

Investigation the effect of pullulan gum coating and rosemary essential oil on physicochemical, microbial and organoleptic properties of tomato

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Extended Abstract

Introduction: The preservation of agricultural products, particularly fruits, is a major concern in food science, especially for highly perishable items such as tomatoes. Traditional preservation methods often involve chemical treatments or refrigeration, but these can have drawbacks related to food safety, nutritional value, and environmental sustainability. Edible coatings have emerged as an effective and eco-friendly alternative. These coatings can extend the shelf life of fruits by acting as barriers against moisture and oxygen, thus slowing down spoilage and maintaining product quality. This study investigates the use of pullulan gum and rosemary essential oil as edible coatings for tomatoes, evaluating their effects on the physicochemical, microbial, and organoleptic properties during storage at different temperatures.

Methods: In this study, ten different treatments were prepared using varying concentrations of rosemary essential oil (0.1%, 0.2%, and 0.5%) combined with pullulan gum as the coating base. Tomatoes were coated with these formulations and stored under two temperature conditions: ambient temperature (25°C) and refrigerated at 4°C, for a period of 16 days. The tomatoes were evaluated using a range of tests at 4-day intervals to assess their physicochemical properties, including pH, titratable acidity, weight loss, texture, and color. Microbial analyses were performed to measure the growth of aerobic bacteria, molds, and yeasts. Sensory evaluations were conducted using a 9-point hedonic scale, with trained panelists assessing the taste, odor, color, texture, and overall acceptability of the tomatoes.

Results: The physicochemical tests revealed that the pH and titratable acidity of the tomatoes were independent of the coating treatments, with variations primarily due to the physiological conditions of the tomatoes. However, significant differences in weight loss were observed between the coated and uncoated tomatoes, with coated samples showing less weight loss. The best performance in

terms of weight loss was observed in treatment number 7, which had a particular combination of coating and rosemary oil concentration. Colorimetric tests showed no significant differences in the color parameters (L, a, b, and ΔE) between the various treatments, indicating that the coatings did not noticeably affect the visual appearance of the tomatoes. In terms of texture, treatment number 10, which involved the highest concentration of rosemary essential oil (0.5%) and refrigeration at 4°C, showed the best results in maintaining the firmness of the tomatoes. Microbial analyses indicated that the coatings, particularly those with higher concentrations of rosemary oil, significantly reduced the growth of total bacteria, molds, and yeasts. This reduction was most noticeable in the 0.5% rosemary oil treatments, particularly under refrigerated storage conditions. Sensory evaluations revealed that the coated tomatoes, especially those treated with 0.5% rosemary essential oil, maintained higher acceptability scores compared to uncoated samples. While all treatments showed a decline in acceptability over time, the decrease was less pronounced in the coated samples, with the highest sensory quality found in treatment number 10.

Discussion: The results of this study demonstrate that the combination of pullulan gum and rosemary essential oil is highly effective in enhancing the shelf life of tomatoes. The use of rosemary essential oil not only helps in preserving the texture and color of the tomatoes but also significantly reduces microbial growth, which is crucial for maintaining food safety. The reduction in weight loss and the maintenance of texture suggests that the coating acts as an effective barrier against moisture loss, which is a major factor in the deterioration of fresh produce. Although the color of the tomatoes did not show significant changes, the reduction in microbial growth and the preservation of texture and overall acceptability highlights the benefits of these coatings. The study also emphasizes the importance of storage temperature, with refrigerated conditions significantly improving the performance of the coatings.

Conclusion: This research confirms that edible coatings made from pullulan gum and rosemary essential oil can significantly improve the shelf life and quality of tomatoes. Treatment number 10, which involved a 0.5% concentration of rosemary essential oil and refrigeration at 4°C, was the most effective in preserving the physicochemical, microbial, and organoleptic properties of the tomatoes over the 16-day storage period. The findings suggest that the integration of natural essential oils, like rosemary, with biopolymer-based coatings offers a sustainable and efficient method for extending the shelf life of perishable fruits like tomatoes. This study provides valuable insights into the potential of edible coatings as a viable alternative to chemical preservatives, contributing to the growing demand for natural and environmentally friendly food preservation techniques.

Key words: Edible coating, Pullulan gum, Rosemary essential oil, Tomato