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Quality Evaluation of Shrink Wrapped Bananas

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A B S T R A C T

Bananas were pretreated (in hot water at 50 °C for 10 min) and shrink wrapped in films of polyolefin 15 µ and cryovac 9 µ and stored at ambient storage conditions (Temp = 33°C; RH 72%). Experiment was conducted both for banana fingers and hands. Periodical observation was recorded on Physiological Loss in Weight (PLW), firmness, colour and other chemical changes of stored bananas were evaluated. The PLW increased gradually for banana fingers and hands wrapped in shrink films during the storage period. The firmness of bananas followed a declining trend because of softening of fruits. Hands wrapped with polyolefin 15 µ retained more firmness. Colour of the fruits changed slowly from green to yellow. pH was found low in banana hands wrapped with polyolefin 15 µ. Titratable acidity decreased with ripening whereas TSS and total sugars were found increasing with storage. Ascorbic acid increased gradually with ripening and declined suddenly during senescence. In all the treatments, banana hands wrapped with polyolefin 15 µ retained higher values of physico- chemical parameters studied and were found best under ambient storage conditions. The shelf life of hands wrapped with polylefin15 increased to 18 days as against 10 days in unwrapped fruits and wrapped fingers, for Dwarf Cavendish respectively.

Introduction

Banana (*Musa* sp.*)* is a large perennial herb with leaf sheaths that form trunk like pseudo stem. Banana is a globally important fruit crop with 97.5 million tones of production.

In India it supports livelihood of millions of people with total annual production of 31.7 million tones. Banana is a rich source of carbohydrate and vitamins. Banana powder is being used as one of the ingredients of baby food. Bananas are generally harvested early in the season at a pre-mature stage to capture early market. Fruit production has increased but the post-harvest losses are not controlled. In a tropical country like India, these losses occur due to various reasons like lack of proper storage facilities, improper handling during long distance transport and rapid ripening due to high temperature followed by microbial spoilage.

Banana being a highly perishable fruit, shows high post-harvest losses to the extent of about 20-30% (Sreenivasa *et al.,* 2009).

The increased production of banana is supplemented with efforts to minimize post-harvest losses by adopting suitable technique with proper storage conditions.

Film wrapping of individual fruits and vegetables is currently being used as a new postharvest technique for extending the shelf life with proper pre-treatments. One of the effective pretreatment involved is curing (hot water treatment) which controls the post-harvest diseases.

Shrink wrapping produces a micro atmosphere and retards ripening by limiting the exchange of oxygen and carbon dioxide. Shrink wrapping with an engineered plastic wrap can reduce shrinkage, protect the produce from disease, reduce mechanical damage and provide a good surface for stick-on labels.

Materials and Methods

Fully matured Dwarf Cavendish banana bunches were separated into banana fingers and hands and for this purpose, uniform sized fruits were selected. The fruits were cured with hot water (50 ºC for 10 min) and then shade dried at room temperature to remove adhered moisture. Cured fruits were shrink wrapped in different heat shrinkable films (Polyolefin 15 µ and Cryovac 9µ) and then stored at room temperature.

Data on Physiological loss of weight, firmness, colour were recorded at alternate days whereas, pH, TSS, titratable acidity, ascorbic acid content and total sugars were recorded at three day interval for 21 days.

Physiological loss of weight

Physiological loss of weight for each treatment was calculated by the following formula.

$$\% \text{ PLW} = \frac{\text{Initial weight- Final weight}}{\text{Initial weight}} \times 100$$

Firmness

Fruit firmness was evaluated at alternate days using fruit firmness device (Wagner, model FT-327).

Colour

The colour of banana samples was measured using Hunter lab colour flex meter (M/s. Hunter lab, Reston, VA, USA; model CFLX-45). The surface colour was quantified in terms of L^*, a^* and b^* values of CIELAB colour space.

Colour index (CI) of the sample was measured by measuring L^*, a^* and b^* values and was calculated using the following equation as suggested by Soltani *et al.*, (2011).

$$\text{Colour index} = 1000\ a^* / L^*\ b^*$$

pH

The pH measurement was performed using a Digital pH meter (Global Electronic, model DPH 100).

