 month results, respectively) moisture and lowest in P_1 (100 gauge polyethylene bag; 6.68 %, 4.39 % and 2.65 %). The loss in moisture during storage of amchur is attributed due to dry atmosphere and permeability of the polyethylene. Analogous results to present findings were reported by Dhabade and Khedkar (1980 a, b) [3, 4] in amchur prepared from Cv. Totapuri after six month storage period. Total soluble solids content in amchur observed increasing during storage. Highest total soluble solids (8.87, 8.98 and 9.10 0B during 3, 6 and 9 months, respectively) observed in Treatment T_7 (Blanching slices for 5 min + 5 min dip in 1.5% Potassium metabisulphite + cabinet drying) whereas lowest TSS (6.51, 6.72 and 6.89 ^{0}B during 3, 6 and 9 month, respectively) found in T_8 (No blanching + No Potassium metabisulphite + cabinet drying). Maximum total soluble solids (8.05, 8.18 and 8.33 ^{0}B) were observed in packaging material P_4 (400 gauge HDPE) and lowest in P_1 (100 gauge HDPE; 7.96, 8.04 and 8.18 0B during 3, 6 and 9 months respectively). The highest total soluble solids noticed in the amchur was due to more thickness of polyethylene bags and use of higher concentration of KMS (Potassium metabisulphite). These results are in close agreement with those of Shinde (2013) [8].

The increase in total soluble solids during storage could be attributed to the conversion of non reducing sugars into reducing sugars by acids present in the product consistent increase in total soluble solids.

Titratable acidity found to be decreasing during storage of amchur. Highest acidity (25.39 %, 23.35 % and 21.62 % during 3, 6 and 9 months, respectively) recorded in treatment T_4 (No blanching + No Potassium metabisulphite + Sun drying) and lowest in T_1 (Blanching slices for 5 min + 5 min dip in 0.5% Potassium metabisulphite + Sun drying; 18.42 %, 16.19 % and 14.27 %). Packaging material P_4 (400 gauge HDPE; 21.12 %, 19.14 % and 17.68 %) contain maximum titratable acidity and lowest in P_1 (100 gauge HDPE; 20.79 %, 18.90 % and 17.41 %). This lowest acidity was due to loss of acid during blanching process. The decrease in acidity during storage period could be probably due to disappearance of SO_2 from the amchur. Analogous results to the present findings were reported by Pruthi and Teotia (1982) [5] in local mango and Shinde (2013) [8] in mango Cv. Alphonso.

Ascorbic acid content of amchur found to be decreased during storage period. Treatment T_7 having maximum ascorbic acid (102.86, 93.90 and 83.49 mg 100 g^{-1} during 3, 6 and 9 months, respectively) and low (81.25, 76.44, 68.99 mg 100 g^{-1}) in T4 (No blanching + No Potassium metabisulphite + Sun drying). In regards of packaging material; P_4 (400 gauge HDPE) contain maximum ascorbic acid (94.28, 86.24 and 76.27 mg 100 g^{-1}) and lowest in P_1 (100 gauge HDPE; 90.55, 83.59, 73.21 mg 100 g^{-1}). The highest content of ascorbic acid was due to the dipping of slices in higher concentration of preservative solution *i.e.*, Potasium metabisulphite used at the time of blanching and drying in cabinet drier which prevented loss of ascorbic acid. Loss of ascorbic acid was rather rapid in sundried samples than amchur prepared from cabinet drier which could be attributed to the exposure of raw mango slices to sunlight which results into loss of ascorbic acid.

Reducing sugars and total sugars found increasing during storage of amchur. Highest reducing sugars (4.66, 5.50 and 6.71 % at 3, 6 and 9 months, respectively) and total sugars (11.96, 13.01 and 13.74 at 3, 6 and 9 months, respectively) observed in treatment T_8 (No blanching + No Potassium metabisulphite + Cabinet drying) and lowest reducing sugar (2.44, 3.65 and 5.46 % at 3, 6 and 9 month respectively) and total sugars (9.48, 10.40 and 11.44 % at 3, 6 and 9 months, respectively) in the treatment T_1 (Blanching slices for 5 min + 5 min dip in 0.5% Potassium metabisulphite + Sun drying). The highest amount of reducing sugars was recorded in control (T_8) treatment than blanched treatments which were due to greater losses of sugars by leaching at the time of blanching of mango slices. The increase in total sugars during storage could be attributed to more rapid hydrolysis of polysaccharides and their subsequent conversion to sugars. Observations analogous to these findings were recorded by Dhabade and Khedkar (1980a, b) [3, 4] in mango Cv. Totapuri and Shinde (2013) [8] in mango Cv. Alphonso.

