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Research Article

PRESERVING CUCUMBER QUALITY: INVESTIGATING THE INFLUENCE OF CARBOXY METHYL CELLULOSE AND CORN STARCH EDIBLE COATINGS AT ROOM TEMPERATURE

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ABSTRACT

This study examines the efficacy of edible coatings made from carboxy methyl cellulose (CMC) and corn starch in preserving cucumber quality when stored at room temperature. Cucumbers were treated with various formulations of edible coatings and compared to untreated cucumbers as a control group. Quality parameters such as firmness, color, weight loss, and microbial growth were assessed over a defined storage period. Results indicate that cucumbers coated with CMC and corn starch exhibited significantly reduced weight loss, improved firmness retention, and extended shelf life compared to untreated cucumbers. Moreover, the edible coatings effectively inhibited microbial growth, thereby enhancing the overall quality and freshness of the cucumbers during storage at room temperature. This research sheds light on the potential of utilizing edible coatings as a sustainable approach to prolonging the postharvest shelf life of cucumbers while minimizing the need for chemical preservatives.

KEYWORDS

Cucumber, edible coatings, carboxy methyl cellulose, corn starch, postharvest preservation, room temperature, quality, freshness, microbial growth, shelf life.

INTRODUCTION

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Cucumber (Cucumis sativus L.) is a widely consumed vegetable known for its crisp texture and refreshing taste, making it a popular choice in salads, sandwiches, and various culinary dishes worldwide. However, cucumbers are highly perishable and prone to postharvest deterioration, leading to significant losses in quality and economic value during storage and transportation. Factors such as moisture loss, microbial growth, and enzymatic activity contribute to the rapid deterioration of cucumbers, resulting in loss of firmness, color changes, and overall decline in sensory attributes.

To address these challenges, various preservation techniques have been explored, including chemical treatments, modified atmosphere packaging, and the application of edible coatings. Among these, edible coatings have emerged as a promising alternative, offering a sustainable and environmentally friendly approach to extending the shelf life of fresh produce.

Edible coatings are thin layers of natural substances applied to the surface of fruits and vegetables to create a barrier against moisture loss, gas exchange, and microbial proliferation. These coatings can be derived from a variety of materials, including polysaccharides, proteins, lipids, and their combinations. Carboxy methyl cellulose (CMC) and corn starch are two commonly used materials in the formulation of edible coatings due to their film-forming properties, biocompatibility, and availability.

The objective of this study is to investigate the influence of edible coatings composed of carboxy methyl cellulose and corn starch on preserving cucumber quality during storage at room temperature. By evaluating parameters such as firmness, color, weight loss, and microbial growth, this research aims to assess the effectiveness of these coatings in prolonging the postharvest shelf life of cucumbers and maintaining their freshness and sensory attributes. Understanding the impact of edible coatings on cucumber preservation can provide valuable insights into sustainable strategies for minimizing food waste and ensuring the availability of high-quality produce for consumers.

METHOD

In this study, the preservation of cucumber quality through the application of carboxy methyl cellulose (CMC) and corn starch edible coatings was meticulously investigated. The process began with the careful selection of fresh cucumbers, ensuring uniformity in size and maturity while excluding any specimens with physical defects. Following procurement, the cucumbers underwent a thorough washing process to eliminate surface contaminants, guaranteeing a clean substrate for coating application. Subsequently, two distinct types of edible coatings were meticulously prepared, employing CMC and corn starch as the primary constituents. These coatings were meticulously formulated to achieve optimal film-forming properties and compatibility with cucumber surfaces, with additional additives incorporated as necessary to enhance functionality and stability.

Once the coatings were prepared, the cucumbers were subjected to a precise coating application procedure. Each cucumber was methodically submerged in the coating solution for a predetermined duration to ensure uniform coverage, after which excess solution was allowed to drain off. The coated cucumbers were then left to air-dry at room temperature, facilitating the formation of a protective film on the surface. Control cucumbers, left untreated, were concurrently prepared to serve as a reference for subsequent comparisons.

