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Preservation of Fruits and Vegetables With Edible Coatings

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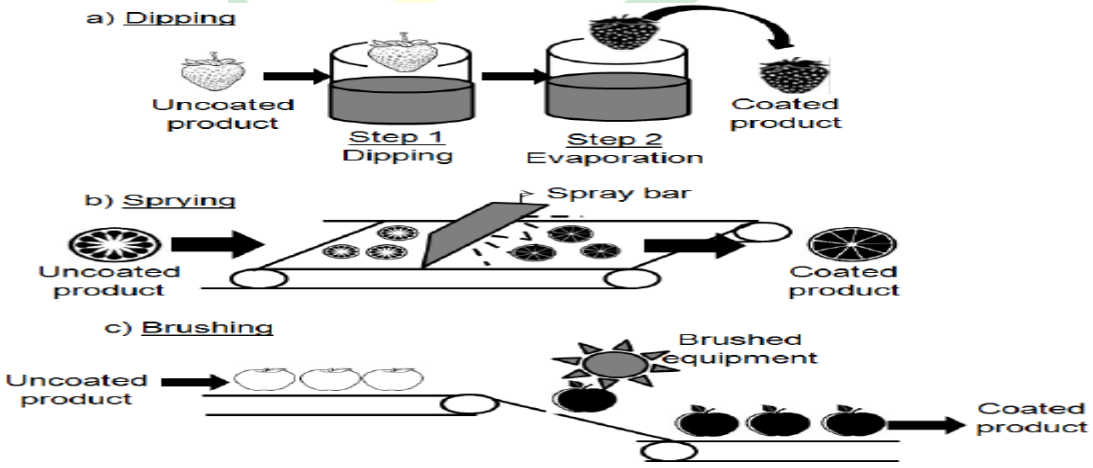
Introduction

Fruits and vegetables are nutritionally important foods. Many bioactive compounds, such as provitamins, vitamins, minerals, antioxidants, and phytochemicals, are found in these foods. Usually, fruits and vegetables are enclosed within a protective covering known as cuticle. The wear and tear of this protective layer results in the speedy loss of water and increased susceptibility to microbial damage. As a result, the shelf life of fruits and vegetables is reduced to a greater extent. One of the potential techniques for quality retention and shelf-life augmentation is to cover fresh-cut food with biodegradable and biocompatible polymers that are safe and edible, also known as edible coatings. The cut fruits and vegetables are covered in a very thin layer of an edible material that maintains the quality and does not need to be removed before consumption.



Methods of application of edible coating

Edible coatings may aid in the retention of water and other volatiles within the fruit, as well as the prevention of microbiological deterioration, and increase the shelf life of fresh-

