

EFFECT OF POSTHARVEST WAX TREATMENT ON WEIGHT LOSS AND SHELF-LIFE OF FIVE TROPICAL FRUITS

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ABSTRACT

Wax emulsion was applied to five tropical fruits, mango, banana, lime, lemonime and pineapple, to study its effect on weight loss, yellow colour development and shelf-life. Wax coating greatly reduced the weight loss of mango, banana, lime and lemonime fresh fruits. It delayed yellowing associated with senescence thereby extending their shelf-life. Percentage of spoilt fruits recorded during early days of storage was markedly diminished by wax coating. Application of the wax with a swab of cotton wool was ineffective for pineapple fruits. Further studies on proper methods of application of wax on a large scale, any toxic effects of wax coat and fruit quality retention are needed before recommending wax coating as a way of storing fruits.

KEY WORDS: Shelf-life, Wax emulsion, Weight loss, Yellow colour development

INTRODUCTION

The care taken during the critical period between harvesting and selling at the market decides the quality of fresh fruits on offer to the customer. Fresh fruits generally contain 80-90% water, and are easily subject to desiccation. In tropical countries like Sri Lanka, the total loss of fresh fruits between harvesting and selling could reach 20-40% or more (Senanayake, 1966). Drying is the most important factor that causes commercial deterioration of fresh fruits (Ben-Yehoshua, 1967). Hence, prevention of water loss from fresh fruits during postharvest handling is relevant to both profits gained and control of postharvest diseases. To overcome this problem up to

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some extent, provision of improved storage facilities including controlled atmosphere and educating the farmer on postharvest technology are essential.

Fruit coating can be a sound substitute to overcome the cost involved in sophisticated storage systems and expensive postharvest treatments. The wax emulsion has been successfully used as a fruit coating material for mango (Nuevo *et al.*, 1984), orange (Ben-Yehoshua, 1969), and tangerines and lime (Senanayake, 1966).

This paper discusses the effect of wax emulsion on extension of shelf-life of five important tropical fruits.

MATERIALS AND METHODS

Thirty fruits each of local lime (*Citrus aurantifolia* (Christm) Swingle), lemonlime (*Citrus limón* L. X. *Citrus aurantifolia* (Christm) Swingle), banana (*Musa spp.*) var. Embon, mango (*Mangifera indica* L.) var. Karutha Colomban and pineapple (*Ananas comosus* (L) Merr.) cv. Mauritius were brought from the market. All fruits were well-matured and green in colour. The fruits were wiped clean using a piece of dry cotton cloth before treatments were imposed. The wax emulsion (Brand name—TAG manufactured by Chemical Industries, Colombo) mixed with benomyl was applied to 15 fruits of each test species using a swab of clean cotton wool. Another 15 fruits of each species were kept without coating for comparison. Treatments were replicated four times. Hereafter, uncoated fruits will be referred to as 'untreated' fruits.

The weight of individual fruits just after treatment was determined. All fruits were labelled and placed in trays under ambient condition. The windows were kept open during the day to provide ventilation; during the night they were kept closed.

RESULTS

Mango

Weight loss: Wax treatment drastically reduced the weight loss of mango (Fig. 1a). The rate of weight loss was higher in untreated fruits than in treated fruits during the storage. The untreated fruits

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lost more than 37% of the weight while treated fruits lost only 15% of their weight during first 8 days of storage. During the first 4 days of storage, treated fruits lost less than 50% of the weight loss recorded for the untreated fruits during the same period. However, rate of weight loss gradually declined as storage time increased in both treated and untreated fruits and became almost similar by the 12th day of storage (Fig. 1a).

Senescence and rejects: Yellow colour development of the treated mango was delayed by four days (Fig. 2a). On the fourth day of storage, difference in yellowing between the treated and untreated fruits decreased. All the treated fruits turned yellow 16 days after treatment while all the untreated fruits turned yellow four days earlier. About 70% of the untreated fruits and 35% of the treated fruits were rejected due to spoilage during the 8 day storage period (Fig. 1a). This difference started to narrow down from the 12th day and all the mango fruits in the study were spoilt and discarded 4 days later.

