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Effect of Different Sanitising Agents on Reducing the Post Harvest Loss in Papaya (*Carica papaya* L.) Variety Coorg Honeydew for Local Market

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ABSTRACT: *Papaya (Carica papaya L.) one of the most widely grown tropical fruit of India suffers from the highest post harvest losses. The desiccation of fruits, perishable nature of papaya and postharvest diseases often leads to the huge losses incurred.The present investigation was under taken with the objective to identify a suitable sanitising agent to improve the shelf life in papaya variety Coorg Honeydew for the local market.The fruits harvested at ¼ yellowing stage were washed in running water followed by different sanitising agents like hot water at 50° C for 15 and 20 minutes, sodium hypochlorite at 120 and 150 ppm for 10 minutes and warm sodium hypochlorite at 120 and 150 ppm for 10 minutes . The shelf life of the fruits, physiological loss in weight and microbial population of the treated and control were observed. The fruits harvested at ¼ yellowing and treated with hot water at 50° C for 20 minutes can be suggested as the best method to control post harvest diseases, improved shelf life, minimum loss of physiological loss in weight and minimum population of microbes under ambient storage conditions compared to control.*

Key words: *postharvest management, papaya, Carica papaya.L.Coorg Honeydew, microbial population, shelf life.*

INTRODUCTION

Papaya (*Carica papaya* L.) is a nutritious tropical fruit widely cultivated in India. With a world production of 12.6 million tons in 2012- 2013, India shares the first position producing around 5.2 million tons of papaya (NHB, 2014).

Papaya fruits are vulnerable to heavy postharvest losses.The estimated postharvest losses of papaya had been 30-60% in South East Asian region (FAO, 2006). According to Gamage and Ranawana (2011) the highest percentage of postharvest loss was found in papaya (46 per cent) compared to banana and pineapple (20-30 per cent). The high water content, the softness of the fruit on ripening, the mechanical damage incurred during harvest and transport and the vulnerability of the fruit to many postharvest diseases altogether contribute to the substantial increase in post harvest losses. Of the different type of losses, post harvest diseases is one of the main causes for the large scale losses in papaya fruits. Heat treatments and use of sanitising agents were reported to reduce the postharvest loss of many fruits due to post harvest diseases. Post harvest disease being one of the highest contributors of post harvest losses in papaya an experiment was carried out to identify the suitable sanitiser for controlling the post harvest diseases and thereby improve the shelf life without making much reduction in physiological loss in weight.

MATERIALS AND METHODS

The experiment was carried out at the Department of Processing Technology, College of Agriculture, Vellayani, Kerala Agricultural University, India during 2012-2014.The papaya fruits of variety Coorg Honeydew were harvested at ¼ yellow stage and were washed in tap water and sanitized withdifferent sanitising agents. The treatments included ,W_1 - hot water treatment at 50° C for 15 minutes,W_2 - hot water treatment at 50° C for 20

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minutes, W_3 - sodium hypochlorite 120 ppm for 10 minutes, W_4 - sodium hypochlorite 150 ppm for 10 minutes, W_5 - warm sodium hypochlorite 120 ppm for 10 minutes,W_6- warm sodium hypochlorite 150 ppm for 10 minutes and W_7- Control (washing with tap water).

After hot water treatment fruits were air cooled and kept at ambient temperature. The observations on shelf life, physiological loss in weight and microbial population for these treatments were recorded under ambient condition.

Shelf Life

In each treatment, fruits at fully ripe stage which was totally fit for consumption was considered as the end of the shelf life in that particular treatment and expressed in days.

Physiological Loss in Weight (PLW)

During the storage period, per cent weight loss (physiological loss in weight) was determined on initial weight basis by weighing the fruit samples on the first day of harvest and final weight on the end of shelf life, using the following formula and expressed as percentage (Koraddi and Devendrappa, 2011) :

$$PLW = \frac{Initial\ weight\ (g/kg) - Final\ weight\ (g/kg)}{Initial\ weight\ (g/kg)} \times 100$$

Microbial Load

The enumeration of microbial load in pre and post treated samples was carried out by serial dilution technique. Nutrient agar and Sabourd Dextrose agar medium were used for the enumeration of bacterial and fungal population of the fruit surfaces respectively.The fruit was washed with 100 ml sterile distilled water and shaken thoroughly for two minutes. One ml of supernatant was accurately pipetted out into eppendroff tube containing 900 µl of sterile distilled water to get 10^{-3} dilution. This procedure was repeated to get 10^{-5} dilution. 100 µl each of 10^{-3}, $10^{-4,}$ 10^{-5} and 10^{-6} were used for enumeration of total bacterial and fungal count. Bacterial count was enumerated for three days continuously from the next day of inoculation whereas fungal count was taken from three days after inoculation and the count just before the damage of the treatment was represented. Number of microorganisms (bacteria and fungi) per cm^2 of post treated sample was calculated as per the following formula (Amith, 2012).

$$No.of\ colony\ forming\ units\ (cfu)/ml\ of\ the\ sample = \frac{Total\ number\ of\ colony\ formed \times Dilution\ factor}{Aliquot\ plated}$$

Statistical Analysis

The observations were analyzed statistically in a Completely Randomized Design (CRD) and significance was tested using analysis of variance technique (Gomez and Gomez, 1984).