Total soluble solids

Total soluble solids (TSS) of pulp samples was measured by placing a drop of the pulp sample on the prism of the Hand Refractometer (Atago Refractometer) and expressed in terms of % Brix.

Titratable acidity

Titratable acidity was determined by titrating the juice sample extracted in water against 0.1N Sodium Hydroxide (Ranganna, 2010).

Ascorbic acid

Sample extract in oxalic acid was titrated against standard sodium 2, 6 dichlorophenol indophenol dye to a faint pink colour which persisted for 5-10 seconds (Sadasivam and Theymoki, 1985).

Total sugars

Total sugars were determined with standard method given by Ranganna (2010).

Statistical analysis

The experiment was laid out in the Complete Randomized Design (CRD) and the data gathered were statistically analyzed using WASP (Web Agriculture Statistical Package).

Results and Discussion

Physiological loss of weight

Physiological loss of weight (PWL) of Dwarf Cavendish wrapped in different heat shrinkable films increased with the increase in storage period (Fig.1). Banana hands wrapped with polyolefin 15 µ significantly recorded the lowest loss of weight. Unwrapped banana fingers recorded the highest loss of weight during the storage period. The moisture loss rate was faster in control, compared to the shrink wrapped samples. Reduction in PLW may be primarily due to the reason that the material acts as a barrier for moisture loss and also creates high relative humidity around the fruit thereby retarding the moisture loss during storage. Similar results were reported by Rashid *et al.,* (2012) in 'milk' banana.

Firmness

A gradual decline in firmness in film packed fruits was noticed with advancement of storage period whereas in control, the decline in fruit firmness was found to be abrupt and fast (Fig.2). At the beginning of storage, firmness of Dwarf Cavendish was 6.5 kg/cm^2 followed by significant decrease in firmness in all the treatments. Among different heat shrinkable films, banana hands wrapped with polyolefin 15µ had higher firmness. The decrease in firmness in all the treatments was caused by softening of the fruit due to conversion of insoluble proto pectin into soluble pectin. Also, when the fruit started ripening as a result of which, cell wall integration is distributed, which lowered down the fruit texture during the storage. Similar trend was observed by Tapre *et al.*, (2012) in 'Robusta' banana.

Colour

The shrink wrapped bananas showed gradual colour change from green to yellow (Fig.3 and 4). The colour change in unwrapped treatments is more rapid than the wrapped treatments. The results revealed that polyolefin 15µ had delayed colour changes and slowed down yellowing of banana. Colour-break is the visual manifestation of the fruit ripening where peel colour changes from green to golden yellow which is mainly attributed due to breakdown of chlorophyll pigments in the peel tissue. On 16th day there was a sudden decrease in colour value which might be due to development of brown spots on the surface of banana Rashid *et al.,* (2012).

pH

pH of Dwarf Cavendish bananas wrapped in different heat shrinkable films increased gradually in all the treatments during the storage period (Fig. 5). The faster rate of increase in pH in the unwrapped treatments could be due to the faster metabolic reactions occurring within them. The lowest pH was recorded in hands wrapped with polyolefin 15µ and the highest was significantly

recorded in fingers wrapped with cryovac 9 µ at the end of storage period. The results obtained in this study revealed that the rate of increase in pH was faster in case of control treatments as compared to shrink wrapped treatments. The increase in pH might be due to continuous reduction of acidity during ripening. The findings of the present investigation were also similar with findings of Zomo *et al.*, (2014).

Total Soluble Solids (TSS)

Total soluble solids gradually increased in all the treatments under the ambient storage conditions with respect to time (Fig. 6). Hands wrapped with polyolefin15µ film recorded the lowest TSS (21%). TSS in control treatment was observed to be more than shrink wrapped treatments. The TSS increased with storage period, irrespective of the treatment in all the samples which is attributed to conversion of starch or polysaccharides into simple sugars.

But the rate of change of TSS during storage was slow in shrink wrapped bananas compared to control samples. Shrink wrapping might had slowed down the metabolic activity of conversion of starch into sugars, by lowering the respiration.

