



Research Article

POST HARVEST DIPPING TREATMENTS ON STORAGE BEHAVIOR OF MANGO (VARIETY- CHHATTISGARH NANDIRAJ) FRUIT UNDER AMBIENT CONDITION

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Abstract: A study was carried out to evaluate storage behavior of mango fruit, to increase the storability and to minimize the post harvest losses in mango fruit variety- Chhattisgarh Nandiraj, under the influence of five dipping treatments and after treatment number of marketable and unmarketable ripe mango fruit, colour, TSS, acidity, ascorbic acid, total sugar, PLW, storability was observed. Matured freshly harvested mango fruits of uniform size were treated with different treatments as post harvest dips for 10 minutes. The result on individual effects of the treatments indicated that mango fruits dipping in adusha leaf extract 5% (D₄) were found superior with significantly high number of marketable fruit, longer storability, lower physiological loss in weight and higher firmness of fruits, excellent organoleptic rating, the treatment was also promising for slower increase in TSS, while slower decrease in ascorbic acid and acidity during storage.

Keywords: Adusha leaf extract, physiological loss, storability, organoleptic, Refractometer

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Introduction

Mango (*Mangifera indica* L.) was said to be originated in India, Burma, Malaysia or Thailand [1]. It has been cultivated for more than 4000 years [2]. It is well known for its taste, excellent flavour and healthful food values [3]. Mango is being grown in more than 87 countries of the world. India ranks first in the world w.r.t. area, 2500 thousands hectares and production of 18002.4 thousands metric tonnes [4]. Mango showed highly prominent post harvest loss because of its high perishability and climacteric pattern of respiration. As estimated by Lashley (1984) [5], approximately 30 to 50% fruits go waste during post harvest handling, storage and ripening. The magnitude of post harvest losses in fresh fruit was estimated to be 5 to 25% in developed countries and 20 to 50% in developing countries [6]. Singh (1998) [7] reported that in India, post harvest loss of fresh mango fruits due to microbial decay varies from 20-33%. At present for the ripening of mango fruit mainly chemical based products are used which are harmful and affect keeping quality of fruits. Therefore, it is essential to search for other eco-friendly option for ripening of the mango fruits.

Materials and Methods

The present investigation was conducted at Fruit and Vegetable Processing Laboratory of Department of Horticulture, College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G.) during the month of June-July, 2014. The two factor experiment was laid out in the factorial randomized complete block design with three replications. Each treatment comprised of 20 numbers of fruits. Physiologically mature (unripe) and fresh fruits of mango variety- Chhattisgarh Nandiraj were harvested along with small pedicel (stem) and used for different post harvest treatments. Sticking material (AG-Film Activator) @ 1 ml/l water solution was used with each dipping treatment, ethylene (39% SL) @ 2 ml/l water was used for preparation of 750 ppm solution, hot water at 50°C and preparations of herbal solution (adusha and custard apple leaf) 5% (50 ml / l). The volume was then made up to 1 liter by adding water. The postharvest treatments were randomly assigned to the experimental material (fruits).

Twenty mango fruits were dipped in the each treatment solution viz. plain water (D₁), ethylene 750 ppm (D₂), hot water 50°C (D₃), adusha leaf extract 5% (D₄), custard apple leaf extract 5% (D₅) for 10 minutes. The fruits were removed and dried under normal air fan.

Number of marketable ripe mango fruits

The unshrinking, golden yellow colour and firm textured fruits were counted from each treatment to get the number of marketable mango fruits at 9th days after harvest.

Number of unmarketable ripe mango fruits

The shrinking, over ripe and rotten fruits were counted from each treatment to get the number of unmarketable mango fruits at 9th days after harvest.

Colour of fruit

Colour of fruits was observed at 3 days interval for each treatment from 1st days of harvest up to 12th days. Days required to reach different stages of colour during storage and ripening were determined objectively using numerical rating scale according to Anwar, (2013) of 1-7, where 1 = Green, 2 = Breaker, 3 = One quarter Yellow (<25%), 4 = Two quarter Yellow (<50%), 5 = Three quarter Yellow (<75%), 6 = Fully Yellow (75-100%), and 7 = Blackened/ Rotten (Fully Yellow and Black) [8].

