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Effect of post harvest treatments of natural plant extract and wrapping material on storage behavior of mango (cv. KESAR)

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ABSTRACT

The investigation was carried out with a view to study the retardation of ripening process, to increase the shelf life and to minimize the post harvest losses in mango fruit cv. 'KESAR', under the influence of various plant extract treatments *viz.*, *neem* leaf extract, *bael* leaf extract, *neem* oil and sesame oil; and wrapping material *viz.*, tissue paper and polynet wrapping. Matured freshly harvested mango fruits of uniform size were treated with different treatments as post harvest dips for ten minutes. Then fruits were wrapped with wrapping materials and kept in Corrugated Fiber Board (CFB) boxes at ambient temperature (35±2^0 C). The fruits treated with different plant extracts and wrapped in different wrapping materials, showed lower and slower rate in physical and chemical changes than control fruits. The fruits treated with *neem* oil 10 per cent proved to be most effective with respect to longer shelf life, lower physiological loss in weight and higher firmness of fruits. The treatment was also promising for slower increase in TSS, while slower decrease in ascorbic acid and acidity during storage. Among wrapping materials, tissue paper was promising material.

Key words : Mango, Storage, *Neem*, Wrapping, Tissue paper

INTRODUCTION

Mango is an important fruit crop of India as well as tropical and subtropical countries of the world. Being a useful and delicious fruit, it is a part of culture and religion since long time. Besides fine taste, its high palatability, sweet fragrance, attractive colour and nutritional value, it is called as "The king of tropical fruits." The fruit is considered to be a good source of vitamin-A, B-complex and C; β-carotene, nutritive minerals, digestible sugars and trace elements. Its taste, flavor and aroma are very fascinating to every one. Because of these naturally built in qualities, it has high demand in global market. Due to changes in the habits of people and awareness in growers, export of mango is now gaining global popularity. India is the largest producer of mango in the world with the production of approximately 14 million tones, contributing more than 57 per cent share of the world production. India has nearly 1000 varieties and grown in an area of 1.23 million hectare (2). In the year 2006-07, India exported 79,060.88 metric tones of mangoes worth Rs. 141.94 crores (3). In Gujarat, mango covers around 1,01,988.00 hectares with a production of about 8,34,288.00 metric tones. Post harvest handling can play a major role in reducing post harvest losses. A number of post harvest treatments such as wax emulsion, plant growth regulators, fungicides, polyethylene film and various chemicals (6 and 1) are being used to extend the shelf life of fruits. But the environmental consciousness on the part of scientists and general public awareness towards the increasing use of chemicals on food stuff and their deleterious effect on human and environment are driving force to find the use of suitable, eco-friendly and minimum risk agents for storage of fruits for longer period. Present studies were, therefore, undertaken to find out the best natural plant extract and wrapping material in extending the shelf life of mango at ambient temperature.

MATERIALS AND METHODS

The investigation was carried out in post graduate laboratory of Department of Horticulture, J.A.U., Junagadh during the year 2007. Green mature of uniform size and shape fruits of mango cv. KESAR were selected. The treatments were given as post harvest dips. In these treatments, the fruits were dipped for 10 minutes in *neem* leaf extract of 10/20 per cent and *bael* leaf extract of 10/20 per cent, then air dried for 30 minutes after each treatment. Treated fruits were wrapped in different wrapping materials and packed in corrugated fibre board (CFB) boxes and stored at ambient condition. For preparation of 1 liter of 10 per cent *neem* oil emultion, one teaspoon full of teepol was mixed in 50 ml distilled water and then 100 ml *neem* oil was added and mixed well. The volume was then made up to 1 liter by adding distilled water. The experiment was laid out on Factorial Completely Randomized Design with three replications, having totally twenty one treatment combinations. The fruits were analyzed periodically for various physical and bio-chemical changes.

RESULTS AND DISCUSSION

Physiological loss in weight increased with increasing period of storage (Table 1) in all the treatments. The

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minimum loss in weight was noted when mango fruits treated with *neem* oil 10 per cent. The reduced weight loss was due to the reason that a thin film of the oil reduced the evapotranspiration and respiration rate in the treated fruits (20). Tissue paper wrapping was also effective in minimizing loss in weight compared to control. This might be due to reason that tissue paper provides full covering to fruit and helped in reducing transpiration rate. Similar findings were obtained by Parmar and Chundawat (14) in 'Kesar' mango.

