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Short communication

Effect of different salt concentrations on drying and non-enzymatic browning of mango slices

B.L. Attri* and Abha Singh
National Research Centre for Women in Agriculture, Bhubaneswar 751 003

Mango (*Mangifera indica* L.) is one of the most popular, choicest and finest sub-tropical fruit cultivated in India with more than 50% of the total world production. A number of varieties are being grown in different parts of the country but the fruit is available only for few months. Post harvest management of mango has been carried out at different locations for enhancing shelf life as well as preparation of various value added products (Singh and Narayana, 6 and Sagar and Khurdiya, 8). Apart from the table purpose, after ripening, mango is also used for various preparations. In coastal areas of Orissa due to cyclonic winds, the mango fruits drop during various stages of development. These fruits when not utilized used to spoil in the fields. The immature and under developed mango fruits can be utilized for making dried products like mango slices/ flakes, *amchur*, pickles, purees, sauces, chutneys etc. Investigations were carried out to find the feasibility of preparation and storage of dried mango slices using different concentrations of salt and drying methods.

The present study was carried out at National Research Centre for Women in Agriculture, Bhubaneswar during 2004-2006. The matured fruits of mango cv. Arka Anmol which dropped due to storm at Central Horticultural Experimental Station (IIHR), Bhubaneswar were collected for the study. After properly washing in running water, the fruits were dried with clean cloth. The physical characteristics like weight, length and breadth of the fruits were taken following standard methods (AOAC, 2). The peel (%), stone (%), moisture (%) and dry matter (%) content of the mango fruits were also recorded as per the methods of Ranganna (5). The peeled mango slices/ flakes (longitudinal) of 0.50 – 0.75 cm thickness were divided in different lots and were dipped in salt (NaCl) solution of 2, 4, 6, 8% along with a control (water dip) for one hour at room temperature (34 – 36^{0}C). The treated slices/ flakes spread on stainless steel trays and were subjected to drying in sun as well as in mechanical/cabinet dehydrator (55 ±1^{0}C). The drying rate of the slices was recorded at 24 h interval till the weight stabilized (Fig. 1). After complete drying/ dehydration the observations on non-enzymatic browning were recorded. The samples were dipped in ethanol (absolute) GR for 12 h. After filtration the optical density (OD) was recorded at 440 nm in UV-spectrophotometer using absolute ethanol as blank. The remaining slices of all the treatments were packed in polyethylene bags (200 gauge) and stored at ambient (24-36^{o}C) and low temperature (refrigerator 0-4^{o}C). The samples were drawn at 6 monthly intervals for 2 years and the optical density was recorded as described earlier (Ranganna, 5). The data were analysed in randomized (RBD) block design as described by Panse and Sukhatme (4).

Matured mango var. Arka Anmol
↓
Washing in running water
↓
Drying with clean cloth
↓
Peeling
↓
Longitudinal slices/ flakes of 0.50 – 0.75cm thickness
↓
Dipping in salt solution for 1 hour
↓
Draining the slices
↓
Drying/ dehydration
↓
Packaging in 200 gauge polyethylene
↓
Storage at ambient/ low temperature

Fig. 1. Flow diagram for the preparation of mango slices

The average fruit weight was recorded as 253.40 g having length of 10.40 cm and breadth 7.42 cm. The per cent peel and stone were 9.43 and 18.60, respectively. The recovery of the fibreless slices was 71.96 per cent. The per cent moisture and dry matter content of the fruit

*Corresponding author's present address: Central Institute of Temperate Horticulture, Regional Station, Mukteshwar, Distt. Nainital (Uttarakhand) 263 138: Email: attribl_cith@rediffmail.com

were 86.50 and 13.50, respectively. The drying of the slices was carried out for 96 h in the sun and it was observed that the drying was faster in the slices which were not dipped in salt solution (control). As the concentration of the salt solution increased, the drying rate was decreased. Similar trend was recorded in the slices which were subjected to drying in mechanical/ cabinet dehydrator. The initial faster drying rate may be attributed due to the presence of more water in the slices. Further, the reduction in the drying rate may be attributed due to the penetration of salt is slices and also deposit on surface causing hindrance in water loss. The drying was comparatively better in mechanical/cabinet dehydrator as compared to sun drying due to constant temperature (Figs. 2 & 3).

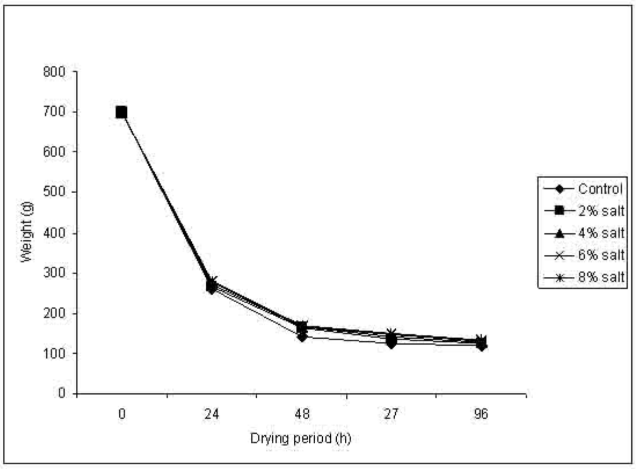

Fig. 2. Effect of salt concentration on sun drying of mango slices.