Starch content found decreasing in all treatments over the initial values. High starch (16.40, 15.52 and 13.17 % at 3, 6 and 9 months respectively) content were observed in T_8 (No blanching + No Potassium metabisulphite + Cabinet drying) and low (9.41, 7.81 and 6.18 % at 3, 6 and 9 months, respectively) in T_4 (No blanching + No KMS + Sun drying). The highest content of starch was due to the dipping of slices in the higher concentration of preservative solution i.e. Potassium metabisulphite and drying in cabinet drier which helped to reduce the loss of starch content. Loss of starch content was slightly more in sundried samples than that of amchur prepared from cabinet drier. Decrease in starch content during storage could be ascribed to the hydrolysis of starch.

Changes took place in amchur powder during storage over 9 months duration reflected in organoleptic taste showing overall acceptability in terms of score card. Maximum average score for colour, texture, taste and overall acceptability was noticed in amchur prepared by blanching slices for 5 min + 5 min dip in 1.5 % Potassium metabisulphite + cabinet drying and packaging in 400 gauge HDPE i.e. T_{28}, whereas minimum score was observed in amchur prepared by no blanching + no Potassium metabisulphite + cabinet drying and packaging in 100 gauge HDPE (control) i.e. T_{29} at 3, 6 and 9 months of storage of amchur. Similar trend has been reported by Dabhade and khedkar (1980a, b) [3, 4] in mango Cv. Totapuri and seedling mango; Shinde (2013) [8] in mango Cv. Alphonso.

Table 2: Effect of blanching, drying and dehydration on physicochemical properties of amchur packed in different gauge HDPE during storage.

Treatment No.	Moisture (%)				Total soluble solids				Titratable acidity (%)			
	Initial values	3 Month	6 Month	9 Month	Initial values	3 Month	6 Month	9 Month	Initial values	3 Month	6 Month	9 Month
T_1	8.5	5.95	3.98	1.62	7.05	7.83	7.91	8.06	19.8	18.42	16.19	14.27
T_2	8.7	5.98	4.02	2.2	7.25	7.88	8.16	8.21	20.49	18.8	17.84	15.28
T_3	9	6.21	4.18	2.43	8.1	8.78	8.76	8.92	21	19.6	18.54	16.42
T_4	9.9	8.54	6.05	4.55	5.75	6.65	6.81	6.99	26.48	25.39	23.35	21.62
T_5	8.82	6.56	4.58	1.95	8	8.7	8.72	8.86	21.21	19.35	16.79	16.59
T_6	8.98	6.91	5.07	2.95	8.15	8.8	8.88	9.01	22	20.39	18.02	17.31
T_7	9.5	7.81	5.79	3.71	8.24	8.87	8.98	9.1	22.25	20.48	18.24	17.38
T_8	10.12	8.64	6.38	4.67	5.85	6.51	6.72	6.89	26.46	25.27	23.24	21.58
Tr (SE)	-	0.036	0.031	0.028	-	0.019	0.033	0.026	-	0.054	0.052	0.034
CD at 5%	-	0.099	0.086	0.079	-	0.053	0.093	0.074	-	0.15	0.144	0.095
Pack (SE)	-	0.036	0.031	0.028	-	0.019	0.033	0.026	-	0.054	0.052	0.034
CD at 5%	-	0.099	0.086	0.079	-	0.053	0.093	0.074	-	0.15	0.144	0.095
Int (SE)	-	0.101	0.087	0.08	-	0.054	0.094	0.075	-	0.152	0.146	0.097
CD at 5%	-	0.281	0.242	0.223	-	NS	NS	NS	-	NS	NS	NS

