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Studies on Quality Parameters in Mango Pulp Stored in Containers at Different Temperatures

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***Abstract*—** *Mango has high nutritive value, delicious taste, excellent flavour, attractive appearance and popularity among masses. It is a rich source of carbohydrates, minerals. Vitamins 'A' and 'B' and Quality aspects like ascorbic acid and protein. Quality characters of pulp gave significant response to containers and colour had shown no change after 9 and 12 months. Texture of the pulp was found highly viscous and smooth in all the containers. Pulp preserved in different containers at room and low temperatures gave effective response for the various quality parameters. Containers showed positive response for different characters. In the overall observations H.D.P.E., glass and tin containers gave significant results. Polypropylene pouches and L.D.P.E. also showed less effective response. Low temperature was found suitable for preservation of mango pulp in glass containers. Shelf life of mango pulp could be enhanced in preserved conditions in different containers for industrial use.*

***Keywords*—** *Mango, pulp, containers, preservation, quality, storage*.

I. INTRODUCTION

Mango fruit is available to the consumer for a short period from mid March to mid September, June-July months being the peak period. More than 30 per cent of the fresh fruit is being wasted during handling, storage and transportation [3]. Preparation of pulp from the edible portion of the fruit, nearer to the fruit growing area, packing it in suitable containers and storing for extended period will help in better utilization of the fruit [4]. It also reduces the wastage, cost of transport and makes the nutritious fruit available for a longer period [4]. In fact in India and abroad, value added fruit products have vital importance [1, 19].

Mango pulp preservation and storage is important for the industry for converting it into various products based on market demand. Suiphited mango pulp with 1000 ppm SO^2 was stored for a year in wooden barrel with-out any detectable deterioration in quality. Ambadan and Adsule [5]. Thus it is essential to replace conventional, rigid metal and glass containers of heavy weight which are considered quite expensive as compared with light weight, flexible packages for packaging of processed fruit products [12]. It is a great interest to explore the possibility of preservation of fruit pulp in flexible pouches without the addition of synthetic colouring and flavouring agents with a view to making the final pack economical and within the reach of larger section of population [13].

Now-a-days a large volume of mango pulp is exported every year and converted into beverages, variously designated as mango juice, nectar, drink, etc. Due to great demand in markets throughout the year, its preservation and packing is an important aspect. Containers play and important role in packaging, therefore, present study is based on qualitative analysis of commercial variety for pulp preservation in various containers at ambient and low temperatures [14].

II. MATERIALS AND METHODS

Experiments were conducted in the Department of Horticulture, C.S. Azad University of Agriculture and Technology, Kanpur during 2010-11 and 2011-12. Mature fruits of Totapuri variety were obtained and ripened at room temperature. The pulp was separated from the ripe fruits and stored at two temperatures: (i) Room temperature (16 to 33°C) and (ii) Low temperature (4 ± 1^0C). Six type of containers were used for packing and preservation of pulp:-

(1) High Density Polythylene (H.D.P.E.) containers of 500g capacity.
(2) Low Density Polyethylene (L.D.P.E.) containers of 500g capacity.
(3) Aluminum pouches of 500gm capacity made from 500gauge foil.
(4) Glass bottles of 500g capacity with airtight fit in metallic lids.
(5) Tin container - No. 1 tall can (control)
(6) Polypropylene pouches of 500g capacity made from 100 gauge sheet.

Ripe fruits were washed, peeled and the pulp was separated from stone by passing the peeled fruit first through a pulper having ordinary sieve followed by passing it once again through a finisher having a fine sieve. It was subjected to heating to a temperature of 95°C. Heated pulp was then sealed and subjected to thermal processing in boiling water at 100^0C in an agitating batch type cooker for a period of 35 minutes. Glass, HDPE and LDPE containers were allowed five minutes more thermal processing time. After storage, A.O.A.C. methods were applied for biochemical analysis of pulp (2). Recorded data were subjected in statistical analysis as per methods of Panse and Sukhatme [15].

III. RESULTS AND DISCUSSION

Results summarized in tables (I-IV) revealed important findings where maximum content of ascorbic acid was 17.0 after 3 months, at 15.0°B in L.D.P.E. containers. Pulp kept in glass containers stored for 12 months revealed maximum

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ascorbic acid 8.7 at low temperature. Present findings are in accordance with the results of Bail (6), Bose and Basu (8) and Chadha and Chadha [9].

A decrease of ascorbic acid content was observed during long term storage. In H.D.P.E. containers, it was observed 15.3, 12.1, 9.3 and 7.4 mg/ 100gm pulp during storage for 3, 6, 9 and 12 months at room temperature, respectively. It was found increased as 16.6, 13.2, 10.9 and 7.8 mg/ 100 gm pulp in storage for 3, 6, 9 and 12 months in polypropylene containers at low temperature. After 9 months preservation, glass containers revealed ascorbic acid 10.5 and 7.8 mg/ 100 gm pulp at room temperature, respectively. Pulp was found to have a considerable range of variation in respect of the preservation period and containers like H.D.P.E., glass, tin and L.D.P.E. Present findings are in accordance with the results reported in mango and aonla by other Ghosh *et al.* [12] in their investigations. Variations have also been reported by the scientists [14, 16, 18]

TABLE I. Ascorbic acid content (mg %) in the pulp.