Total soluble solids (TSS °Brix)

Total soluble solids content of mango pulp was estimated by using Erma Hand Refractometer. A drop of mango juice squeezed from the fruit pulp on the prism of the refractometer. Percent TSS was obtained from direct reading of the instrument.

Acidity (%)

Acidity of mango pulp was determined by method of Ranganna (1986) [9].

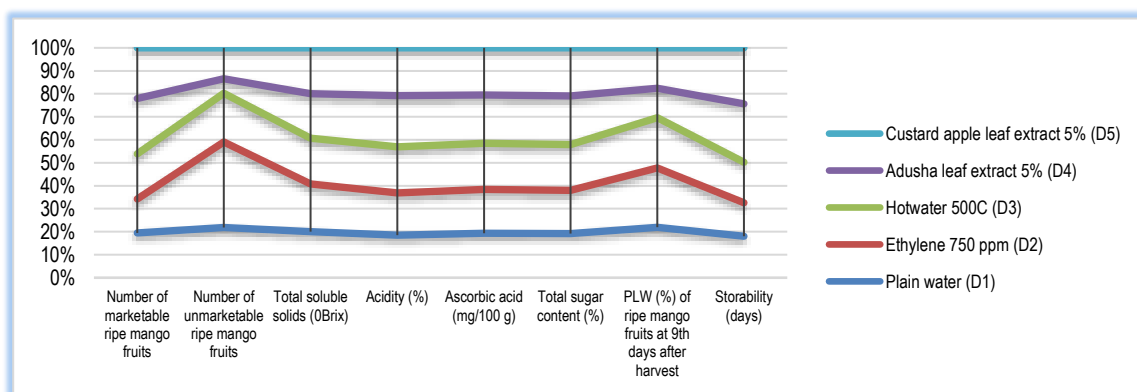
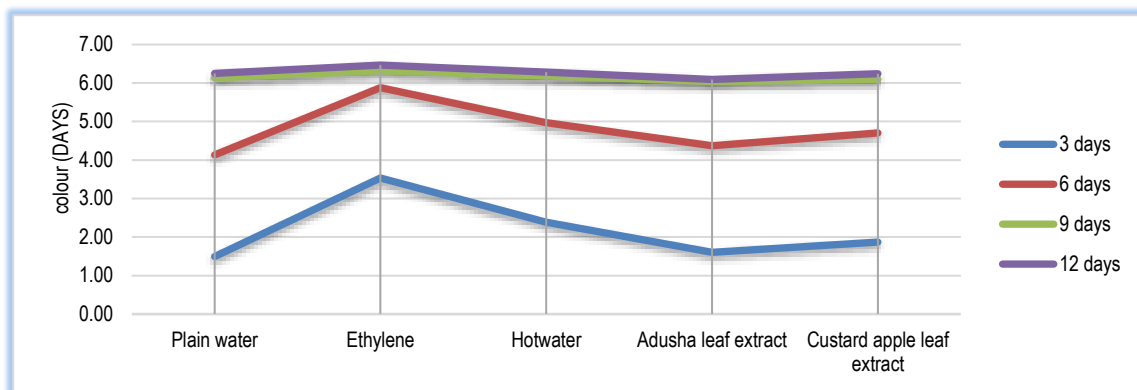

Fig-1 Graphical presentation of dipping in ripe mango fruit at 9th day after harvest


Fig-2 Graphical representation of dipping on colour of mango fruit at 3 days interval

Table-1 Effect of dipping treatments on Number of marketable ripe mango fruits, Number of unmarketable ripe mango fruits, Total soluble solids (TSS) °Brix, Acidity (%), Ascorbic acid (mg/100 g) and total sugar content (%), Physiological loss in weight (PLW %), storability (days) in ripe mango fruits at 9th days after harvest