The shelf life of fruits determines their keeping quality. Maximum shelf life observed in fruits treated with *neem* oil 10 per cent (Table 1). It was due to the *neem* oil have been found to posses antifungal properties and thin film of the oil emulsion reduced the evapotranspiration and respiration rate and show minimum decay (20). The finding were by Bhowmick and Vardhan (5), Khader *et al*. (8) in mango. Among wrapping materials, the tissue paper resulted in to maximum shelf life. This might be due to the reason that the tissue paper wrapped fruits were completely isolated from each other, which act as barrier for the pathogens to spread and hence less decay loss (19). These results are in conformation with the results of Somkuwar *et al*. (21), Deol and Bhullar (7), Mortuza *et al*. (13) and Parmar and Chundawat (14).

A fall in firmness in all the treatments (Table 1) was observed during storage period. Yet, maximum fruit firmness was recorded in fruits treated with *neem* oil 10 per cent. Gradual conversion of carbohydrate in to sugar along with change in cell wall polysaccharides and uronic acid, as suggested by Labavitch and Ahmad (10) lead to the decrease in firmness. Decline in alkali soluble pectin and increase in polygalactouranase activity was found to be correlated with the loss of firmness. These results are also supported by, Singh *et al.* (20) in mango. Tissue paper wrapping had profound effect in minimizing the softness in fruits. This might be due to slow rate of ripening as tissue paper might be slowed down the rate of respiration by less gaseous exchange. The similar results were conformed with Shivani *et al*. (19).

There was increase in TSS with increasing period of storage (Table 2). The initial rise in TSS could be due to accumulation of sugar as consequence of starch hydrolysis, while the later decrease was due to consumption of sugar for respiration during storage (9). The rise in TSS was slow in *neem* oil 10 per cent treated fruits. The final level of TSS was also higher in the same treatment compared to control. The TSS is directly correlated with PLW of fruits (16). Similar trend was recorded by Singh *et al*. (20), Bhardwaj and Sen (4) in their findings. The TSS was also influenced by wrapping materials due to quick metabolic transformation in soluble compounds and more conversion of organic acid in to sugar (17). The tissue paper wrapped fruits showed gradual increase in TSS during storage. This might be due to TSS is directly correlated with PLW of fruits (16)

Table 1 : Effect of plant extracts and wrapping materials on physiological loss in weight (%), firmness (kg/cm^2) and shelf life of mango (cv. Kesar) fruit during storage

Treatment details	Physiological loss in weight (%)				Firmness (kg/cm^2)						Shelf life (days)
	Storage period (days)				Storage period (days)						
	4	8	12	16	0	4	8	12	16	20	
Plant Extracts											
Control	4.69	14.40	18.47	24.89	8.83	5.59	1.89	1.06	0.51	0.09	9.67
Neem leaf extract 10%	4.46	13.66	16.46	22.06	8.94	6.60	2.59	2.56	0.68	0.66	16.67
Neem leaf extract 20%	4.43	12.96	16.18	21.66	9.12	6.73	2.73	2.59	0.70	0.69	17.67
Bael leaf extract 10%	4.56	13.77	17.40	23.37	8.87	6.15	2.25	1.10	0.61	0.14	13.33
Bael leaf extract 20%	4.54	13.74	17.13	22.89	9.08	6.27	2.35	1.13	0.64	0.15	15.00
Neem oil 10%	4.30	12.63	15.78	21.07	9.10	6.96	2.89	2.69	1.57	1.26	19.00
Sesame oil 2%	4.50	13.70	16.76	22.48	8.93	6.43	2.47	1.17	0.66	0.18	15.67
S.E. ±	0.07	0.31	0.43	0.21	0.09	0.14	0.05	0.03	0.01	0.01	0.45
C.D. (P=0.05)	0.22	0.89	1.24	0.62	NS	0.41	0.16	0.09	0.05	0.04	1.28
Wrapping materials											
Control	4.57	13.92	17.33	23.31	8.88	6.12	2.24	1.73	0.72	0.42	13.36
Tissue paper	4.36	12.83	16.06	21.39	8.99	6.91	2.85	1.80	0.86	0.50	17.36
Polynet wrapping	4.56	13.91	17.25	23.19	9.08	6.15	2.27	1.74	0.73	0.44	15.14
S.E. ±	0.05	0.20	0.28	0.14	0.06	0.09	0.03	0.02	0.01	0.01	0.29
C.D. (P=0.05)	0.14	0.58	0.81	0.40	NS	0.27	0.10	0.06	0.03	0.02	0.84
C.V.%	5.24	6.92	7.76	2.89	3.16	6.83	7.11	5.59	7.11	9.64	8.85
Interaction	Plant Extracts x Wrapping materials – Non significant										

Table 2 : Effect of plant extracts and wrapping materials on total soluble solids (%), Ascorbic acid and acidity of mango (cv. KESAR) fruit during storage