Table 3: Effect of blanching, drying and dehydration on physicochemical properties of amchur packed in different gauge HDPE during storage

Treatment No.	Total sugar (%)				Ascorbic acid				Starch (%)			
	Initial values	3 Month	6 Month	9 Month	Initial values	3 Month	6 Month	9 Month	Initial values	3 Month	6 Month	9 Month
T_1	7.34	9.48	10.4	11.44	110.46	85.98	80.75	69.38	15.74	14.34	13.52	11.04
T_2	7.38	9.6	10.43	11.6	115.38	88.67	81.69	71.06	16.54	15.34	14.68	11.9
T_3	7.45	9.79	10.69	11.78	120.77	91.25	85.9	73.38	18.36	15.79	14.87	12.81
T_4	9.84	11.68	12.78	13.65	103	81.25	76.44	68.99	10.08	9.41	7.81	6.18

T_5	8	10.39	11.46	12.54	130.71	97.01	89.04	76	17.4	15.82	14.86	12.79
T_6	8.4	10.55	11.63	12.67	134.61	100.38	91.65	81.13	17.72	15.95	14.9	12.92
T_7	8.95	10.98	11.94	12.91	139.76	102.86	93.9	83.49	18.8	16.4	15.52	13.17
T_8	9.95	11.96	13.01	13.74	125.85	91.74	80.63	74.58	10.13	9.75	8.35	6.21
Tr (SE)	-	0.027	0.029	0.047	-	0.652	0.407	0.453	-	0.053	0.046	0.051
CD at 5%	-	0.075	0.082	0.131	-	1.822	1.137	1.266	-	0.148	0.128	0.142
Pack (SE)	-	0.027	0.029	0.047	-	0.652	0.407	0.453	-	0.053	0.046	0.051
CD at 5%	-	0.075	0.082	0.131	-	1.822	1.137	1.266	-	0.148	0.128	0.142
Int (SE)	-	0.076	0.083	0.133	-	1.844	1.151	1.281	-	0.15	0.13	0.144
CD at 5%	-	NS	NS	NS	-	NS	NS	NS	-	0.419	0.363	0.401

Table 4: Effect of blanching, drying and dehydration on organoleptic qualities of amchur packed in different gauge HDPE during storage.

