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Plant-derived active substances incorporated as antioxidant, antibacterial or antifungal components in coatings/films for food packaging applications

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ABSTRACT

Many investigations have been carried out analyzing the characteristics of various materials for development of edible coatings/films for food applications. Subsequent modifications for improvement and ameliorating the film/coating characteristics has been the pivot of research in the last decade. An inclination has developed among researchers towards use of plant-based active substances for development of food products and food packaging. Plant based materials have been widely used as antioxidants or antimicrobials in film/coating formulations. Such materials include plant extracts, essential oils, oleoresins, and plant exudates. The compounds present in these materials mostly perform the antibacterial, antiviral, antifungal, antioxidant, and anti-browning functions. Such compounds may also be isolated from plant materials and then incorporated into edible coatings/films. This document is a comprehensive review describing the plant derived active substances used as antimicrobial and antioxidant components in edible films/coating. It also focuses on their applications for improving quality of different foods along with their safety regulations.

1. Introduction

Globally, the use of plastic packaging in food industries has been enormously increasing for several decades. However, only a small portion of this packaging is being recycled, thereby posing a serious threat to the environment. On the other hand, the consumer demand for the increased shelf life of food products using edible natural packaging has received prominent upsurge. Considering the above-mentioned concerns, biocompatibility, edibility, non-toxic nature coupled with a plethora of potential applications of biodegradable films, recent times have witnessed an increased attention towards the replacement of synthetic polymers by renewable biodegradable films as an effective and innovative alternative for the shelf life extension of various food products (Kaya et al., 2018). In fruit and vegetable industry, edible coatings/films form the semipermeable network, cohesive in nature that can slow down the process of moisture loss, maintain the gaseous exchange and hence the shelf life extension of horticulture produces (Vargas--Torres et al., 2017).

Food packaging industries have immensely focused on the research pertaining to the technology of coating/film development but, the source of additives used was either natural or synthetic. Out of the two, coatings/films containing natural plant extracts have retarded or inhibited the microbial growth thereby keeping the food quality intact. Moreover, an inclination has been developed among researchers towards plant-based food product development due to various health benefits of polyphenols and their effectiveness against certain diseases (Randazzo, Fabra, Falcó, López-Rubio, & Sánchez, 2018). As a replacement to the synthetic polymers, literature has revealed the potential of coatings/films from different sources incorporated with terrestrial plant extracts (obtained from various parts) as active and ecofriendly components (Mir, Dar, Wani, & Shah, 2018). Besides being ingested as an integral part of food, edible coatings/films arrest the food product's quality impairment, thereby promoting shelf life enhancement. Edible films and coatings may be incorporated with compounds isolated from plant extracts having antimicrobial, antioxidant and anti-browning properties (Manzoor & Ahmad, 2021). The presence of high concentration of phenolic compounds is responsible for the strong antioxidant activity of plant-origin active substances channelized into coatings/films, which are also reported to have modified physicochemical, mechanical and barrier properties. Senescence, a natural process in agricultural produce can be delayed by coating the fresh fruits and vegetables with coatings containing plant extracts. Other benefits of

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