CEST 2023

18th International Conference on Environmental Science and Technology

Athens, Greece, 30 August to 2 September 2023

Improve the post-harvest quality of fruits based on edible natural resources

RODINO S.[1], BUTU M.[2,*], BUTU A.[2,*]

[1]Romanian Farmers Association, Bucharest, Romania

[2]National Institute of Research and Development for Biological Sciences, Bucharest, Romania

*corresponding author:

e-mail: marian_butu@yahoo.com, alina_butu@yahoo.com

Abstract. Edible coatings and films from natural resources from which benefit both the consumer and the environment. The primary objective of this study is to enhance the post-harvest quality of fruits using recycled edible natural resources and edible natural plasticizers, while maintaining their nutritional value, taste, and sensory properties. Edible coatings and films are a viable, eco-friendly solution for prolonging the shelf life of fresh fruit throughout the supply chain, while being cost-effective. Edible films and coatings offer a cost-effective and environmentally friendly way to extend the shelf life of fresh fruit throughout the supply chain. These are made from commonly consumed food products, including natural extracts, which interact when combined to create an effective gas barrier, making it more difficult for oxygen to enter the fruit and water vapor to escape. The rise in fascination and exploration of edible packaging is driven by two key factors: firstly, the growing desire among consumers for food that is safe, easy to handle, and remains fresh for longer; and secondly, the recognition of the harmful effects of non-biodegradable packaging on the environment.
Keywords: edible coatings, edible films, fruits, natural resources, plant extracts

1. Introduction

In recent years, there has been a growing interest in finding ways to reduce food waste and improve post-harvest quality of fruits. An approach that can be taken is to repurpose natural resources as edible coatings or natural plasticizers, with the aim of enhancing the shelf life of fruits and preserving their freshness (Dutta, D., 2022; Pham, T.T., 2023).

Edible coatings, which act as a film that can be applied to the surface of fruits, provide protection against moisture loss, physical damage, and oxidation. Edible coatings and films made from natural resources offer a sustainable alternative to traditional synthetic coatings. These materials can help to improve food safety, extend shelf life, and provide functional benefits to food products. Edible coatings and films consist of a blend of polysaccharides, proteins, lipids, and plasticizers, which are employed to enhance the functional attributes and overall quality parameters of fruits and vegetables. These coatings and films can help maintain the desired texture, color, acidity, and total soluble solids of the produce, while also preventing undesirable browning and oxidation (Díaz-Montes E, 2021).

2. There are several methods for applying edible coatings and films to food products, including: dipping, spraying, coating, panning, fluidized bed, film wrapping. The choice of method may depend on factors such as the type of food product, the desired thickness and coverage of the coating, and the production scale. Additionally, active edible coatings or films can be created using plant extracts to augment the functional properties of the produce, such as providing antioxidant and antimicrobial benefits.Edible coatings and films from natural resources

Utilizing natural resources to create edible coatings and films is a forward-thinking approach to prolonging the shelf life of food items and elevating their safety and quality. By acting as a barrier against moisture, oxygen, and other environmental factors that can lead to spoilage or degradation of the food, these coatings and films serve as an effective solution.Starch, proteins, lipids, and polysaccharides are among the natural resources that are typically utilized in the creation of edible coatings and film (Hammam A.R.A., 2019). These materials are biodegradable, renewable, and safe for human consumption. Starch-based coatings have been found to be effective in retaining moisture, preventing oxidation and protecting against physical damage (Sapper M., 2018). Chitosan, a biopolymer derived from chitin, is another popular choice due to its antimicrobial properties, biodegradability and its ability to form a protective film (Gianfranco Romanazzi, 2017; Jiménez-Gómez CP, 2020).

Some edible coatings can also provide functional properties to food, such as improved texture, flavor, and nutritional value. Adding essential oils or antioxidants to

the edible film can help to preserve the freshness and flavor of the food product.

3. Techniques for applying edible coatings and films

There are several techniques for applying edible coatings and films, including dipping, spraying, brushing, and casting. The choice of technique depends on the type of food product, the coating material, and the desired thickness of the coating.

Dipping is a common technique for applying liquid coatings, where the food product is immersed in the coating solution and then dried. This method is simple and efficient, but it may not provide a uniform coverage of the coating.

Spraying is another popular method for applying liquid coatings, where the coating solution is atomized and sprayed onto the food product. This technique is faster and more efficient than dipping, but it requires specialized equipment.

Brushing is a manual technique for applying semi-solid or solid coatings, where a brush is used to spread the coating onto the surface of the food product. This method is suitable for small-scale production and provides a more controlled and uniform coverage of the coating.

Casting is a technique for preparing solid films, where the coating material is melted and then poured onto a flat surface to form a film. The film is then cut into the desired size and shape and applied to the food product. This method is suitable for the preparation of uniform films with a defined thickness.

4. Active edible coatings or films developed with plant extracts

Active edible coatings or films are coatings or films are made from various natural materials, such as plant extracts, that are safe for human consumption.

