Studies on utilization of some edible films in preservation of some foods

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Summary

This study focuses on the use of edible coatings as a simple and innovative method to extend the shelf life of fruits and vegetables. The research explores the application of three types of edible coatings (gum Arabic, pectin, and beeswax) on two types of fruits (orange and guava) and one type of vegetable (green bell pepper). The study aims to evaluate the effectiveness of these coatings in maintaining the freshness and quality of the produce during a six-week storage period at room temperature.

To achieve the study's objective, the following research points were investigated:

1. Preparation and application of the edible coatings for use in the covering process.
2. The effect of these coatings on some physiological properties of the treated fruits (water loss percentage, ripening coefficient) and comparison with uncovered fruits.
3. The effect of these coatings on some physicochemical properties (pH, total soluble solids, total acidity as citric acid, ascorbic acid content, total sugars) of the treated fruits and comparison with uncovered fruits.
4. The effect of these coatings on some biochemical properties (total phenols, total flavonoids, pigments (chlorophylls and total carotenoids), antioxidant activity) of the treated fruits and comparison with uncovered fruits during a six-week storage period.
5. The effect of these coatings on some microbiological properties (total microbial count, total fungal and yeast count, coliform bacteria count) of the treated fruits and comparison with uncovered fruits during a six-week storage period.

The main results of the study can be summarized as follows:

1. The coating process with edible coatings affected the water loss percentage of the fruits, with beeswax coating showing the greatest reduction in water loss compared to pectin and Arabic gum coatings, as well as the control sample

(without coating) in all studied fruits. Generally, an increase in water loss was observed with an increase in storage period.

2. The coating process reduced the concentration of total soluble solids (%) compared to the control sample, with the lowest percentage observed in samples coated with beeswax in all studied fruits. An increase in total soluble solids was observed with the advancement of the storage period, accompanied by a decrease in some cases.
3. The coating process with the studied coatings increased the percentage of acidity (as citric acid) in the coated samples compared to the uncoated samples (control). Beeswax had the greatest effect compared to pectin and Arabic gum. Generally, a decrease in acidity concentration was observed with an increase in storage period.

4- The total sugar content increased over time, especially in uncovered fruits, with the lowest increase observed in fruits covered with a thin layer of beeswax.

5- The pH values were slightly affected by the covering process, with a general increase in pH values during storage. The rate of increase was lower in fruits covered with beeswax compared to other coverings (paraffin wax and Arabic gum) and the control sample.

6- The study revealed that guava fruits had the highest content of total phenols (238.4 mg gallic acid per 100g sample), followed by loquat fruits (89.5 mg gallic acid per 100g sample), and then green pepper (39.07 mg gallic acid per 100g sample). The covering process affected the total phenol content, with an increase observed in covered fruits and a decrease in uncovered fruits (control sample). The highest increase was observed in fruits covered with beeswax.

7- The study found that guava fruits had the highest content of total flavonoids (112.75 mg quercetin/100g), followed by mandarin (57.6 mg quercetin/100g) and sweet pepper (26.63 mg quercetin/100g).

8- The study found that the flavonoid content decreased in uncovered samples over time, while covered samples showed fluctuations in flavonoid content, with the highest levels observed in samples covered with beeswax.

9- The study found that the ascorbic acid (vitamin C) content of the fruits was affected by covering and storage. The ascorbic acid content decreased in uncovered samples over time, while covered samples showed an initial increase followed by a decrease. The highest levels of ascorbic acid were observed in samples covered with beeswax.

10- The study found that the antioxidant activity of the fruit extracts was affected by covering and storage. The antioxidant activity decreased in uncovered samples over time, while covered samples showed an initial increase followed by a decrease. The highest antioxidant activity was observed in samples covered with beeswax.

11- The results showed that the covering process affected the ratio of chlorophyll and carotenoids in the fruits, with a decrease in chlorophyll content and an increase in carotenoid content. The uncovered fruits had a higher rate of chlorophyll breakdown and carotenoid production compared to the covered fruits. The fruits covered with beeswax had the lowest rate of chlorophyll breakdown and carotenoid production.

12- The microbial load increased during post-harvest storage, but the covering process reduced the microbial load in the treated fruits compared to the uncovered ones.

13- The number of yeast and fungi decreased in the covered fruits after storage at room temperature, with the beeswax-covered fruits having the lowest content of yeast and fungi.

14- All samples, both covered and uncovered, were free from coliform bacteria during the storage period until spoilage.

Based on the current study's findings, it is recommended to use beeswax as a coating for some fruits and vegetables to extend their shelf life. The beeswax coating slows down the respiration rate, reduces oxygen availability, and minimizes the oxidation of organic acids, thereby preserving ascorbic acid (vitamin C) and bioactive compounds. Additionally, the coating reduces water loss, weight loss, and microbial load.