RESULT AND DISCUSSION

Shelf Life

The effect of different sanitizing agents on shelf life of papaya var. Coorg Honeydew for local market is shown in Table 1. Significant difference was noticed between different sanitising agents with respect to shelf life (Fig.1). A higher shelf life (6 days) was noticed in papaya fruits treated with hot water treatment at 50° C for 20 minutes (W_2) and warm sodium hypochlorite 150 ppm for 10 minutes (W_6) compared to untreated ones (control) .The control sample (W_7) showed lowest shelf life (3.67 days).

According to Alvindia (2012) hot water treatment delayed ripening and prolonged green life of fruit. Zaho *et al*. (2013) observed that hot water treatment at 54° C for 4 minutes effectively slowed fruit ripening in papaya. The appropriate hot water treatment reduced respiration rate and ethylene production of fruit and inhibited activity of polygalacturonase and pectin methyl esterase enzymes associated with cell wall degradation and enhanced poly galacturonase inhibiting protein gene expression.

According to Nishijima (1994) sodium hydroxide, sodium carbonate, sodium hypochlorite (Clorox), EDTA, and calcium hypochlorite were found to be safe to use in a five- minute dip at 8,000 ppm for papaya fruits instead of mancozeb for the prevention of major postharvest diseases as well as blight caused by *Phytophthora palmivora*. The wash water containing a mild detergent like hypochlorous acid at concentration of 150 ppm and water at pH of 6.5 along with thiobendazole 50 ppm was reported to control postharvest disease of papaya (New GMC, 2003).Several studies demonstrated that the application of chlorine dioxide, hydrogen peroxide and sodium hypochlorite can reduce populations of total aerobic bacteria, yeasts and moulds on strawberry (Kim *et al*., 2010). The higher shelf life in the W_2 and W_6 treatments might be due to lesser microbial load as observed as well as the delayed ripening in these treatments compared to control.

Physiological Loss in Weight

The effect of different sanitizing agents on physiological loss in weight of papaya var. Coorg Honeydew for local marketharvested at ¼ yellow stage showed significant variation among different treatments and is shown in Table 1. Papaya fruits treated with hot water treatment at 50° C for 20 minutes (W_2) recorded lowest PLW (2.98 %) and was significantly different from the control. (Fig. 2). The control sample (W_7) showed the highest loss in physiological weight (5.18%). The less physiological loss in weight in W_2 treatment might be due to the less loss in membrane integrity. The membrane being intact, the loss of water will be less.

Arina *et al*. (2010) reported that hot water treatment of Eksotika papaya fruit left to ripen at ambient temperature (25° C) and about 80 per cent relative humidity experienced about almost 12 per cent fresh weight loss during the ripening period.

Microbial Load

The effect of different sanitizing agents on microbial load of papaya var. Coorg Honeydew harvested at ¼ yellow for local market showed significant variation between treatments and is shown in Table1. Papaya fruits sanitized with hot water at 50° C for 20 minutes (W_2) had lowest count of bacterial population (35.00x 10^6), which was on par with the fruits sanitized with warm sodium hypochlorite, 150 ppm for 10 minutes W_6 (57.50 x10^6) and hot water treatment at 50° C for 15 minutes W_1(59.50 x 10^6). The control sample (W_7) had maximum count of bacterial population (122.00 x 10^6).

Regarding the fungal population, hot water treatment at 50° C for 20 minutes (W_2) had lowest count (3.00x 10^3), followed by fruits sanitized with warm sodium hypochlorite 150 ppm for 10 minutes, W_6 (4.00 x10^3). The control sample (W_7) had maximum count of fungal population (11.50 x 10^3).Thus it may be inferred that sanitization with hot water treatment at 50°C for 20 minutes (W_2) and warm sodium hypochlorite 150 ppm for 10 minutes (W_6) had the lower count of bacterial and fungal population. (Fig 3,4)

New Guyana Marketing cooperation reported that wash water containing a mild detergent like hypochlorous acid at concentration of 150 ppm in water at pH of 6.5 along with thiabendazole 50 ppm was effective to control postharvest disease of papaya (New GMC, 2004). Hot water treatment is suggested as a method for fruit fly disinfestation which is a quarantine requirement for the papaya exporting industries. The hot water treatment at 47 ±1 °C could maintain postharvest quality of 'Eksotika' papaya fruit and at the same time prevented it from insect infestation (Arina *et al*. 2010). Martins *et al*. (2010) reported that treatments of papaya fruit with hot water at 48- 50° C for 20 minutes controlled the *Colletotrichum gleosporoides* and *Phoma caricae*.