Treatments	Number of marketable ripe mango fruits	Number of unmarketable ripe mango fruits	Total soluble solids (°Brix)	Acidity (%)	Ascorbic acid (mg/100 g)	Total sugar content (%)	PLW (%) of ripe mango fruits at 9 th days after harvest	Storability (days)
Plain water (D ₁)	14.93 (3.92)	5.07 (2.29)	19.55	0.24	37.46	16.79	9.89	12.53
Ethylene 750 ppm (D ₂)	11.33 (3.41)	8.67 (2.98)	20.19	0.24	36.71	16.36	11.64	10.11
Hotwater 50°C (D ₃)	15.07 (3.94)	4.93 (2.28)	19.47	0.26	38.77	17.35	9.85	12.25
Adusha leaf extract 5% (D ₄)	18.53 (4.36)	1.47 (1.30)	18.83	0.29	40.63	18.44	5.80	17.64
Custard apple leaf extract 5% (D ₅)	16.87 (4.16)	3.13 (1.85)	19.41	0.27	39.62	18.27	7.94	16.92
SEm±	0.02	0.03	0.02	0.001	0.02	0.01	0.02	0.06
CD (5%)	0.04	0.08	0.05	0.002	0.07	0.02	0.06	0.18
CV %	8.97	28.97	2.48	8.16	4.10	5.20	24.68	23.35

$$\text{Acidity\%} = \frac{\text{Titre} \times \text{Normality of NaOH} \times \text{Volume made up} \times \text{Equivalent weight of acid}}{\text{Volume of sample taken for estimation} \times \text{Weight of sample taken} \times 1000} \times 100$$

Ascorbic acid (mg/100g)

Ascorbic acid content was determined according to the method of Ranganna (1986) [9].

$$\text{Ascorbic acid content (mg/100g)} = \frac{\text{Titre} \times \text{Dye factor} \times \text{Volume made up (ml)}}{\text{Volume of extract used for titration} \times \text{Weight of sample (g)}} \times 100$$

Total sugar content (%)

Sugars were determined by the method of Lane and Eynon as described by Ranganna (1986) [9].

$$\text{Total sugars(\%)} = \frac{\text{Invert sugar (mg)} \times \text{Dilution} \times 100}{\text{Titre} \times \text{Wt. or Volume of the sample} \times 100}$$

Physiological loss in weight (%) of mango fruit

Physiological loss in weight (%) of fruits was recorded after 9th days of harvest and calculated as per following formula.

$$\text{PLW (\%)} = \frac{\text{Weight of fresh fruit} - \text{Weight of Ripen fruit}}{\text{Weight of fresh fruit}} \times 100$$

Storability

Storability of mango fruits as influenced by different postharvest storage treatments was recorded up to 20th days after harvest and calculated by counting the days required to fully ripe as to retaining, optimum marketing and eating qualities.

Results and Discussion

Number of marketable ripe mango fruits at 9th days after harvest

The effects of postharvest dipping treatments the maximum transformed marketable ripe mango fruit 18.53 (4.36) have been found under the dipping treatment with adusha green leaf extract 5% (D₄) as compared to (D₁) control plain water 14.93 (3.92). The minimum transformed marketable ripe mango fruit 11.33 (3.41) have been found under the ethylene treatment 750 ppm (D₂) [Table-1]. Similar finding was also reported earlier by Chowdhury *et al.* (2007) [10], Parmar *et al.* (1989) [11].

Number of unmarketable ripe mango fruits at 9th days after harvest

As regards the effect of postharvest dipping minimum number of unmarketable ripe mango fruit 1.47 (1.30), was recorded in adusha leaf extract 5% (D₄) followed by custard apple leaf extract 5% (D₅) 3.13 (1.85), while highest number of unmarketable ripe mango fruit 8.67 (2.98), was recorded in ethylene 750 ppm (D₂) dipping treatment [Table-1].

Colour of fruit

Longer period was required for adusha green leaf extract (D₄) than ethylene 750ppm (D₂) to reach different stages of ripening. The higher colour score 3.53, 5.88, 6.32 and 6.47 were observed in ethylene and lower colour score 1.60, 4.37, 6.04 and 6.09 were observed in adusha green leaf extract 5% at 3rd, 6th, 9th and 12th days of storage respectively [Table-2]. The result corroborates with the finding of Patil *et al.* (2009) [12].