Banana

Weight loss: Treated fruits showed less weight loss than untreated fruits (Fig. 1b). While untreated fruits lost 18% of weight during 12 day of storage period, treated fruits lost only about 10% of the weight. During the first 4 days of storage the rate of weight loss in treated fruits was lower than that in untreated fruits. Thereafter both treated and untreated fruits had similar rates of weight loss.

Senescence and rejects: In banana wax coating delayed yellowing only slightly (Fig. 2b). Between 8 and 12 days of storage, 5% of the treated and 12% of the untreated fruits were spoilt. But after 16 days of storage, all fruits regardless of the treatment were spoilt and had to be rejected (Fig. 1b).

Lime

Weight loss: The percentage weight loss recorded in treated lime fruits was very much lower than that in the untreated fruits (Fig. 1c). The untreated lime fruits lost 16% of the weight by the 8th day of storage while treated fruits lost only 8% of their weight. During the

first 4 days of storage, there was a big difference in the rate of weight loss between treated and untreated fruits (Fig. 1 C). This difference in rate was maintained even after 8 days.

Senescence and rejects: There was no yellow colour development observed in lime fruits. Instead, all of them initially turned brown and then black regardless of the treatment. However, 85% of the treated and 58% of the untreated fruits were in an acceptable condition after 8 days of storage (Fig. 1c). But after the 8th day all the fruits started to turn brown rapidly and by the 12th day they were all rejected (Fig. 1 C).

Lemonime

Weight loss: Weight loss of lemonime fruits increased with increase in storage period regardless of the treatments (Fig. 1d). The difference in weight loss between treated and untreated fruits widened (especially after 12 days of storage) with extended storage period. The weight loss in treated fruits was 30% after 36 days of storage while this was 60% for the untreated fruits. The highest rate of the weight loss was detected during first 12 days of storage. Thereafter, the rate decreased in both treated and untreated fruits. The untreated lemonime fruits exhibited a more uniform and higher weight loss than the treated fruits up to the 12th day; in the treated fruits the rate of weight loss was low up to the 8th day (Fig. 1 d).

Senescence and rejects: The rate of yellowing of lemonime was markedly retarded by the wax treatment during first 4 days (Fig. 2c). During the second interval of storage, yellowing of treated fruits proceeded at a lower rate than that of the untreated fruits. All the untreated fruits and 67% of the treated fruits turned full yellow after 28 days. The treated fruits too, turned full yellow, 32 days after the commencement of the experiment.

None of the treated lemonime fruits were rejected until the 16th day; during the same period 15% of untreated fruits was rejected due to spoilage. Beyond 30—40% weight loss, the percentage of the fruits with defects increased drastically (Fig. 1 d).

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Pineapple

Weight-loss: There was no major difference in weight loss between treated and untreated pineapple fruits (Fig. 1e). During a period of 24 days, weight loss was about 30%.

Senescence and rejects: Wax coating slightly retarded yellowing for 4 days but the difference rapidly disappeared by the 8th day when all the fruits (both treated and untreated) became yellow (Fig. 2d). Up to 20 days of storage there was no difference in the percentage rejects (Fig. 1e). Thereafter wax coating greatly reduced the percentage of fruits spoilt; on the 24th day of storage all the untreated fruits had to be rejected due to spoilage. But 4 days later (28 days of storage) even the treated fruits were spoilt and had to be discarded.

DISCUSSION

Weight loss was reduced by wax coating and this reduction was very prominent throughout the period of storage. Wax coating also decreased the rate of weight loss. Moisture loss is responsible for a major portion of weight loss. The stomata of the fruit surface might have been covered by the wax coat. It may have partially sealed the fruit resulting in restricted gas exchange. Respiration probably has been slowed down causing reduction in loss of food reserves. According to Ben-Yehoshua (1969) drying of peel causes deterioration of fruits and skin coating markedly reduces transpiration, doubling shelf-life.

