

EFFECT OF CHITOSAN FILM FOR EXTENDING SHELF LIFE OF BANANA

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Abstract

In this investigation, a chitosan film was obtained by casting evaporation method (the method which minimizes the production cost and has effective for producing complicate without the mold) before used as the material on storage quality of banana. The properties of chitosan film investigated with Energy Dispersive X-Ray Fluorescence (EDXRF) and X-Ray Diffraction (XRD), respectively. After that, the banana wrapped with chitosan films and hold on at room temperature. The physiological loss of weight, pH and other chemical changes recorded at alternate days. The result showed that the banana wrapped with chitosan film changed slowly. The shelf life of the banana wrapped with chitosan film raised quite more than the unwrapped banana. The wrapped with chitosan film could also appearance quality higher than unwrapped.

Keywords: Chitosan Film, Extending shelf life, Banana

Introduction

The major storage problem of fruits and vegetables is desiccations during storage, increasing the storage temperature enhances the speed of decline in quality and increase storage losses in fruits and vegetables. The losses of fruits and vegetables can also depend

on production area and market distance and the mode of transportation (Sudhakar Rao *et al.*, 2001). Then, a new technique for extending the shelf-life of fruits and vegetable product is enrobing by the thin layer of material (i.e., coating or wrapping) (Hosseini *et al.*, 2018).

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Wrapping film able to replace some standard artificial that used for the shelf-life materials used to preserve and protect fruits and vegetables (O'Sullivan *et al.*, 2005). concerning the shelf-life of the fruits and vegetables, chitosan has good properties such as high compatibility with different incorporated compounds, biodegradability, edibility and serving as carriers of food additives (Yasser and Mohebi, 2017). Chitosan is a new material which fascinating in any fields because chitosan comes from renewable sources and readily biodegradable and biocompatibility (Plascencia-Jatomea *et al.*, 2010; Navasa *et al.*, 2013). The chitosan can be used for the development of coatings or wrapping films because of its biodegradable, biofunctional, biocompatible, non-toxic, film-forming, and antimicrobial characteristics. Besides that, chitosan film exhibits a high sensitivity to moisture and low water barrier properties. Thus, the specific properties such as inherent water sensitivity, hardness and strength, and thermal stability, which are intended to function of chitosan film (Zhou *et al.*, 2018).

The aim of this present study was to prepare chitosan film and evaluated the chemical bonding and mechanical properties. All information carried out to assess the quality and losses of banana during under shelf-life conditions, by examining the physiological changes in active wrapped climacteric fruits (banana) with those of management samples.

Experimental Procedure

The chitosan (CS) used in this work are laboratory chemical agent grade in powder form. The appropriate amount of chitosan powder was dried at 85°C for many hours before use. After that, the chitosan solution was prepared by dissolving 2.00 g of chitosan powder in 100 ml of 1% (w/v) acetic acid. The mixture was slowly stirred overnight at room temperature. The viscous solution was left overnight before preparing the chitosan film. The chitosan film was obtained by chitosan solution that was in 2% acetic acid for 2%

(w/v) concentration was cast onto dishes, and dried at 60°C in an oven to constant weight. Once the films were formed, they were removed from the dishes and stored in a desiccator at a relative humidity (RH) of 57% and denoted as CS-F before analysis. Several different techniques have been analyzed in this work: characterized the qualitative and quantitative analyses of in chemical composition in the Energy Dispersive X-rays spectrometer (EDXRF) Panalytical minipal-4. For the mineralogy and crystal structure were characterized by a powder X-ray diffractometer. The powder diffraction data were recorded at room temperature using a Bruker AXS D8 Advance powder diffractometer [CuK α (Ni filtered) with scintillation detector; 2 θ range, 5-50° step size 0.02°]. The minerals in each case were identified from the diffractograms by reference to Joint Committee on Powder Diffraction Standard File (JCPDS).

The banana was randomized and divided into two equal lots. One group (designated “unwrapping” and denote as BNN-NW) and also the different group (designated as “wrapping” and denote as BNN-W), both groups were scrub lightly with fabric to remove outside surface matter. Afterward, each samples group were washing thoroughly with distilled water. After that, bananas from each group were wrapping with the chitosan film, for study the effect of temperature shelf life and quality, the BNN-NW and BNN-W sample (randomly selected) were kept at room temperature for at least 2 weeks. Different parameters were studied on the BNN-NW and BNN-W sample with the interval of 2 weeks. The physiological loss of weight for every treatment (% weight loss: %WL): They were weighed before storage and at the end of every storage interval. The rate of weight loss was calculable by the initial and final weight for each interval and converted to percent weight loss, every treatment was calculated by the subsequent formula:

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

while, the pH measurement was performed using a Digital pH meter (Global Electronic, model DPH 100) and titratable acidity was determined by titrating the juice sample extracted in the water against 0.1N Sodium Hydroxide.