Table-2 Effect of dipping treatments on colour of mango fruits on three days interval

Treatments	Colour at different days after storage (DAS)			
	3	6	9	12
Plain water (D ₁)	1.49	4.13	6.13	6.25
Ethylene 750 ppm (D ₂)	3.53	5.88	6.32	6.47
Hot water 50°C (D ₃)	2.39	4.97	6.19	6.28
Adusha leaf extract 5% (D ₄)	1.60	4.37	6.04	6.09
Custard apple leaf extract 5% (D ₅)	1.87	4.71	6.09	6.24
SEm±	0.05	0.03	0.01	0.01
CD (5%)	0.13	0.08	0.02	0.02
CV%	38.28	14.08	1.75	2.17

TSS^oBrixat 9th days after harvest

TSS content increased in mango fruit during storage. The minimum TSS 18.83 ^oBrix was found under the dipping treatment adusha leaf extract 5% (D₄), custard apple leaf extract 5% (D₅) 19.41 ^oBrixas compared to control plain water (D₁)19.55 ^oBrix. The maximum TSS 20.19 ^oBrix was found under the dipping treatment ethylene 750ppm (D₂) dipping treatment [Table-1]. Similar finding was reported by Kahlon and Uppal (2005) [13] and Shinde *et al.* (2009) [14].

Acidity (%) at 9th days after harvest

The reduction in acidity per cent may be due to rapid utilization of organic acids during respiration at maturity as mango is a climacteric fruit. The maximum acidity percent was found in adusha leaf extracts 5% (D₄) 0.29% dipping followed by custard apple leaf extract 5% (D₅) 0.27% and hot water treatment 500C (D₃) 0.26% as compared to control plain water (D₁)0.24%. Minimum acidity percent was recorded in ethylene 750 ppm (D₂) 0.24% dipping [Table-1]. The result corroborates with the finding of Shinde *et al.* (2009) [14] and Singh *et al.* (2011) [15].

Ascorbic acid of ripe mango fruits (mg/100 g) at 9th days after harvest

Ascorbic acid content of mango pulp was significantly influenced by different dipping treatment during storage period. The higher ascorbic acid content 40.63 mg/100g was found in adusha leaf extract 5% (D₄), custard apple leaf extract 5% (D₅) 39.62 mg/100g as compared to control plain water (D₁) 37.46 mg/100g and lower ascorbic acid content 36.71 mg/100g was recorded in ethylene 750 ppm (D₂) dipping treatment [Table-1]. The result corroborates with the finding of Shinde *et al.* (2009) [14].

Total sugar content (%) at 9th days after harvest

Highest total sugar 18.44% was recorded in adusha leaf extract 5% (D₄) dipping, followed by custard apple leaf extract 5% (D₅) 18.27 % and hot water 500C (D₃) 17.35% dipping treatment as compared to control plain water (D₁)16.79%. Minimum total sugar 16.36% was recorded in ethylene 750 ppm (D₂) dipping treatment [Table-1]. The present findings are in accordance with the report of Shinde *et al.* (2009) [14] and Singh *et al.* (2011) [15].

Physiological loss in weight (PLW %)

The lowest physiological loss in weight of 5.80% was recorded in adusha leaf extract 5% (D₄) dipping treatment, custard apple leaf extract 5% (D₅)

7.94% dipping treatment as compared to control plain water (D₁)9.89%. Maximum weight loss of 11.64% was recorded in ethylene 750 ppm (D₂) dipping treatment [Table-1]. It closely related with by the findings of Shinde *et al.* (2009) [14] and Singh *et al.* (2011) [15].

Storability of mango fruits (Days)

The storability 17.64 days with adusha leaf extract 5% (D₄) was found longer, 16.92 days with custard apple leaf extract 5% (D₅) dipping treatment as compared to control plain water (D₁)12.53 days and minimum storability of 10.11 days were recorded in ethylene 750 ppm (D₂) dipping treatment with an overall mean of 13.89 days [Table-1]. The results are in accordance to the findings of Kacha and Patel (2009) [16].

Application of research: The results of this experiment will be useful with particular reference to long term storage, quality control, transportation and marketing will also be beneficial for both the growers and consumers. The present study shows that with help of different post harvest treatment the mango variety Chhattisgarh Nandiraj could also be a very prominent mango variety for India and international market.

Research Category: Post harvest treatments**Abbreviations:**

CD	Critical Difference
CV	Coefficient of variation
ppm	Parts per million
SEm±	Standard error of difference between two treatments mean
SL	Soluble liquid

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Study area / Sample Collection: Fruit and Vegetable Processing Laboratory of Department of Horticulture, College of Agriculture, Raipur

Cultivar / Variety name: Mango - Chhattisgarh Nandiraj

Conflict of Interest: None declared

Ethical approval: This article does not contain any studies with human participants or animals performed by any of the authors.
Ethical Committee Approval Number: Nil

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