coatings

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*Review*

# Bio-Coatings for Preservation of Fresh Fruits and Vegetables

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**Abstract:** In response to increasing concerns over food waste and safety, and the environmental impacts of traditional conservation methods, this review aims to explore the potential of bio-coatings in preserving the freshness of fruits and vegetables. Our primary objective is to provide a comprehensive analysis of recent advancements in bio-coating technologies, detailing their benefits in terms of enhancing food safety, prolonging shelf life, and reducing waste. This paper delves into various forms of bio-coatings, their applications, and their effectiveness in maintaining post-harvest quality. We further elucidate the underlying mechanisms that govern their preservation efficacy. This review is intended for researchers, industry professionals, and policy makers who are interested in sustainable preservation alternatives and their implications for food security and environmental sustainability. By the end of this review, the audience will gain a thorough understanding of the current state of bio-coating technology and its prospects in the food preservation industry.

**Keywords:** edible coating; food safety; post-harvest technology; prolonged shelf life; biodegradable coatings



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## 1. Introduction

Consuming fresh food is undoubtedly the best way to enjoy various flavors and nutrients, but their preservation helps to enjoy all these even out of season [1]. Food production and supply are not always in balance with the needs of the population. In the case of surplus production of fresh fruits or vegetables, which are perishable or semi-perishable, it is important to store and preserve them to ensure a continuous food supply. Some fruits and vegetables cannot be grown in every type of soil and climate, so preserving food will aid importing them abroad. After harvest, the ripening and aging process can be delayed by different preservation methods [2], maintaining the taste and quality, and extending the sale/consumption ratio of food out of season. Preservation makes the product available on the market in a wide variety, and when there is no discrepancy between supply and demand, stabilization of food prices can also be observed. In broad terms, the preservation of fresh fruits and vegetables consists of handling and treating them to stop or slow down their decay or spoilage (contamination by microorganisms, loss of nutritive value, loss of flavor, change in texture, microbial and enzymatic decomposition) while ensuring a longer shelf life for the food. Fruits are susceptible to a variety of post-harvest diseases caused by bacteria and fungi. These diseases can lead to visible decay and a loss of quality [3]. The loss of fruit quality during ripening and post-harvest is also influenced by several physiological changes. These changes can be categorized under factors such as maturity, respiration, ethylene production, and enzymatic reactions [4,5]. The stage of maturity at which fruits are harvested affects their quality and shelf life. When fruits are harvested too soon or too late, they may not have the flavor or texture that they should, and their shelf life may be shortened [6]. The process by which the fruit's stored organic elements are transformed into energy is called respiration. After the fruit is harvested, this process continues, causing it to lose weight and nutritional content. In

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## Abbreviations

| | |
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| LOX | Lipoxygenase |
| PG | Polygalacturonase |
| Chlase | Chlorophyllase |
| $SO_2$ | Sulfur dioxide |
| HPMC | Hydroxypropylmethylcellulose |
| GLY | Glycerine |
| G | Gelatine |
| CHI | Chitosan |
| SA | Sodium alginate |
| nano-ZnO | Nano-zinc oxide |
| *M. fructicola* | *Monilinia fructicola* |
| *B. cinerea* | *Botrytis cinerea* |
| *C. gloeosporioides* | *Colletotrichum gloeosporioides* |
| *E. coli* | *Escherichia coli* |
| *S. typhimurium* | *Salmonella typhimurium* |
| TU | Turmeric |
| GT | Green tea |
| EO | Essential oil |
| TSO | Tea seed oil |
| GSE | Grapefruit seed extract |
| AVG | Aloe vera gel |
| SPI | Soy protein isolate |
| GB | Blueberry juice |
| LEO | Lemon essential oil |
| °C | Degrees Celsius |
| h | Hour |
| min | Minute |
| GSE | Grapefruit seed extract |
| AI | Artificial Intelligence |
| CRISPR | clustered regularly interspaced short palindromic repeats |
| XG | Xanthan gum |
| CMC | Carboxymethyl cellulose |
| ASKG | Artemisia sphaerocephala Krasch |

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