Fig.1 Effect of heat shrinkable films on PLW (%) of Dwarf Cavendish

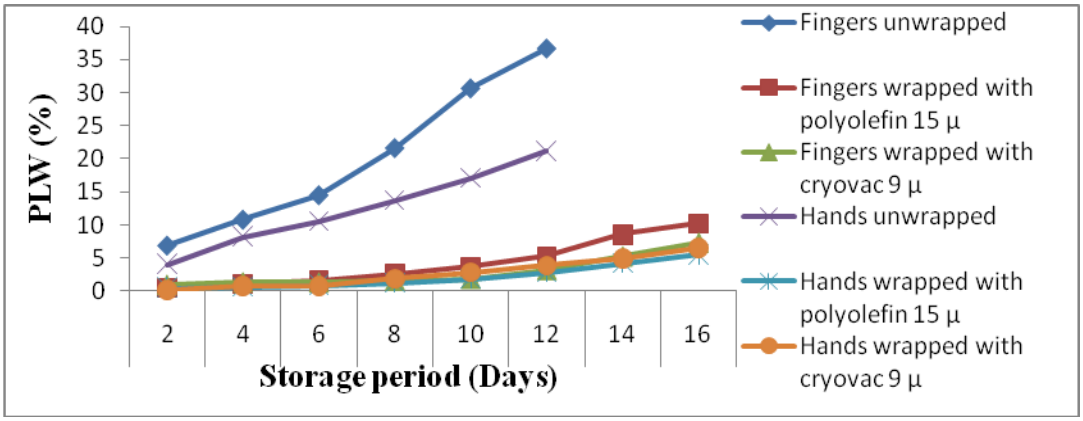


Fig.2 Effect of heat shrinkable films on firmness of Dwarf Cavendish

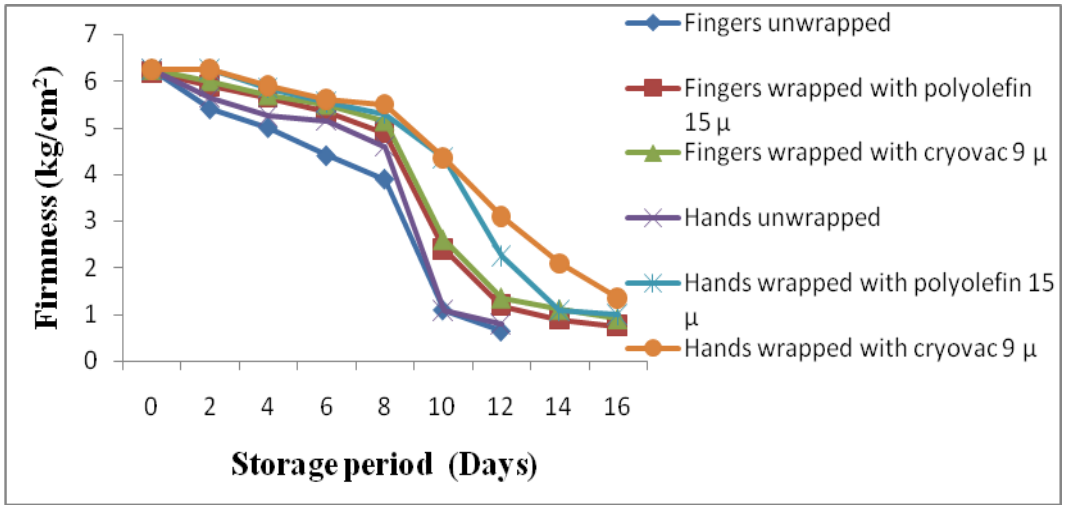


Fig.3 Visual appearance of Dwarf Cavendish bananas during storage

1st Day

3rd Day

7th Day

10th Day

14th Day

18th Day

Fig.4 Effect of heat shrinkable films on colour index of Dwarf Cavendish

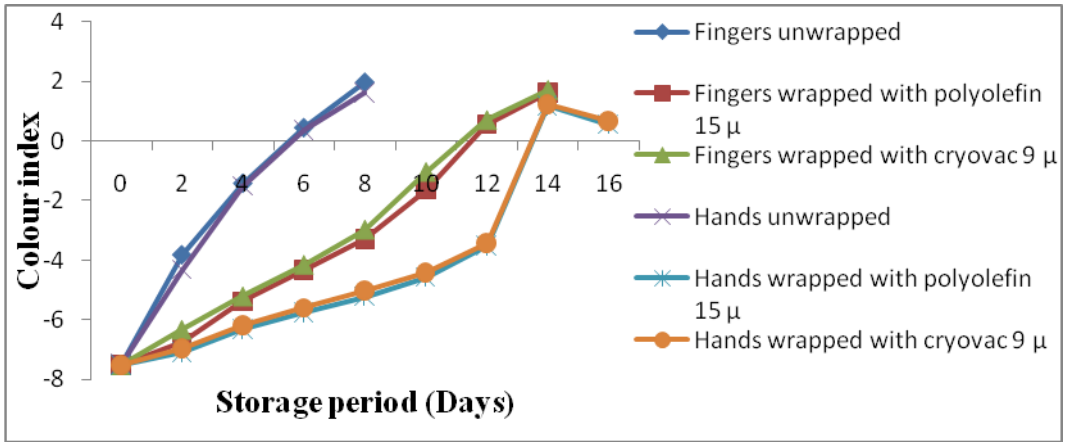


Fig.5 Effect of heat shrinkable films on pH of Dwarf Cavendish

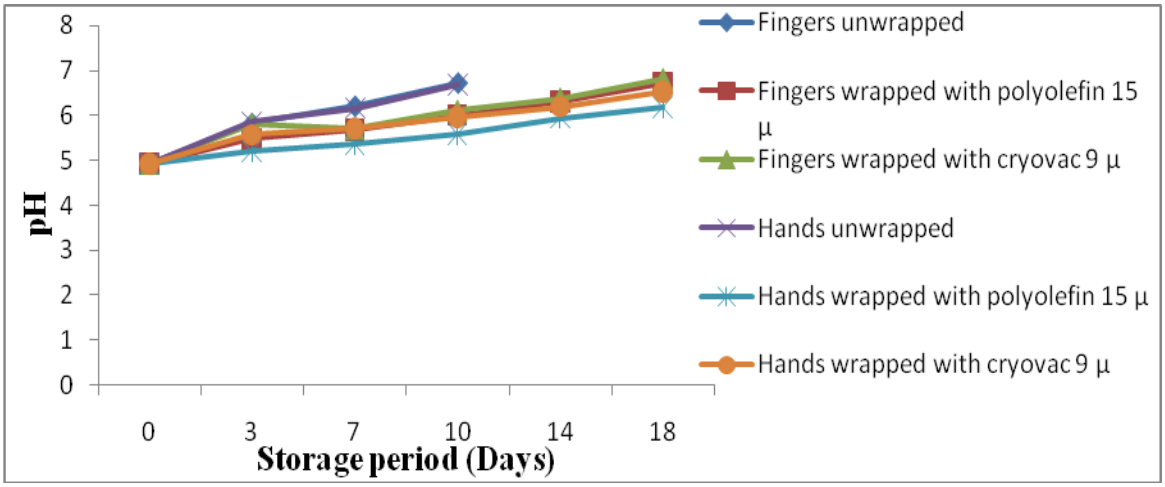


Fig.6 Effect of heat shrinkable films on TSS of Dwarf Cavendish

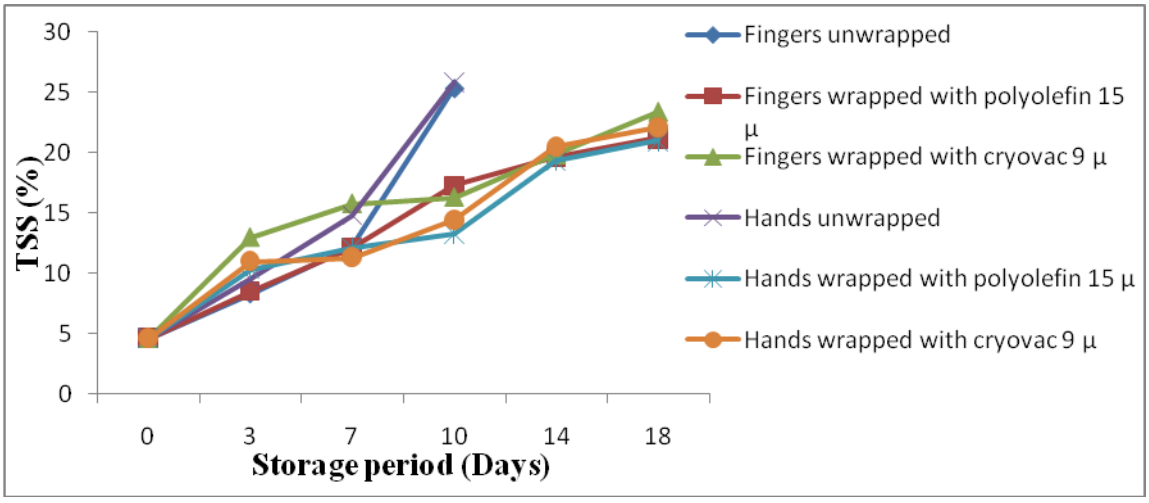


Fig.7 Effect of heat shrinkable films on titratable acidity of Dwarf Cavendish

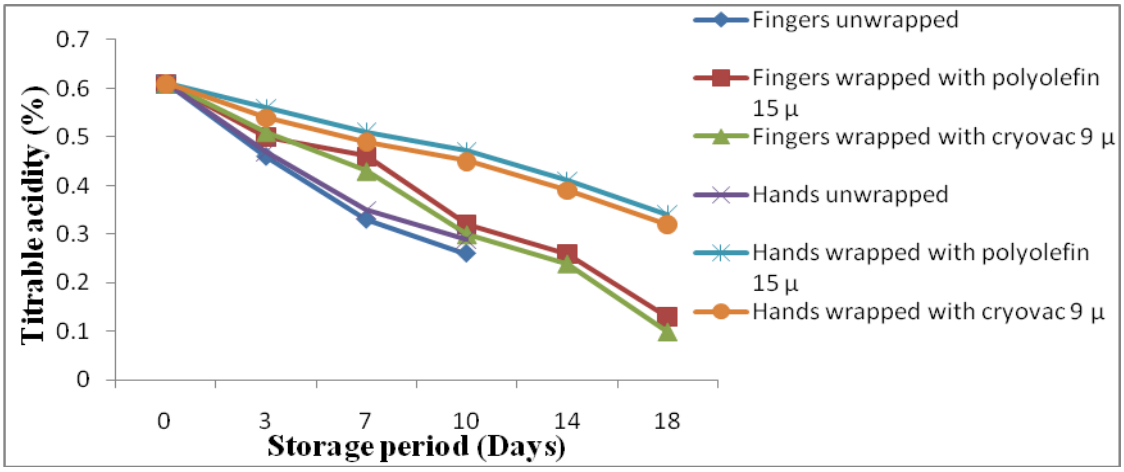