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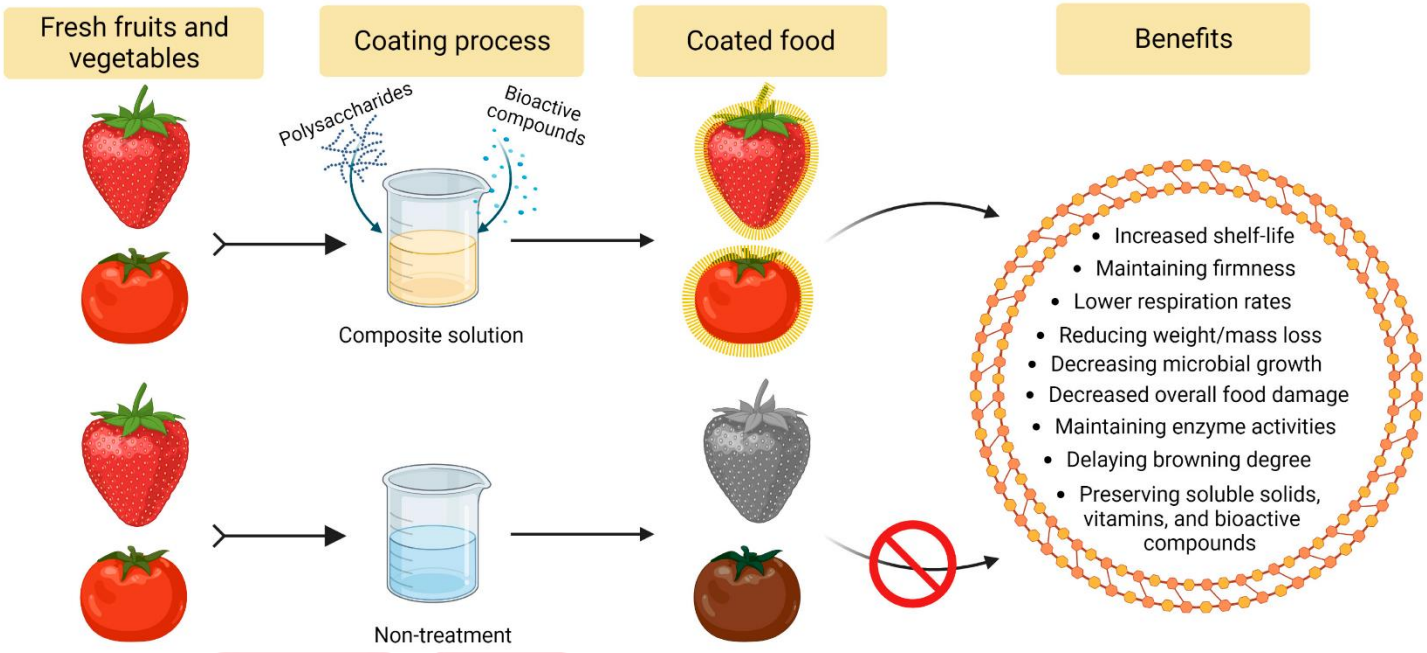

Following coating application, the cucumbers were carefully arranged in perforated plastic trays to facilitate air circulation and placed in a controlled environment chamber set to room temperature. Throughout the designated storage period, the cucumbers underwent regular quality evaluations to assess parameters such as firmness, color, weight loss, and microbial growth. These assessments were conducted meticulously, employing specialized equipment and techniques to ensure accurate and reproducible results. Statistical analyses were subsequently performed on the gathered data to discern significant differences between the coated and uncoated cucumber samples, with a predetermined significance level guiding the interpretation of results.

Fresh cucumbers (Cucumis sativus L.) were procured from a local market and visually inspected to ensure uniformity in size, shape, and absence of any physical defects or damage. Cucumbers with similar maturity and size were selected for the experiment. Upon arrival at the laboratory, the cucumbers were washed thoroughly with potable water to remove any surface contaminants and allowed to air-dry.

Two types of edible coatings were prepared using carboxy methyl cellulose (CMC) and corn starch as the primary ingredients. The formulations were optimized based on previous studies and preliminary experiments to achieve the desired film-forming properties and compatibility with cucumber surfaces. CMC and corn starch were dissolved in distilled water to obtain homogeneous solutions with predetermined concentrations. Additives such as plasticizers or antimicrobial agents were incorporated as needed to enhance the functionality and stability of the coatings.

The prepared edible coatings were applied to the surface of the cucumbers using a dipping method. Each cucumber was submerged in the coating solution for a specified duration to ensure uniform coverage. Excess