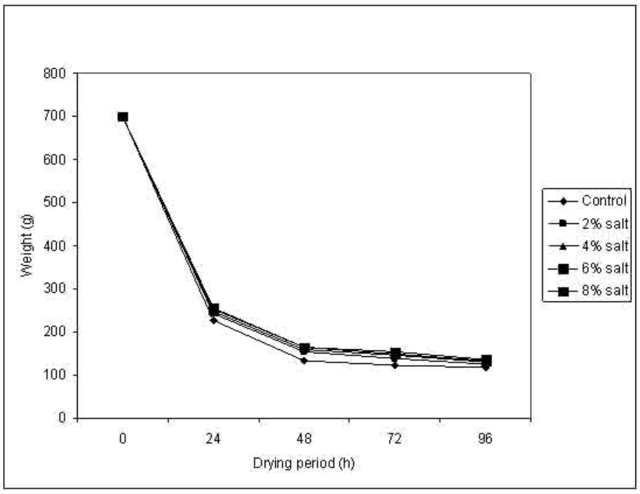

Fig. 2. Effect of salt concentration on dehydration of mango slices.

In the storage study of the mango slices at ambient and low temperature, the optical density (OD) for non-enzymatic browning (NEB) was recorded at six monthly intervals for two years. A significant increase was recorded in the O.D. of the extracted solution of slices at ambient temperature compared to that of low temperature. Among the treatments it was observed that the slices having higher salt concentration showed significantly low NEB value as compared to those which were treated with lower salt concentration. In storage of mango slices, it was observed that the NEB is significantly higher at ambient to that of low temperature (Table 1). The increase in the NEB at ambient temperature might be attributed due to higher temperature leading to browning of the slices. On the other hand the slices stored at low temperature showed an increased trend of NEB but at slower rate which is due to the reduction in the non enzymatic browning activity due to lower temperature. Similarly, better quality of dried rings in apricot was obtained at lower temperature (Sharma *et al*., 7). In dehydrated ripe mango slices sugars and non-enzymatic browning increased with the increase in storage period (Sagar and Khurdiya, 8). During storage of raw mango slices by using different combination of additives, the slices stored with 0.1% sodium benzoate turned light brown (Garg *et al*., 3). In the dried apple rings there was increase in reducing sugars, non-enzymatic browning and sugar: acid ratio

Table 1. Effect of drying and storage on non-enzymatic browning in mango slices.

Treatment	Storage period (months) Optical density (OD)				
	0	6	12	18	24
T_1	0.510	0.658	0.745	0.770	0.795
T_2	0.510	0.594	0.675	0.696	0.708
T_3	0.486	0.572	0.637	0.662	0.683
T_4	0.486	0.528	0.598	0.612	0.620
T_5	0.438	0.486	0.543	0.585	0.600
T_6	0.438	0.452	0.492	0.518	0.530
T_7	0.396	0.427	0.476	0.490	0.502
T_8	0.396	0.406	0.418	0.426	0.434
T_9	0.384	0.418	0.432	0.440	0.458
T_{10}	0.384	0.402	0.408	0.414	0.422
$CD_{0.05}$	0.004	0.005	0.002	0.006	0.006

T_1 = Control (Ambient temperature), T_2 = Control (Low temperature), T_3 = 2% salt soln. (Ambient temperature), T_4 = 2% salt soln. (Low temperature), T_5 = 4% salt soln. (Ambient temperature), T_6 = 4% salt soln. (Low temperature), T_7 =6% salt soln. (Ambient temperature), T_8 = 6% salt soln. (Low temperature), T_9 =8% salt soln. (Ambient temperature), T_{10} = 8% salt soln. (Low temperature) during storage for 6 months (Alkesh, 1). In the osmotically dehydrated slices of different varieties of ripened mango including Arka Anmol the loss of carotenoids was observed after one year storage at room temperature (Tiwari and Jalali, 9).

From the present study it can be concluded that the mango fruit which drop as pre-mature may be converted into slices. After treating with salt solution (4-6%) and sun/mechanical drying, the slices can be packed and stored successfully for two years with out degradation in the quality. These slices can be used for various culinary purposes. It will not only reduce the post harvest losses in mango but also help to provide bi-products to the market.

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REFERENCES

1. Alkesh, 2002. Evaluation of some low chilling apple cultivars for dehydration and development of dehydrated fruit based products. M.Sc. Thesis, University of Horticulture and Forestry, Solan.
2. A.O.A.C. 2000. *Official Methods of Analysis*. 17th edn. Association of Official Agricultural Chemists, Washington D.C., U.S.A.
3. Garg, N., Kalra, S.K. and Tandon, D.K. 1994. Storage of raw mango slices by using combination of additives. Abstract in ICFOST-94, S-13, pp. 75.
4. Panse, V.G. and Sukhatme, P.V. 1985. *Statistical Methods for Agricultural Workers*. Indian Council of Agricultural Research, New Delhi.
5. Ranganna, S. 1997. *Handbook of Analysis and Quality Control for Fruit and Vegetable Products*. Tata McGraw Hill Pub. Co. Ltd., New Delhi.
6. Singh, B.P. and Narayana, C.K. 1999. An integrated approach for storage of mango. *Indian J. Hort*. **56**: 5-9.
7. Sharma, K.D., Kumar L. and Kaushal, B.B.L. 2004. Mass transfer characteristics, yield and quality of five varieties of osmotically dehydrated apricots. *J. Food Sci. Tech*. **41**: 264-75.
8. Sagar, V.R. and Khurdiya, D.S. 1994. Studies on packaging and storage of dehydrated ripe mango slices. Abstract in ICFOST-94, P-9, and pp. 55.
9. Tiwari, R.B. and Jalali, S. 2004. Studies on osmotic dehydration of different mango varieties. **In**: *First Indian Horticulture Congress* on *Improving Productivity, Quality, Post harvest Management and Trade in Horticultural Crops*. Abstract No. 8.21.

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