Fig.8 Effect of heat shrinkable films on ascorbic acid of Dwarf Cavendish

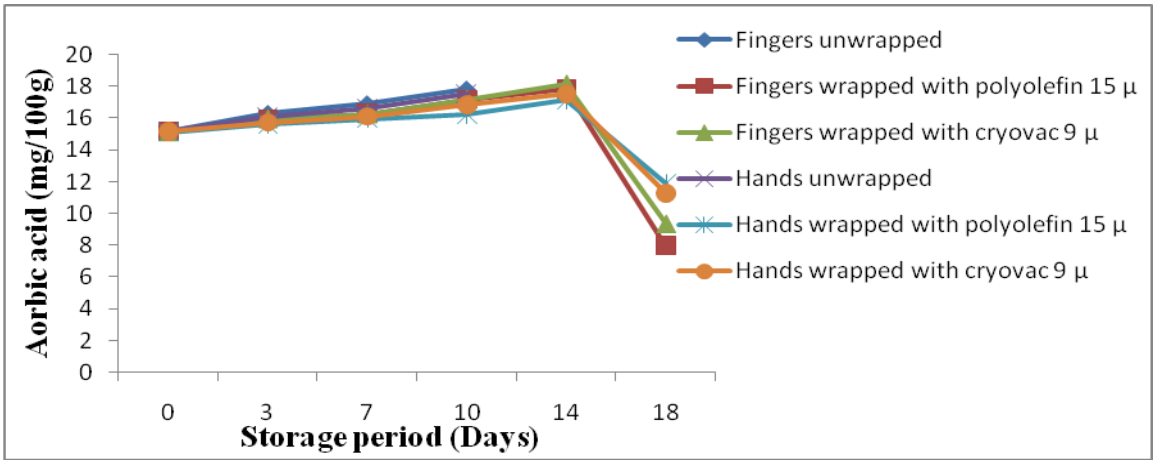
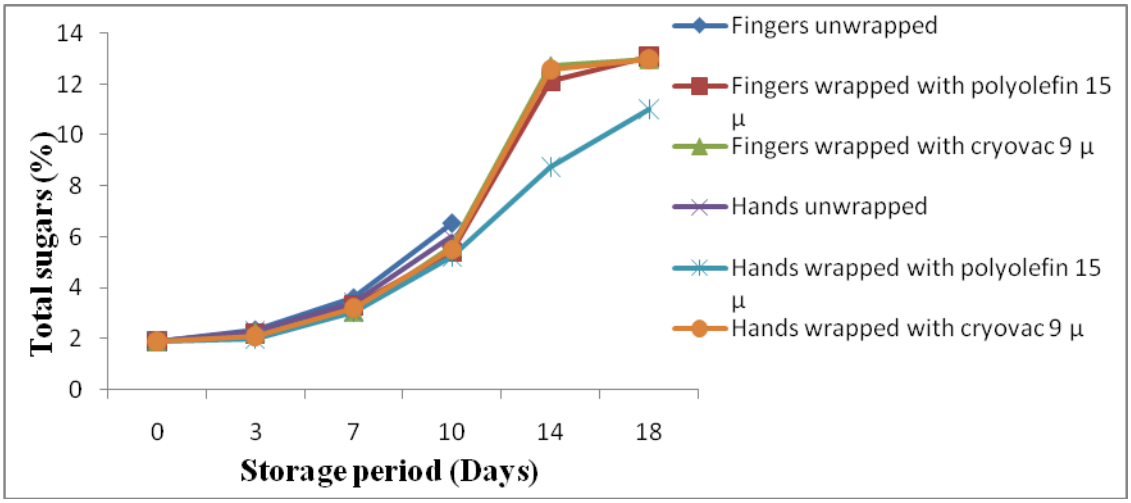


Fig.9 Effect of heat shrinkable films on total sugars of Dwarf Cavendish



Titratable acidity

Titratable acidity declined gradually in all the treatments with the advancement of storage period. Banana hands wrapped with polyolefin 15 µ significantly recorded the highest acidity and the lowest was observed in fingers unwrapped. Similar trend of change in titratable acidity was observed by Soltani *et al.*, (2011) in Cavendish variety of banana. The decrease in acidity content might be due to conversion of acids into sugars by enzymes. The application of different packaging treatments had been reported to slow down the metabolism of fruits by maintaining higher CO_2 and lower O_2 levels inside the packed fruits.