Period Treatments		2010-11		2011-12	
		3 months	6 months	9 months	12 months
H.D.P.E.	a	15.3	12.1	9.3	7.4
	b	16.0	14.0	10.8	8.6
L.D.P.E.	a	15.0	13.2	9.0	6.6
	b	17.0	14.3	11.2	8.2
Aluminium pouches	a	14.6	10.3	7.4	5.7
	b	16.2	12.5	9.2	7.8
Glass Container	a	15.6	13.1	10.5	7.8
	b	16.5	13.6	11.0	8.7
Polypropylene Pouches	a	14.8	11.6	9.4	6.3
	b	16.6	13.2	10.9	7.8
Tin Container (Control)	a	16.0	13.6	10.7	7.6
	b	16.2	14.4	10.9	8.4
C.D. at 5%	a	0.198	0.540	0.263	0.210
	b	0.114	0.312	0.152	0.121

a = room temperature, b = low temperature

TABLE II. Protein content (%) in the pulp.

Period Treatments		2010-11		2011-12	
		3 months	6 months	9 months	12 months
H.D.P.E.	a	0.66	0.65	0.61	0.57
	b	0.68	0.66	0.65	0.61
L.D.P.E.	a	0.65	0.62	0.59	0.54
	b	0.67	0.64	0.61	0.58
Aluminium pouches	a	0.65	0.61	0.58	0.52
	b	0.67	0.64	0.61	0.57
Glass Container	a	0.67	0.65	0.62	0.58
	b	0.67	0.65	0.64	0.61
Polypropylene Pouches	a	0.65	0.63	0.60	0.56
	b	0.66	0.64	0.62	0.59
Tin Container (Control)	a	0.66	0.64	0.61	0.57
	b	0.67	0.65	0.63	0.60
C.D. at 5%	a	0.012	0.012	0.012	0.012
	b	0.007	0.007	0.007	0.007

a = room temperature, b = low temperature

TABLE III. Crude fibre content (mg %) in the pulp.

Period Treatments		2010-11		2011-12	
		3 months	6 months	9 months	12 months
H.D.P.E.	a	0.82	0.81	0.80	0.78
	b	0.82	0.82	0.81	0.79
L.D.P.E.	a	0.81	0.81	0.79	0.76
	b	0.82	0.81	0.80	0.78
Aluminium pouches	a	0.81	0.79	0.8	0.76
	b	0.81	0.80	0.80	0.78
Glass Container	a	0.82	0.81	0.81	0.79
	b	0.82	0.82	0.81	0.80
Polypropylene Pouches	a	0.81	0.79	0.77	0.75
	b	0.81	0.80	0.79	0.78
Tin Container (Control)	a	0.82	0.81	0.79	0.78
	b	0.82	0.82	0.81	0.80
C.D. at 5%	a	0.012	0.012	0.01	0.010
	b	0.007	0.00	0.006	0.006

a = room temperature, b = low temperature

Kiran Singh, Ram Rakha, Rajeev Kumar, and Manorama Singh, "Studies on quality parameters in mango pulp stored in containers at different temperatures," *International Research Journal of Advanced Engineering and Science*, Volume 2, Issue 1, pp. 208-210, 2017.

TABLE IV. Total carotenoides content (mg/100g) in the pulp.

Period Treatments		2010-11		2011-12	
		3 months	6 months	9 months	12 months
H.D.P.E.	a	3.60	3.56	3.50	3.43
	b	3.64	3.60	3.56	3.52
L.D.P.E.	a	3.59	3.50	3.41	3.32
	b	3.63	3.58	3.52	3.47
Aluminium pouches	a	3.58	3.50	3.40	3.29
	b	3.62	3.56	3.50	3.43
Glass Container	a	3.60	3.54	3.48	3.41
	b	3.65	3.61	3.56	3.51
Polypropylene Pouches	a	3.59	3.51	3.39	3.27
	b	3.62	3.57	3.50	3.41
Tin Container (Control)	a	3.61	3.56	3.49	3.44
	b	3.65	3.60	3.56	3.51
C.D. at 5%	a	0.012	0.012	0.012	0.012
	b	0.007	0.007	0.007	0.007

a = room temperature, b = low temperature

Data of observations on protein content in stored mango pulp varied from 0.65 to 0.67 per cent and 0.66 to 0.68 per cent in different containers after 3 months of preservation at room and low temperatures, respectively. Its content was found 0.62 per cent in L.D.P.E. at room temperature. Aluminium pouches and glass containers revealed significant differences with rest of the treatment. 12 months preserved pulp revealed significant differences in tin and L.D.P.E. containers at room temperature. Protein content was found increased in glass containers stored at room and low temperatures. Next best its content was found in glass container. This nature of protein content has also been reported by Thakur *et al.* [17] in their findings. Crude fibre was found maximum (0.82%) in containers at room temperature. At low temperature, it was found 0.82, 0.81, 0.80, 0.82, 0.82 and 0.82 in H.D.P.E., L.D.P.E., aluminium pouches, glass containers, polypropylene and tin containers, respectively. 9 months preserved pulp showed maximum crude fibre (0.81%) in glass containers at room temperature. After 12 months storage, crude fibre was found in mango pulp 0.78 per cent in H.D.P.E. containers. Crude fibre was found highest in glass containers and minimum in polypropylene container after storage for 3 months. It was found partially decreased in the storage of mango pulp for 12 months. Das *et al.* [10] and Ethiraj and Suresh [11] also studied the crude fibre content in mango and observed similar results in some varieties.

Crude fibre and sugars were present in the pulp packed in aluminium pouches at 3 months of storage. After 6 months of pulp storage, total sugar was found maximum 12.71 in L.D.P.E. Similar results have been obtained by Bandyopadhyay and Gholap [7] in their investigations. Sugar content was found increased at room temperature. Total sugars content in pulp was found maximum (12.71%) in aluminium pouches kept at room temperature for 6 months. Present findings are in accordance with the results reported by Ghosh *et al.* [12].

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