Table 1
Effect of different sanitizing agents on papaya var. Coorg Honeydew for local market

Treatments	*Shelf life (days)*	*Physiological loss in weight (%)*	*Bacteria (cfu/ml x 10 ^{6})*	*Fungi (cfu/ml x 10^3)*
W_1	5.33	3.69	59.50	5.00
W_2	6.00	2.98	35.00	3.00
W_3	4.67	3.76	102.00	8.00
W_4	5.67	3.49	74.50	6.50
W_5	5.33	3.30	80.00	5.00
W_6	6.00	3.23	57.50	4.00
W_7	3.67	5.18	122.00	11.50
SE	0.356	0.395	10.370	0.308
CD (0.05)	1.081	1.199	34.683	'0.729

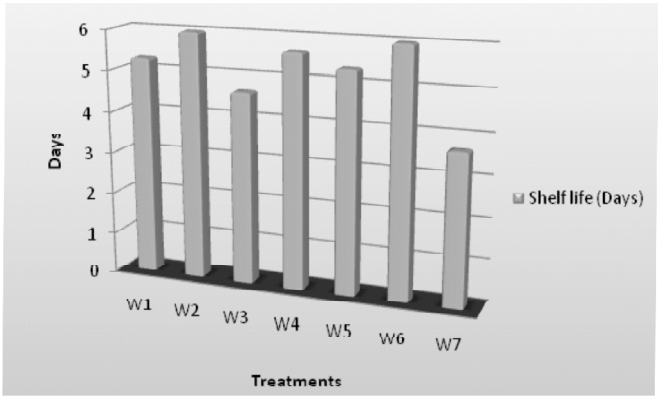

Figure 1: Effect of different sanitizing agents on shelf life of papaya var. Coorg Honeydew for local market

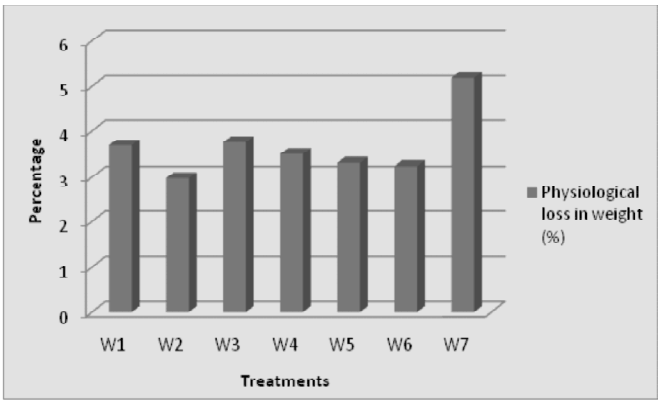

Figure 2: Effect of different sanitizing agents on physiological loss in weight of papaya var. Coorg Honeydew for local market

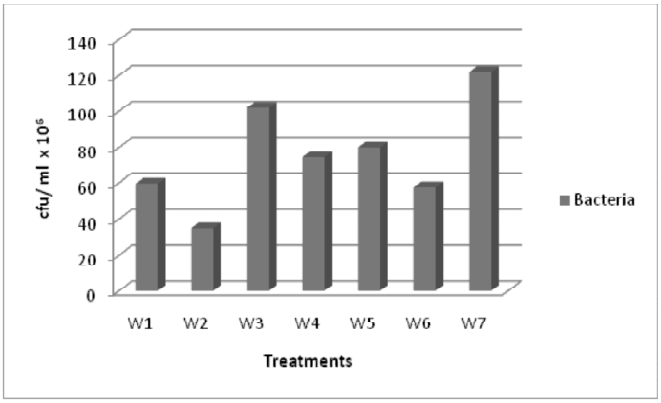

Figure 3: Effect of different sanitizing agents on bacterial count of papaya var. Coorg Honeydew for local market

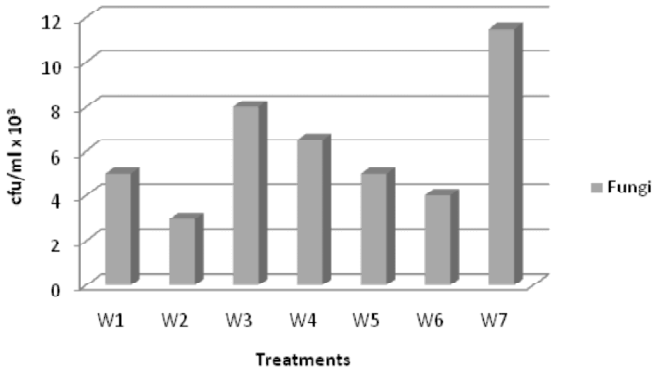

Figure 4: Effect of different sanitizing agents on fungal count of papaya var. Coorg Honeydew for local market

CONCLUSION

The results from this study clearly demonstrated that papaya var. Coorg Honeydew fruits treated with hot water at 50° C for 20 minutes and warm sodium hypochlorite 150 ppm for 10 minutes were effective in improving shelf life, less physiological loss in weight and less microbial load . How ever the hot water treatment of 50°C for 20 minutes can be suggested as a better method as it was more effective and had less bacterial and fungal load. Though hypochlorites are chemical agents which are found to be safe to use, hot water treatment may be the best alternative, considering the lesser microbial load and better to avoid chemical treatment strategy.

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