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Edible Films and Coatings: Technology for Extend the Shelf-life of Agro and Horticultural Produce

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Edible films and coatings have received considerable attention in recent years because of their advantages including use as edible packaging materials over synthetic films. This could contribute to the reduction of environmental pollution. Fruits and vegetables are perishable in nature. Major losses in fruit and vegetable occur between harvest and consumption. Therefore, the application of new technologies to extend the postharvest life of these commodities is much needed. The use of edible coatings and or edible films appears to be a good alternative.

Introduction

Fruits and vegetables are perishable in nature. A large portion of all fresh produce is lost worldwide after harvest. The main causes are physiological (wilting, shrivelling, chilling injury, etc.), pathological (decay due to fungi and bacteria) and physical (mechanical injury). These causes in many instances are interrelated, i.e. mechanical injury can lead to postharvest decay in many cases. The losses occurring during harvest, preparation for market, transportation and consumption of fruits and vegetables vary from 15 to 50%.

Edible films are a thin layer of material which can be consumed and provides a barrier to moisture, oxygen and solute movement for the food. The material can be a complete food coating or can be disposed as a continuous layer between food components. Consumers today have higher expectations than ever before, insisting their food be more nutritious and safer to eat, with wider variety and longer shelf life. In case of produce, maintaining high quality food for long periods of time is difficult, since fruits and vegetables are composed of living tissue which undergoes major changes in chemical and physical states due to synthetic and degradative biochemical processes. Nutritional, flavor, textural, and pigmentation changes can all affect quality of produce.

Classification of Edible Films and Coatings

Edible films can be classified into three categories:

1. Hydrocolloids
   a. Proteins - wheat gluten, corn zein, soy protein, mung bean protein, and peanut protein, gelatin, casein and whey protein.
   b. Polysaccharides - cellulose, starch derivatives, pectin derivatives, Chitin and chitosan etc.
   c. Alginate
2. Lipids
   a. Fatty acids – mineral oil, vegetable oil etc.
   b. Acyl-glycerol - glycerol monosterate
   c. Waxes - paraffin wax, candelilla wax, carnauba wax and bees wax.
3. Composites - consisting of a blend of polysaccharides, protein, and/or lipids

Edible Films and Coatings for Preservation of Fruits and Vegetables

Water Loss: Edible films/coatings decrease water vapor transmission rate by forming a barrier on the fruit or vegetable surface. This barrier prevents texture decay, since water is essential for preservation of cell turgor. Metabolic alterations that can cause accelerated rate of senescence due to water loss can also be avoided with their use.

Texture: Edible coatings can also preserve texture of fruits and vegetables by acting as a partial barrier to water and serving as carriers of texture enhancers. When coating or film is applied to a commodity, a modified atmosphere is developed. Reduction of internal oxygen and increase of carbon dioxide in the commodity will in some cases delay softening.

Respiration: Edible films or coatings can reduce respiration and, hence increase shelf life of a commodity. In selection of a coating, several considerations should be addressed to avoid extremely low oxygen concentration inside the commodity. Low oxygen concentration in the product could lead to anaerobic respiration, which can result in deterioration of product due to production of off-flavors and accelerated senescence.

Ethylene: Edible coating will produce a modified atmosphere inside the fruit, reducing levels of internal oxygen. If oxygen concentration inside the commodity drops below 8%, there will be a decrease in ethylene production and the commodity's quality will be preserved longer.

Color: One of the most important attributes of fruits and vegetables is color. For some minimally-processed fruits and vegetables, browning is a big problem that can be controlled by use of films or coatings as carriers of anti-browning agents (ascorbic acid, citric acid, calcium chloride).

Flavor: Can be preserved or modified with edible films or coatings by two different means: (1) as a barrier to aroma volatiles, and (2) as a carrier of flavors.

Microbial Contamination: In case of minimally-processed fruits and vegetables, where natural protection (skin) has been eliminated, opportunity for microorganisms to invade and grow on the surface of the fruit is present. Incorporating antimicrobial compounds (potassium sorbate,

sodium benzoate, sorbic acid, benzoic acid and propionic acid) into edible films or coatings will preserve quality of fresh-cut fruits and vegetables.

Table 1: List of commercially used coatings for fruits and vegetables

Name	Main component	Uses
Freshseel™	Sucrose esters	Extending shelf life of melon
Fry Shield™	Calcium pectinate	Reduces fat uptake during frying potatoes, and other vegetables
Nature Seal™	Calcium ascorbate	Apples, avocado, carrot, and other vegetables
Nutrasave™	*N, O* -Carboxymethyl chitosan	Reduces loss of water in avocado, retains Firmness
Opta Glaze™	Wheat gluten	Replaces raw egg based coating to prevent microbial growth
Seal gum, Spray gum™	Calcium acetate	Prevents darkening of potato during frying
Semperfresh™	Sucrose esters	Protect pome fruits from losing water and Discoloration
Z*Coat™	Corn protein	Extends shelf-life of peanut

Conclusion

Use of edible films and coatings are good alternative for preservation of intact and fresh cut-fruits and vegetables. Overall, the purpose of using edible films and coatings for fruits and vegetables is to retard transfer of gas, vapor and volatiles, thus providing food with a modified atmosphere that decreases respiration and senescence, reduces aroma loss, retains moisture and delays color changes throughout storage. Therefore, the application of new technologies to extend the postharvest life of these commodities is needed. The use of edible coatings appears to be a good alternative.

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