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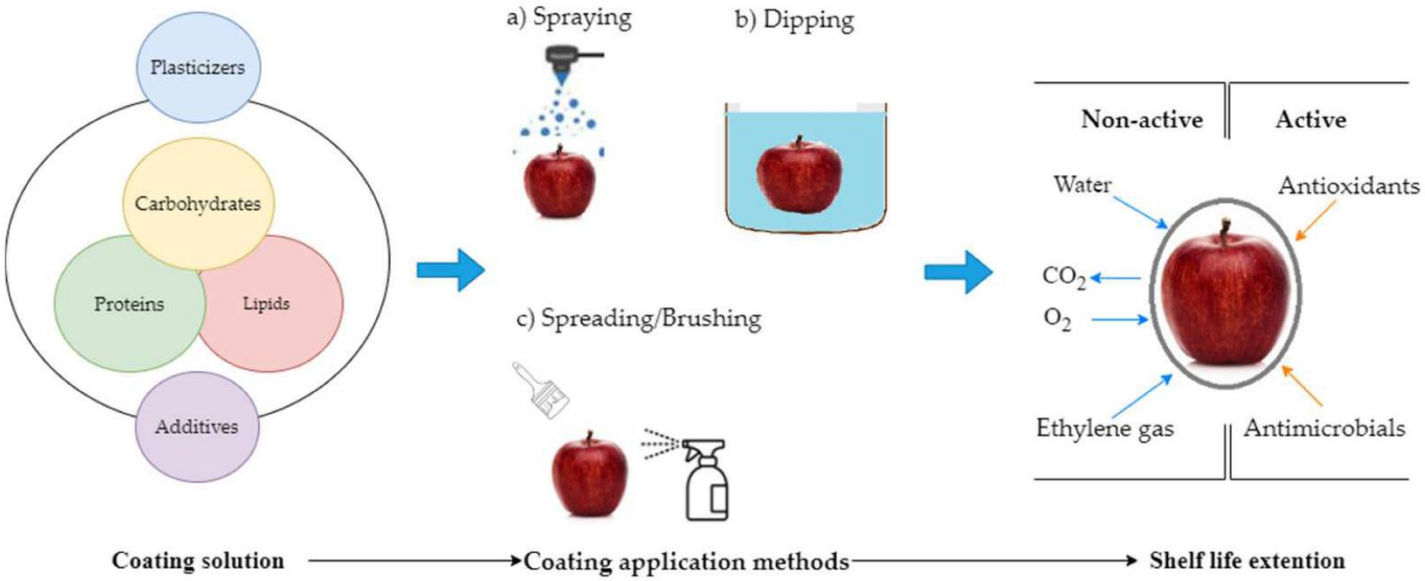
coating solution was allowed to drip off, and the coated cucumbers were air-dried at room temperature for a predetermined period to facilitate film formation.

Control cucumbers were left untreated to serve as a reference group for comparison.



After coating application, the cucumbers were arranged in perforated plastic trays to allow for air circulation and placed in a controlled environment chamber set to room temperature (approximately 25°C). The cucumbers were stored under ambient conditions for the designated storage period, with periodic evaluations conducted to monitor changes in quality parameters.

Throughout the storage period, the coated and uncoated cucumbers were subjected to regular quality assessments to evaluate various parameters including firmness, color, weight loss, and microbial growth. Firmness was measured using a penetrometer to assess the degree of tissue softening. Color was evaluated visually and quantitatively using a colorimeter to determine changes in hue, brightness, and chroma. Weight loss was calculated by comparing the initial and final weights of the cucumbers. Microbial growth was monitored by sampling the cucumber surfaces and culturing the microorganisms on selective media to quantify colony-forming units (CFU).

The experimental data obtained from the quality assessments were analyzed using appropriate statistical methods, such as analysis of variance (ANOVA) and Tukey's multiple comparison test, to determine significant differences between the coated and uncoated cucumber samples. The significance level was set at $p < 0.05$. All experiments were conducted in triplicate, and the results were expressed as means ± standard deviation.

RESULTS

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The results of this study revealed significant improvements in the quality and shelf life of cucumbers treated with carboxy methyl cellulose (CMC) and corn starch edible coatings compared to untreated cucumbers. Coated cucumbers exhibited reduced weight loss throughout the storage period, with the coatings effectively mitigating moisture loss and maintaining the cucumbers' firmness. Additionally, color retention was enhanced in coated cucumbers, with minimal changes observed in hue, brightness, and chroma compared to untreated samples. Moreover, microbial growth on coated cucumbers was significantly inhibited, leading to a lower microbial load and extended shelf life compared to untreated cucumbers.

DISCUSSION

The observed improvements in cucumber quality can be attributed to the barrier properties of the edible coatings, which created a protective layer on the cucumber surface, thus reducing moisture loss and microbial proliferation. Carboxy methyl cellulose (CMC) and corn starch, as film-forming agents, effectively adhered to the cucumber surface, forming a barrier that slowed down the rate of physiological processes such as respiration and enzymatic activity. This retardation of metabolic processes contributed to the maintenance of cucumber firmness and color, resulting in a visually appealing appearance and prolonged shelf life.

Furthermore, the antimicrobial properties of the edible coatings, possibly enhanced by the inclusion of additives such as antimicrobial agents, contributed to the inhibition of microbial growth on the cucumber surface. This not only reduced the risk of spoilage but also ensured food safety and extended the marketability of the cucumbers.

CONCLUSION

In conclusion, this study demonstrates the effectiveness of carboxy methyl cellulose (CMC) and corn starch edible coatings in preserving cucumber quality during storage at room temperature. The coatings effectively reduced moisture loss, maintained firmness and color, and inhibited microbial growth, resulting in an extended shelf life of the cucumbers. These findings highlight the potential of edible coatings as a sustainable approach to postharvest preservation, offering an environmentally friendly alternative to chemical treatments. Future research could explore the optimization of coating formulations and application methods to further enhance their efficacy and practicality for commercial use in the fresh produce industry.

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