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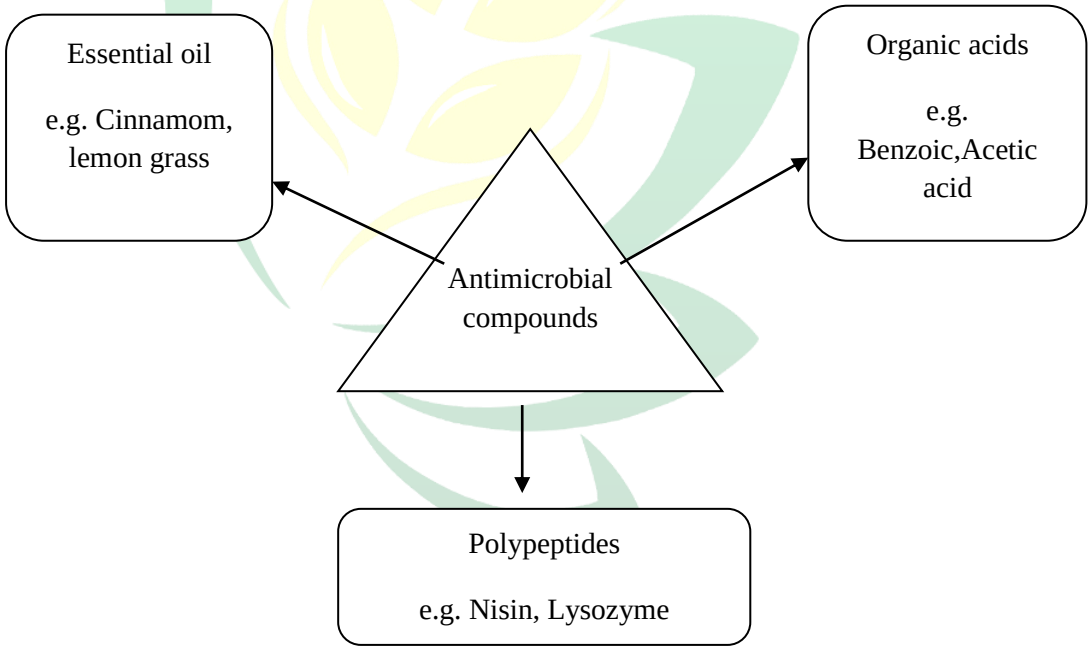
cut fruits and vegetables (Bourtoom, 2008). Edible coatings are made from natural, environmentally acceptable materials and are applied to surfaces by dipping, brushing, or spraying (McHugh and Senesi, 2000).

Types of Edible coatings

1. Polysaccharide based coatings
2. Protein based coatings
3. Lipid based coatings
4. Composite coatings

Functions of Edible coatings

The key constituents of edible coatings include proteins, polysaccharides, and lipids; whereas, active ingredients include food-grade additives, which are classified as generally regarded as safe compounds. The addition of these active compounds increases the shelf-life, safety, and sensory aspects of edible coatings while also compensating for the limits of edible coatings. The role of each broad category of active components while being incorporated into coatings is discussed below:



Examples of antimicrobials incorporated into coatings for fresh-cut fruits and vegetables

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A. **Antimicrobial agents** - Antimicrobial compounds in edible coatings can provide a novel way to ensure fresh-cut product safety while also extending shelf life. Some edible coatings, such as chitosan coating, have natural antibacterial characteristics. Antimicrobial components, on the other hand, can be added into the coatings.

B. **Antibrowning agents** - Browning is one of the most common difficulties with fresh-cut fruits and vegetables, and it is always regarded as a sign of inferior quality. Antibrowning agents and other food additives are carried by edible coatings. Antibrowning compounds prevent fresh-cut fruits and vegetables from oxidative rancidity, degradation, and enzymatic browning (Rojas-Grau *et al.*, 2007). Edible coatings can contain anti-browning chemicals. Browning was greatly decreased when fresh-cut apples were covered with a whey protein concentrate beeswax coating containing ascorbic acid, cysteine, or 4-hexylresorcinol (Perez-Gago *et al.*, 2006).

Application of edible coatings for preservation of different fruits

Fruit	Coating	Ingredients	Type
Strawberry	Gellan	Geraniol and pomegranate extract	Polysaccharide
Apricot	Basil seed gum	*Origanum vulgare* sub sp. *viride* essential oil	Polysaccharide
Kiwifruit	Rice bran oil, whey protein concentrate	-	Composite
Oranges	Gelatin	*Aloe vera*, green tea extract	Protein
Apple	Carnauba wax, cassava starch	-	Composite
Apple	Sodium alginate and pectin	Eugenol and citral	Polysaccharide