Plant extracts, such as carrageenan, and pectin, are commonly used in the development of active edible coatings. These extracts have antimicrobial properties that can help to preserve the freshness and safety of food products by preventing the growth of spoilage and pathogenic microorganisms.

In addition to their antimicrobial properties, plant extracts used in active edible coatings can also improve the texture, flavor, and appearance of food products. This makes them a versatile and valuable ingredient in the food industry, helping to create high-quality food products that are safe and enjoyable to consume.

5. Improve the post-harvest quality and extend the shelf-life of fruits

Edible natural resources and edible natural plasticizers are derived from food waste and plant-based sources, respectively, and offer environmentally friendly alternatives to synthetic preservatives and plasticizers.

Re-used edible natural resources refer to waste materials from food production that are recovered and utilized to extend the shelf-life and improve the post-harvest quality of fruits. These materials include fruit peels, seeds, and pulps, which are rich in antioxidants, phenols, and other bioactive compounds.

Fruit peels, such as those from oranges, are a valuable source of antioxidants, such as vitamin C, that can be used to preserve the freshness of fruits. In addition, orange peels have been shown to have antimicrobial activity against common foodborne pathogens, making them a valuable resource for preserving fresh fruits.

Edible natural plasticizers are substances derived from plant-based materials that are used to improve the texture and mechanical properties of food products. They offer a healthier alternative to synthetic plasticizers, as they are biodegradable and safe for human consumption.

Natural plasticizers are substances that can be added to fruits to enhance their flexibility, reduce cracking and bruising, and improve their overall freshness and texture. Some of the most commonly used natural plasticizers include citric acid, ascorbic acid, and sorbitol. These substances are derived from natural sources, such as fruits and vegetables, and are considered safe for consumption. They can help to maintain the texture and quality of fruits by reducing the amount of moisture that is lost and by improving the permeability of the fruit's skin, which can help to prevent the growth of spoilage microorganisms.

The use of natural resources as edible coatings and natural plasticizers has several advantages over traditional methods of post-harvest preservation. One of the main advantages is that these approaches are environmentally friendly and sustainable, as they do not rely on synthetic chemicals or preservatives that can harm the environment. Additionally, edible coatings and natural plasticizers are considered safe for consumption, which means that they do not pose a risk to human health. This is in contrast to synthetic preservatives, which can have harmful effects on human health.

Another advantage of using natural resources as edible coatings and natural plasticizers is that they do not affect the nutritional, organoleptic, and sensory attributes of fruits. By using edible coatings and natural plasticizers, it is possible to maintain the nutritional and sensory quality of fruits, while also improving their shelf life and reducing food waste.

6. Conclusion

Incorporating natural resources as edible coatings and natural plasticizers is a novel and eco-friendly method for enhancing the post-harvest quality of fruits. These approaches are not only safe, but also preserve the nutritional value, taste, and sensory properties of the fruits. Selecting a suitable technique for the application of edible coatings and films depends on various factors, such as the coating material, the type of food product, and the desired thickness and uniformity of the coating. By using edible coatings and natural plasticizers, it is possible to reduce food waste and improve the quality and freshness of fruits for consumers.

Acknowledgements

This work was supported by National Program for Rural Development 2014-2020 through the Agency for Financing Rural Investments within the Ministry of Agriculture and Rural Development, project no F 16 1 A 0000 0118 316 00001/2021 and the Program NUCLEU within the framework of the National Research Development and Innovation Plan 2022-2027, carried out with the support of Ministry of Research, Innovation and Digitalization, project no: 23020101.

References

Díaz-Montes E, Castro-Muñoz R. (2021), Edible Films and Coatings as Food-Quality Preservers: An Overview. Foods. 10(2):249. doi: 10.3390/foods10020249.

Dutta, D., Sit, N. Application of natural extracts as active ingredient in biopolymer based packaging systems. J Food Sci Technol (2022). https://doi.org/10.1007/s13197-022-05474-5

Gianfranco Romanazzi, Erica Feliziani, Silvia Bautista Baños & Dharini Sivakumar (2017) Shelf life extension of fresh fruit and vegetables by chitosan treatment, Critical Reviews in Food Science and Nutrition, 57:3, 579-601, DOI: 10.1080/10408398.2014.900474

Hammam, A.R.A. (2019), Technological, applications, and characteristics of edible films and coatings: a review. SN Appl. Sci. **1**, 632. https://doi.org/10.1007/s42452-019-0660-8

Jiménez-Gómez CP, Cecilia JA. (2020), Chitosan: A Natural Biopolymer with a Wide and Varied Range of Applications. Molecules. **25**(17):3981. doi: 10.3390/molecules25173981. PMID: 32882899; PMCID: PMC7504732.

Pham, T.T.; Nguyen, L.L.P.; Dam, M.S.; Baranyai, L. (2023), Application of Edible Coating in Extension of Fruit Shelf Life: Review. AgriEngineering, 5, 520-536. https://doi.org/10.3390/agriengineering5010034

Sapper, M.; Chiralt, A. (2018), Starch-Based Coatings for Preservation of Fruits and Vegetables. Coatings, 8, 152. https://doi.org/10.3390/coatings8050152