Fruit senescence and loss of weight are directly related. Senescence is associated with yellow colour development. In this study yellowing of fruits was delayed by wax treatment. This suggests that the processes of ripening are impaired by wax coating. Ethylene (C_2H_4) is one of the volatile products that emanates from ripening fruits which causes yellowing of fruits (Young and John, 1972). In wax treated fruits, it has been shown that internal O_2 level is lower than the internal CO_2 concentration (Ben-Yehoshua, 1969). Wax coating also increases the peel resistance to CO_2 and C_2H_4 diffusion. According to Nuevo *et al.* (1984) wax coating has been found to reduce O_2 level in ripening fruits especially mango. Therefore endogenous synthesis of

C_2H_4 in wax coated fruits can be reduced since this process needs a good supply of O_2 (Burg and Burg, 1967). Thus when C_2H_4 biosynthesis is impaired, senescence or ripening will be delayed.

The absence of the beneficial effects of wax coating in pineapple may be due to the fact that wax could not be uniformly applied over the entire fruit. The skin of the pineapple fruit is full of depressions, short hairs and partially opened uneven flower bracts. Hence, the method used for application of wax seems to be inappropriate. Instead, immersing of the whole fruit in wax foam would have been more effective.

The large scale use of this wax needs the development of an effective method of application. However, toxic effects of wax coat, if any, and fruit quality retention need to be investigated before recommending wax coating as a way of storing fruits.

ACKNOWLEDGEMENT

The authors extend their sincere gratitude to Mrs. I. S. Padmasiri for giving valuable suggestions during the study, Messrs. A. A. Jayawardena and Hemantha Gunawardena of CIC Ltd., Colombo for providing all experimental materials and Mr. K. M. Seneviratne for assisting in the laboratory.

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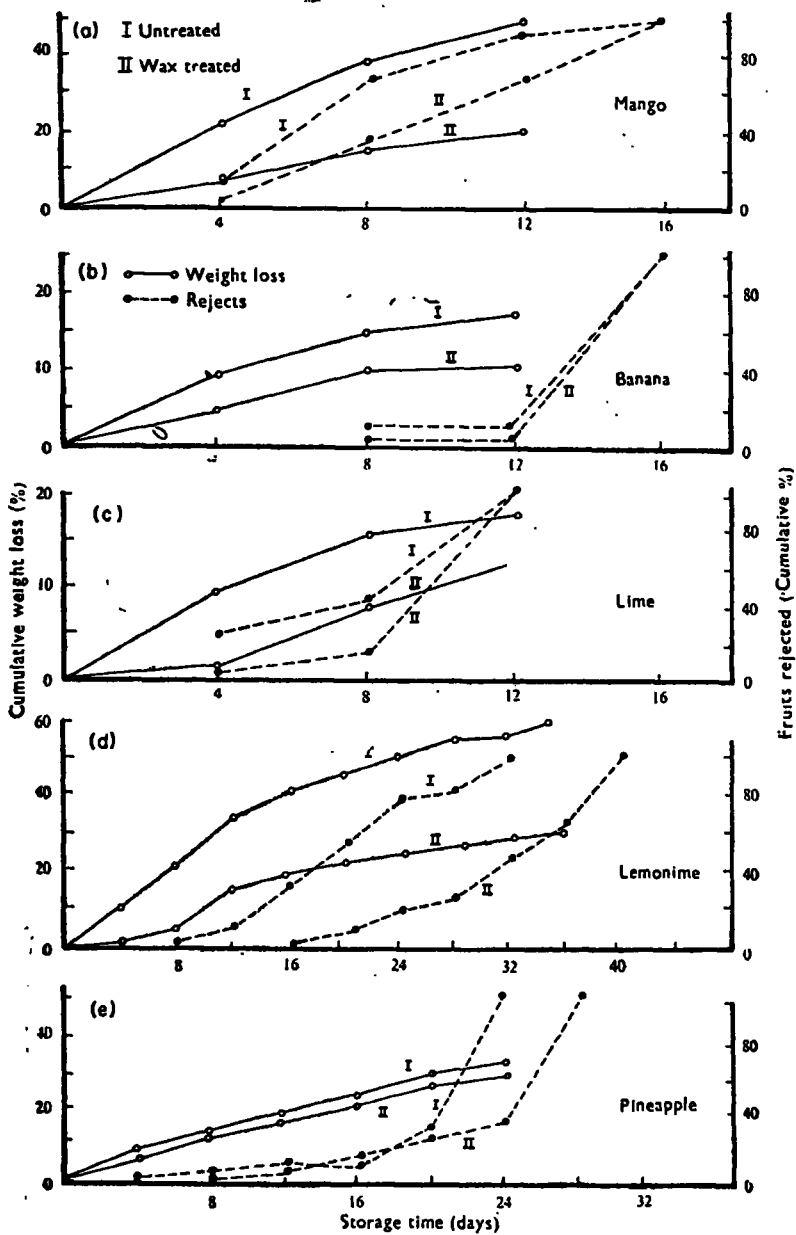