Results and Discussion

The chitosan film with obtained by casting evaporation method to contain element Hydrogen (H), Carbon (C), Nitrogen (N) and Oxygen (O) are the higher concentration than the other elements as shown in Figure 1 and Table 1. The Concentrations of element Phosphorous (P), Iron (Fe) and Calcium (Ca) were detected in analyses samples and these components have lower concentrations.

Tables 1. XRF analysis of constituents of chitosan film (Wt %)

Element / Concentration (Wt %)	Chitosan film
P	0.076
Ca	0.078
Fe	0.003
CHO	99.362

After the film forming as shown in Figure 2, the XRD patterns present the structural of chitosan film which indicated an amorphous structure. The peak around $2\theta=20^\circ$ became wider which corresponding to (J.W. Rhim *et al.*, 2006)

For the physiological loss of weight (%WL) in percent weight loss shows that when the storage period is increasing and have been shown in Figure 3. The BNN-W sample significantly declines occurred with the lowest loss of weight. Whereas the BNN-NW sample declines the highest loss of weight throughout within the same storage period. Reduction of %WL may be primarily due to the material acts as a barrier for moisture loss and also creates high relative humidity around the sample. The results of the physiological loss of weight corresponding with the results were reported by (Rashid *et al.*, 2012). in 'milk' banana.

The pH of the BNN-NW and BNN-W sample has been shown in Figure 4, they increased gradually in all the treatments throughout the storage period. The faster rate of increase in pH in the BNN-NW sample could be due to the faster metabolic reactions occurring within them. The lowest pH was recorded in the BNN-W sample and therefore the highest was significant.

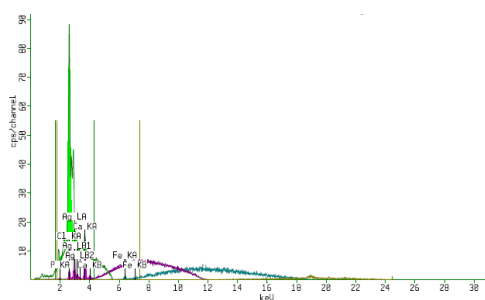


Figure 1. EDXRF spectra of the chitosan film

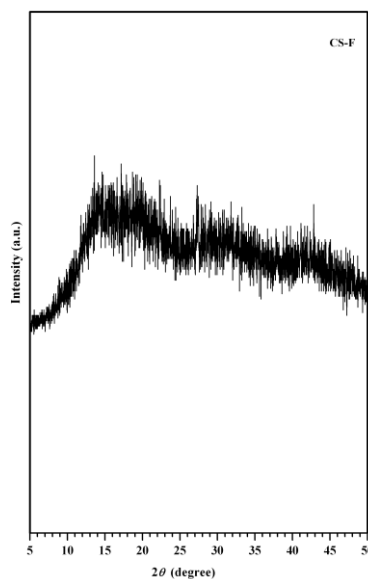


Figure 2. Powder XRD patterns of the chitosan film

Titratable acidity declined gradually in all the treatments with the advancement of storage period. The BNN-W sample significantly recorded the highest acidity and the lowest was observed in the BNN-NW sample as shown in Figure 5. The similar trend

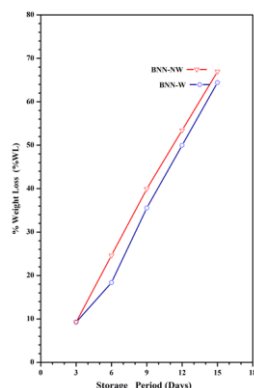


Figure 3. Effect of chitosan film on (% weight loss: %WL) of the BNN-NW and BNN-W sample

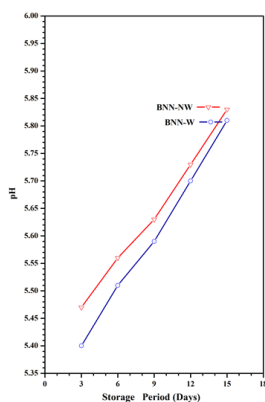


Figure 4. Effect of chitosan film on pH of the BNN-NW and BNN-W sample

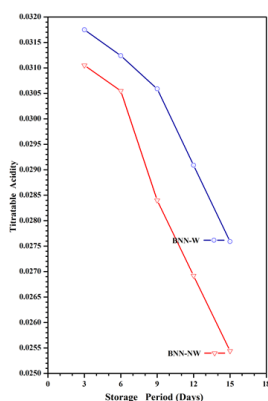


Figure 5. Effect of chitosan film on the titratable acidity of the BNN-NW and BNN-W sample

of change in titratable acidity was discovered by (Soltani *et al.*, 2011) in the Cavendish variety of banana. The decrease in acidity content might be due to the conversion of acids into sugars by enzymes. The application of various packaging treatments had been reported to slow down the metabolism of fruits by maintaining higher CO₂ and lower O₂ levels inside the packed fruits.

Conclusions

The present study envisaged that banana which wrapping film (BNN-W) maintained higher values for many of the physicochemical properties studied under ambient storage conditions. From the result can be concluding that the chitosan film will prolong the shelf life up to 2 weeks with acceptable quality.

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