Treatment details	TSS (%)						Ascorbic acid (mg/100 g pulp)						Acidity (%)					
	Storage period (days)						Storage period (days)						Storage period (days)					
	0	4	8	12	16	20	0	4	8	12	16	20	0	4	8	12	16	20
Plant Extracts																		
Control	8.26	9.49	13.65	16.64	18.69	18.25	74.72	69.35	50.66	46.88	39.05	0.00	3.44	2.81	0.96	0.65	0.23	0.00
Neem leaf extract 10%	8.37	9.11	13.53	15.31	17.58	17.51	75.86	71.94	60.17	55.37	43.73	36.81	3.46	3.07	2.03	0.89	0.28	0.23
Neem leaf extract 20%	8.29	9.21	12.73	15.15	17.50	17.28	75.47	71.96	61.77	57.93	44.03	36.87	3.45	3.09	2.06	0.93	0.29	0.24
Bael leaf extract 10%	8.06	9.33	13.58	16.04	18.29	17.73	75.07	70.24	56.37	51.73	40.62	36.50	3.47	2.92	1.90	0.82	0.26	0.21
Bael leaf extract 20%	8.06	9.31	13.57	16.01	17.92	17.68	75.87	70.26	57.67	53.00	40.97	36.73	3.45	2.94	1.93	0.84	0.26	0.21
Neem oil 10%	8.30	9.17	12.70	14.99	17.41	17.01	74.97	71.98	65.11	59.38	44.33	39.32	3.44	3.11	2.09	0.95	0.31	0.24
Sesame oil 2%	8.16	9.28	13.55	15.47	17.76	17.61	75.43	71.92	58.90	54.17	43.30	36.78	3.44	3.05	1.97	0.85	0.27	0.22
S.E. ±	0.12	0.08	0.27	0.36	0.26	0.20	0.35	0.36	0.94	0.65	1.01	0.65	0.02	0.06	0.04	0.02	0.006	0.004
C.D. (P=0.05)	NS	0.22	0.78	1.03	0.75	0.58	NS	1.03	2.70	1.86	2.90	1.86	NS	0.17	0.12	0.06	0.01	0.01
Wrapping materials																		
Control	8.15	9.33	13.59	15.98	18.11	17.88	75.35	70.82	55.75	51.65	40.65	31.33	3.46	2.95	1.72	0.79	0.25	0.18
Tissue paper	8.17	9.16	12.82	15.03	17.43	17.00	75.13	71.63	64.25	58.55	45.45	32.84	3.44	3.08	2.08	0.94	0.30	0.21
Polynet wrapping	8.32	9.32	13.58	15.97	18.09	17.87	75.53	70.83	55.99	52.00	40.77	31.40	3.46	2.96	1.75	0.81	0.26	0.18
S.E. ±	0.08	0.05	0.18	0.23	0.17	0.13	0.23	0.23	0.61	0.42	0.66	0.42	0.01	0.04	0.02	0.01	0.004	0.003
C.D. (P=0.05)	NS	0.14	0.51	0.67	0.49	0.38	NS	0.68	1.76	1.22	1.90	1.22	NS	0.11	0.08	0.04	0.01	0.008
C.V.%	4.57	2.58	6.21	6.96	4.41	3.51	1.42	1.53	4.84	3.63	7.22	6.16	2.53	6.11	7.09	7.72	6.43	6.74

Interaction Plant Extracts x Wrapping materials – Non significant

and the minimum PLW was observed in tissue paper wrapped fruits. These results are in agreement with Shivani *et al.* (19).

The ascorbic acid content of fruits decreased gradually during storage in all the treatments (Table 2), these all might have happened due to rapid conversion of l-ascorbic acid in to dehydro-ascorbic acid in the presence of enzyme ascorbinase with different level of oxidation in different treatments (11). Maximum ascorbic acid content was observed in *neem* oil 10 per cent. The *neem* oil treatment retards the ripening process and slow down the respiration of fruits and therefore higher level of ascorbic acid was observed (20). Among different wrapping materials tissue paper had beneficial effect in reducing more ascorbic acid. This might be due to wrapping materials have been helpful to reduce the oxidation of ascorbic acid. These findings are in agreement with those obtained by Sharma *et al.* (18).

The loss of acids was also rapid and titrable acidity showed a continuous decrease, such as rapid decline in organic acids suggests their faster utilization in the process of respiration. Mango is a climatric fruit an on increased respiration will be exposed in the post harvest storage (12). Maximum acidity was recorded (Table 2) in *neem* oil 10 per cent treatment due to their effects on the utilization of organic acids in respiration which delays ripening and restricts starch degradation hence results in higher acidity contents. This result was confirmed with the findings of Singh *et al.* (20). In different wrapping materials the lowest degree of decrease in acidity was observed in fruit wrapped in tissue paper. This might be due to quick metabolic transformation in soluble compounds and slow conversion of organic acid in to sugar during storage (17, 18 and 19). These results corroborate the findings of Parmar and Chundawat (14) and Pruthi (15).

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