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Aquatic Biopolymers Used in Edible Film and Edible Coating in The Food Industry

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Abstract

Edible film and edible coating approaches are accepted as useful and prompt techniques that improve the sensory, physicochemical, and microbial quality of both plant-based and animal-based food items. With increasing awareness of the detrimental impacts of synthetic packaging materials, the utilization of natural polymers has increased in popularity in food science. Aquatic biopolymers are known as important sustainable and versatile materials used not only in the food industry but also in pharmacology and biomedical science. Gelatin, chitosan, and alginate are obtained from aquatic animals and aquatic plants and these biopolymers offer quality protection and sensory attributes. Edible coating and edible films extend shelf life inhibit microbial deterioration and protect chemical quality. The formulation, physical, and chemical characteristics of aquatic biomaterial-based edible coating and film differ depending on the used aquatic material and applied food properties such as moisture, shape, and proximate composition. In this review, aquatic biopolymers from gelatin to chitosan and alginate were deeply investigated. Biochemical properties, functional characteristics, and sensorial quality of these aquatic polymers were evaluated. Besides these advantages, the limitations of these aquatic polymers in edible film and coatings at both academic and industrial levels are deeply investigated in this review. Novel approaches of aquatic biomaterials on the different food items from seafood to meat products, vegetables to fruits were highlighted.

Key Words: *Edible film edible coating, aquatic sources, biopolymers*

Introduction

Within changing consumer preference in food consumption and the trends in food industry, novel approaches have applied to improve quality of food and extend shelf life. Edible film and edible coating are accepted as the most preferable approaches that can used in various food products from vegetables and fruits to meat and seafood (Atta et al.,2022: Oladzadabbasabadi et al.,2022). While grass synthetic polymers used traditionally, within better understanding of the side effect of synthetic compounds in the food products, natural polymers have gained importance over the last decades (Mohamed et al.,2020). Film forming capacity of protein, hydrocolloids and lipid are different due to their physic-chemical characteristics. Besides improving physic chemical qualities, another important functionality of edible coating and edible film should be improving sensorial properties of these approaches. In addition to terrestrial sources, the aquatic sources have also used in the extraction of polymers within several characteristics. Aquatic sources refer the animals and plants species living in both marine and freshwater bodies (Aksun Tümerkan et al.,2023). Due to wide distribution and reaching easily to raw material are essential parameter to selecting a biopolymer in the sustainable production in the food industry, aquatic biopolymers are robust materials for any kind of food application (Udayakumar et al.,2021). In this review, the drawbacks and advantages and potential solutions of most used aquatic biopolymers in the edible films and edible coatings were deeply investigated.

The most common used Aquatic Biopolymers Used in Edible Film and Edible Coatings

With the discovery of excellent properties of fish collagen and gelatin, alternative usage of these materials in food industry has grown rapidly as both food ingredient or external usages such as edible film and coatings. Due to the foaming, gelling and other physico-chemical properties of fish collagen and fish gelatin differ depending on the raw material that used in the production, several kinds of fish collagen and gelatin can be obtained (Aksun Tümerkan 2021). The bulk of raw material and gelling capacity offers excellent usages in food coating. The main challenges of fish gelatin and collagen are the weakness of structure that could limit the folding and wrapping capacity of edible film (Park et al.,2021: Maroufi et al.,2022). Another critical issue of fish gelatin in the edible film and coating approaches is fishy odor that can limit the sensorial acceptance by consumers (Sae-leaw, 2015). Chitosan known as a superior material used in different approaches in food industry (Kumar et al.,2020). Antimicrobial and antifungal characteristics of chitosan lead to usage of this material in different aims (Elsabee and Abdou, 2013). While chitosan can be obtained from shell of crustaceans, the extraction methods change the characteristics of chitosan and thereof edible films and coatings (Oladzadabbasabadi et al.,2022). Iqbal et al.,(2021) and Kumarihami et al.,(2022) reported that the edible film obtained by chitosan improved the quality and extended the shelf life of cheese and kiwifruit. The protect food items by its antimicrobial and antioxidant

effect make chitosan as preferable material for edible coating and edible films, however like fish gelatin and fish collagen, some problems limit its usage. Mechanical properties and physical characteristics are the main problems in its usage in edible film (Souza et al.,2020).

Similar to fish derived collagen, gelatin and crustacean derived chitosan, alginate has also used alone or combined with other natural additives to usage in edible coating and edible film. Due to alginate is derived from brown algae species, easily accessing to the raw material and processing capabilities offer several benefits and this material frequently used in all type of food products (Senturk Parreidt et al.,2018).. Moisture barrier and other physical properties of alginate based edible coating improve the quality of food products. Additionally colorimetric properties enhanced by within barrier between air and the surface of food materials. Gheorghita et al., (2020) highlighted that edible film contained sodium alginate improve the quality and improve the shelf life of cheese and meat, even in the coffee sample.

Conclusion

In this review, the opportunities and challenges of different aquatic biopolymers used in edible film and edible coatings evaluated. In addition to fish gelatin, chitosan from crustacean and alginate from algae, other aquatic sources could be used as biomaterial and could be investigated by mechanically and physico-chemically. In addition to usage of solely usage of these materials, combination with other natural antioxidant and antimicrobial could be improve the protective capacity of these approaches. The weakness of these materials could be improved by some natural strengthening material, thereof common mechanical limitations could be avoided.

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