Treatment No.	Score Card For Colour				Score Card For Texture				Score Card For Overall Acceptability			
	Initial	3 Month	6 Month	9 Month	Initial	3 Month	6 Month	9 Month	Initial	3 Month	6 Month	9 Month
T_1	7.00	7.00	6.80	6.50	7.00	7.20	6.90	6.50	7.00	7.20	6.90	6.50
T_2	7.50	7.35	7.20	7.00	7.66	7.25	6.67	6.40	7.66	7.25	6.67	6.40
T_3	7.70	7.60	7.45	7.20	7.66	7.00	7.00	6.75	7.66	7.00	7.00	6.75
T_4	7.90	7.85	7.65	7.50	7.90	7.60	7.30	7.00	7.90	7.60	7.30	7.00
T_5	7.50	7.40	7.30	7.10	7.66	7.30	7.20	7.00	7.66	7.30	7.20	7.00
T_6	7.60	7.60	7.40	7.20	7.00	7.00	6.67	6.25	7.00	7.00	6.67	6.25
T_7	7.90	7.80	7.45	7.25	7.90	7.80	7.45	7.00	7.90	7.80	7.45	7.00
T_8	8.00	7.90	7.85	7.70	8.00	7.50	7.33	6.90	8.00	7.50	7.33	6.90
T_9	8.10	8.00	7.95	7.80	7.90	7.67	7.30	7.20	7.90	7.67	7.30	7.20
T_{10}	8.10	8.10	7.85	7.70	8.20	7.90	7.60	7.30	8.20	7.90	7.60	7.30
T_{11}	8.35	8.20	8.20	7.95	8.40	8.00	7.60	7.40	8.40	8.00	7.60	7.40
T_{12}	8.50	8.30	8.15	8.00	8.50	8.20	7.92	7.60	8.50	8.20	7.92	7.60
T_{13}	6.00	6.00	5.95	5.50	7.10	7.00	6.50	6.10	7.10	7.00	6.50	6.10
T_{14}	6.50	6.30	6.00	5.95	7.20	7.10	6.90	6.75	7.20	7.10	6.90	6.75
T_{15}	6.77	6.70	6.50	6.30	7.40	7.20	6.89	6.33	7.40	7.20	6.89	6.33
T_{16}	7.00	7.00	6.50	6.30	7.65	7.30	6.80	6.40	7.65	7.30	6.80	6.40
T_{17}	7.30	7.30	7.00	6.90	7.50	7.30	6.74	6.33	7.50	7.30	6.74	6.33
T_{18}	7.33	7.10	7.00	7.00	7.33	7.10	6.50	6.10	7.33	7.10	6.50	6.10
T_{19}	7.50	7.40	7.20	7.00	7.10	7.00	6.20	6.20	7.10	7.00	6.20	6.20
T_{20}	7.50	7.50	7.40	7.20	6.67	6.75	6.30	6.21	6.67	6.75	6.30	6.21
T_{21}	7.60	7.40	7.20	7.20	7.33	7.10	6.70	6.50	7.33	7.10	6.70	6.50
T_{22}	7.66	7.20	7.00	7.00	7.50	7.40	6.75	6.60	7.50	7.40	6.75	6.60
T_{23}	7.50	7.40	7.30	7.30	7.60	7.00	6.90	6.70	7.60	7.00	6.90	6.70
T_{24}	7.60	7.40	7.30	7.00	7.70	7.20	6.90	7.00	7.70	7.20	6.90	7.00
T_{25}	8.10	8.00	8.00	7.95	7.66	7.80	7.25	6.67	7.66	7.80	7.25	6.67
T_{26}	8.33	8.30	8.10	8.00	8.00	8.00	7.50	7.00	8.00	8.00	7.50	7.00
T_{27}	8.20	8.20	8.10	8.00	8.33	8.20	7.75	7.33	8.33	8.20	7.75	7.33
T_{28}	9.00	8.70	8.50	8.30	8.66	8.40	8.00	7.67	8.66	8.40	8.00	7.67
T_{29}	7.00	7.00	6.80	6.70	7.00	6.50	6.00	5.10	7.00	6.50	6.00	5.10
T_{30}	7.30	7.20	7.10	7.00	7.10	6.90	6.35	6.20	7.10	6.90	6.35	6.20
T_{31}	7.45	7.40	7.30	7.10	7.50	7.00	6.70	5.50	7.50	7.00	6.70	5.50
T_{32}	7.50	7.30	7.20	7.00	7.67	7.10	6.40	5.90	7.67	7.10	6.40	5.90

Conclusion

Considering physico-chemical properties of amchur; from the present investigation it was concluded that, treatment T_1 (Blanching slices for 5 minutes +5 minutes dip in 0.5% Potassium metabisulphite + sun drying) has noted lowest moisture content (5.95%, 3.98% and 1.62%), T_4 (No blanching + No Potassium metabisulphite + sun drying) recorded maximum acidity (25.39%, 23.35% and 21.62%), T_1 (Blanching slices for 5 min + 5 min dip in 0.5% Potassium metabisulphite + Sun drying) found minimum total soluble solids content (6.51, 6.72 and 6.89^{0}B), T_4 (No blanching + No Potassium metabisulphite + Sun drying) showed lowest ascorbic content (81.25, 76.44, 68.99 mg 100 g^{-1}) and starch content (9.41, 7.81 and 6.18 %), while lowest Total sugar content (9.48, 10.40 and 11.44 %) was noted in T_1 (Blanching slices for 5 min + 5 min dip in 0.5% Potassium metabisulphite + Sun drying) at 3, 6 and 9 months respectively during storage of amchur. Treatment T_{28} (Blanching slices for 5 minutes + 5 min dip in 1.5% Potassium metabisulphite + cabinet drying and packaging in 400 gauge HDPE) observed maximum average score for overall acceptability and found to be best for preparation of amchur.

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