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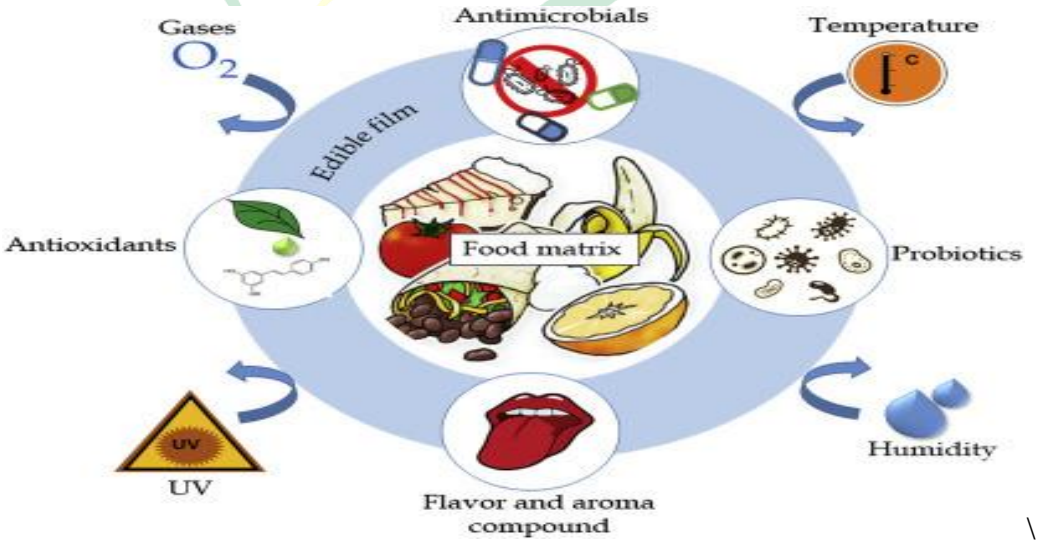
Effects of coating on fresh-cut fruits and vegetables quality

1. **Effect of coating on water vapour permeability and moisture/weight loss-** Weight loss in fruits and vegetables is typically caused by water loss through transpiration, which impacts freshness and shelf life. According to Nongtaodum and Jangchud (2009), chitosan coating reduced the weight loss of fresh-cut mango. They discovered that the weight loss of uncoated samples was significantly higher than that of coated samples after storage.
2. **Coating's effect on texture-** Tissue softening is a serious problem that reduces the fresh-cut product's shelf life. Customers equate texture with freshness and wholesomeness, therefore fresh-cut fruits and vegetables must maintain firm and pleasing textures. Fresh-cut produce can be given a calcium treatment to keep it firm. It has been claimed that dipping fresh cut items in calcium chloride solutions (0.5 per cent–1 per cent) can help to keep tissue firm.
3. **Effect of coating on colour –** To avoid enzymatic browning in fresh-cut fruits and vegetables, a variety of antibrowning agents can be applied. Organic acids such as ascorbic acid, citric acid, and oxalic acid, which can be found in most fresh fruits and vegetables, are used to prevent excessive browning.
4. **Effect of coating on respiration rate and ethylene production** – The quick loss of quality and shelf-life is caused by two key reactions: an increase in the rate of respiration and ethylene synthesis.



Role of edible films

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Different edible coatings, on the other hand, can be utilised to dramatically lower the rate of respiration. In the case of kiwifruit coated with *Aloe vera* (Benitez *et al.*, 2013), sweet cherry coated with *Aloe vera* (Martinez-Romero *et al.*, 2006), and kiwifruit with alginate based coatings with grape fruit seed extracts, the reduction in respiration rate has been recorded (Mastromatteo *et al.*, 2011).

Conclusion

Edible coating can be used to augment or replace traditional preservation techniques. Edible coatings have showed promise in reducing weight loss, microbial growth, and metabolism rate, delaying ripening, and prolonging the shelf life of fresh and fresh-cut fruits and vegetables. Edible coatings can be used to protect perishable foods like fresh-cut fruits and vegetables.

Future Thrust

The discovery of novel techniques to improve the delivery qualities of edible coatings will be the focus of future research. The majority of studies on the application of edible coatings to fresh-cut vegetables and fruits have been conducted in the lab. However, efforts should be made to commercialize the technique of edible coating as a fresh-cut product protection strategy. In addition, further research is needed to better understand the process and outcomes of incorporating active substances into edible coatings, as well as their mechanical, sensory, and functional properties.

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