Ascorbic acid

Ascorbic acid increased up to 14th day followed by a decrease in acid at the end of storage period (Fig.8). Unwrapped fruits remained only for 10 days and the other treatments had a storage period of 18 days. The increase in ascorbic acid content in Dwarf Cavendish with ripening has been attributed to the increase in lipid peroxidation. The fruit ripening which was considered as an oxidative phenomenon and requires turnover of active oxygen species with antioxidant compounds includes ascorbic acid and decline in ascorbic acid takes place due to moisture development during senescence. Similar results were reported by Fernando *et al.*, (2014) in 'Hom Thong' and **'**Khai' bananas.

Total sugars

Total sugar content followed an increasing trend during the storage period (Fig.9). The rate of increase was faster in case of control as compared to shrink wrapped treatments. Hands wrapped with polyolefin 15 µ recorded the lowest total sugar content at the end of storage period. Similar increase in sugars during ripening was reported by Venkata *et al.*, (2013) in banana fruit. Increase in sugars during ripening could be attributed due to hydrolysis of starch in to soluble sugars.

The present study envisaged that hands wrapped with polyolefin 15 µ retained higher values for most of the physico-chemical properties studied under ambient storage conditions (72% RH, 33°C). Heat shrinkable packaging film can prolong the shelf life of Dwarf Cavendish bananas up to 18 days with acceptable quality.

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