Fig. 1. Cumulative percentage weight loss and rejects in five tropical fruits

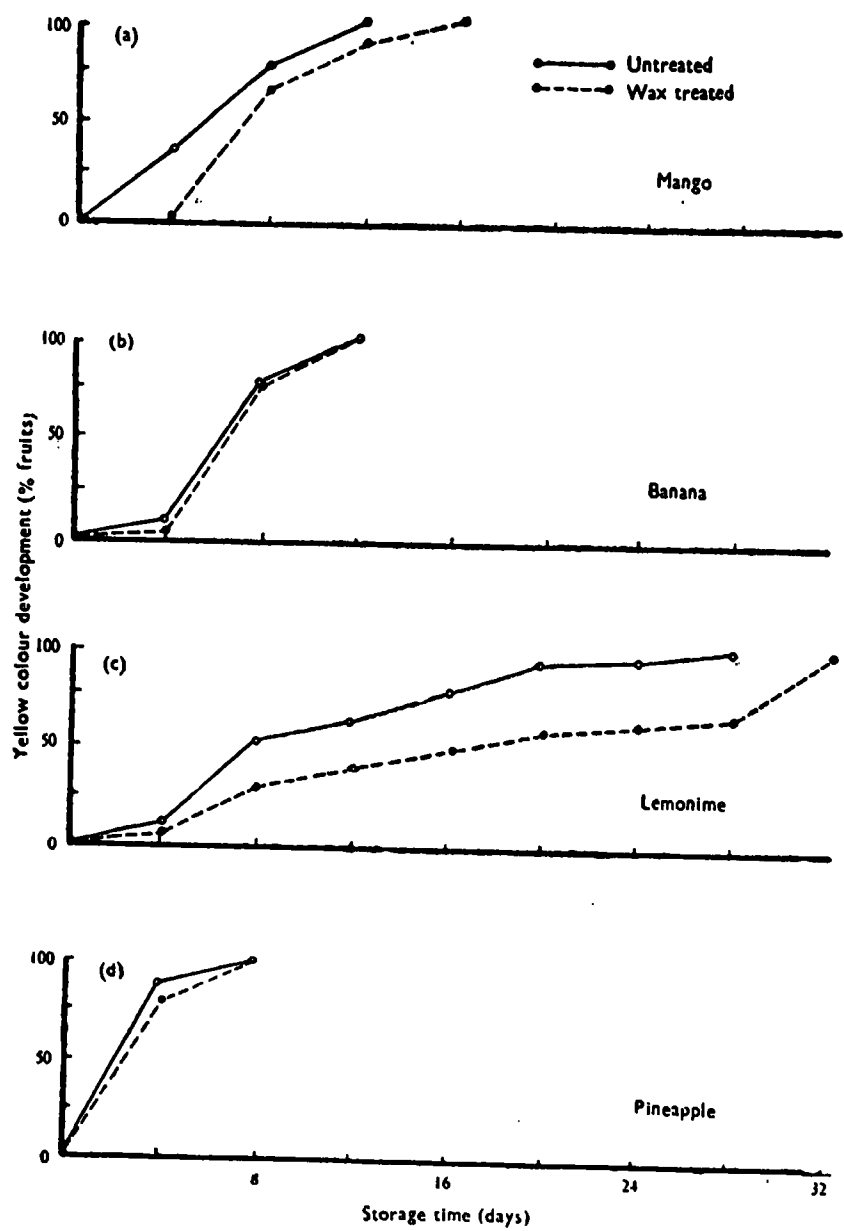


Fig. 2. Yellow colour development in four tropical fruits