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Edible Waxing on Fruits and Vegetables

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Fruits and vegetables can be classified as climacteric or non-climacteric. Climacteric fruit continue to ripen after harvest, whereas non-climacteric does not continue to ripen after harvest. Nowadays, fruits and vegetables are highly demanded in the market because of its nutritional value. Fruits and vegetables have short shelf life due to its perishable nature. About 30% fruits and vegetables are affected or damaged by insects, microorganisms, pre and post harvesting conditions during transport and preservation. Preservation of fruits and vegetables is a big challenge for world. External appearance is an important attribute of overall fruit and vegetable quality. It is the first attribute that buyers notice. A protective edible coat on fruit and vegetable which protect them from transpiration losses and reduce the rate of respiration is called 'waxing'. Waxing consists of applying a thin layer of edible wax to the outer surface of the product. The benefits obtained by the product from waxing include an improved appearance, less moisture loss and shrivelling, reduced postharvest decay, and a longer shelf-life. Fruits and vegetables have a natural waxy layer on the whole surface (excluding under-ground ones). It may be obtained from both animal and vegetable sources. Nature of edible coating may be of protein, lipid, polysaccharide, resin alone or in combination. It acts as a barrier for moisture and gases during processing, handling and storage. Today herbal edible coatings are used as a nutraceutical and beneficial for consumer health. These have good barrier properties to O_2, CO_2, moisture and water vapour. These can also be safely eaten as part of the product and do not add unfavourable properties to the foodstuff. Edible coatings or films increase the shelf

life of fruits and vegetables and are environment friendly. In recent years, new edible films and coatings have been developed with the addition of various and edible herbs, antimicrobial compounds to preserve fresh fruits and vegetables. Edible coatings also help to prevent loss of firmness and moisture. They control maturation, development and respiratory rate. Edible coatings prevent oxidative browning and decrease growth of microorganism in fruits and vegetables for example, Tomato, Cucumber, and Cherries etc., (Kumar and Bhatnagar, 2014). Moreover, one of the most important things of this edible coating is the fact that they can be eaten together with the fruits and vegetables. Thickness of edible coating is generally less than 0·3 mm (Tharantharn, 2003).

Advantages of Waxing

Advantage of edible coatings are included (Park, 1999).

1. Edible coatings improve retention of acids, colour, flavour and sugar.
2. Maintain quality of fruits and vegetables during storage.
3. Reduce weight loss and firmness loss.
4. Decrease polymer packaging and waste.
5. Edible coatings can be consumed along with fruits and vegetables; they contain health beneficial nutrients.

Disadvantages of Waxing

Edible coatings have some disadvantages (Ghaouth *et al*., 1991).

1. Thick coating can prohibit Oxygen exchange, causes off-flavour development.
2. Edible coatings have good gas barrier properties which causes anaerobic respiration due to this normal ripening process is disturbed in fruits and vegetables.
3. Some edible coatings are hygroscopic in nature, which helps to increase microbial growth.

Fruits and Vegetables Benefited by Waxing

Edible coatings play a very important role to handle this situation. Edible Coatings are applied on whole and fresh-cut fruits and vegetables (Youssef *et al*., 2015). Fruits and vegetables which has been coated are:

Fruits: Edible coated fruits are Orange, Apple, Grapefruit, Cherry, Papaya, Guava Lemon, Strawberry, Mango, Peach etc. and fresh-cut Apple, fresh-cut Peach, fresh-cut Pear etc.

Vegetables: Tomato. Cucumber, Capsicum, Cantaloupe and minimally processed Carrot, fresh-cut Potato, fresh-cut Cabbage, fresh-cut Tomato slices, fresh-cut Onion, Lettuce.

Types of Waxes

1. **Solvent Waxes**: Solvent waxes widely used in citrus are composed of 70 to 80% aliphatic. Hydrocarbons and solvents such as acetone, ethyl acetate. The solvent will contain either a synthetic resin or a natural wood resin plus one or more plasticizers.
2. **Water Waxes**: Water waxes are a second major type. The most extensively used being resin solution waxes and emulsion waxes. Resin solution waxes are simply solution of one or more alkali –soluble resin or resin-like materials such as shellac, natural gums or wood resins. Emulsion waxes are composed of a natural wax such as carnauba or paraffin or synthetic wax such as polyethylene emulsion.

3. **Paste or Oil Waxes**: These are mainly composed of paraffins that are different in melting point and blended to give a desired viscosity. These are often used on vegetables.

Categories of Wax According to Their Use

1. **Storage Wax**: when fruit is not to be marketed immediately.
2. **Packout Wax**: when fruits are to be marketed immediately.
3. **High Shine Wax**: for giving a very high grace on market demand.

Waxes used commercially

1. Paraffin wax
2. Carnauba wax
3. Bee wax
4. Microcrystalline waxes
5. Shellac wood resins
6. Polyethylene

Methods of Application of Wax

Waxes may be applied in several different ways, ranging from manual rubbing of the product surface to automated roller brush application.

- **Manual Rubbing**: Liquid waxes can be applied by manually rubbing the commodity and smearing the wax evenly over the surface. A soft absorbent cloth or fine bristled brush can be used to speed up the process. After application, the products should be left to air dry for about 15 minutes before packing.
- **Dipping/Submergence**: Paraffin wax is typically applied as a brief dip or submergence of the product in a bath of melted paraffin. Submergence time is usually one second or less. Upon removal from the melted solution, the paraffin solidifies almost instantaneously. It is easy to apply on mostly fruits. The products are ready for packing within a minute after submergence.
- **Roller Brushing**: Liquid waxes can be applied automatically to the surface of the commodity by using a series of roller brushes. The wax is dispensed from above and saturates the brushes, which rotate and spin the product, smearing the wax evenly over the product surface. The 7 brushes on the wax applicator should be completely saturated with the wax solution before any product passes over them.
- **Extrusion Method**: This method depends on thermoplastic properties of edible coatings; it is best technique for applying of EC for industrial purpose as compared to other methods.

Conclusion

The most sophisticated method of food packaging is the edible coating. It has been shown that edible coating technology lowers waste materials in the packaging sector. The ingredients used to make these coatings might be synthetic or natural, and they are edible. The primary structural constituents with favorable gelation qualities include carbohydrate, protein, fat, wax, and oils. Plasticizers were applied to improve the gelation qualities as well as other features including the oxygen and water barrier properties. Sorbitol, mannitol, sucrose, and glycerol are all suitable food-grade plasticizers. Fruits and vegetables may be kept fresher longer on the store while still maintaining their nutritional value thanks to edible coatings. Edible coatings can be applied to the surface of fruits and vegetables using a variety of techniques, including dipping, spraying, brushing, and film creation. In the packaging sector these days, composite

film/coating creation is a more focused field. Compared to a single component film or coating, a composite film or coating has additional functional characteristics. The purpose of herbal coating is to add antioxidants and useful elements to food items to improve their nutritional value. It produces improved outcomes and health advantages.

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