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Murine Fish Chemical Compositions are being enhanced for use in Food Packaging

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Abstract

The purpose of this study was to describe the properties of cold-water fish (FG) gelatin mixed with poultry gelatin (PG) to prepare olive oil sachets. To find desirable films, different ratios of FG-PG based films were characterized in terms of mechanical properties. As the proportion of PG increased in PG-FG based films, the tensile strength and elastic modulus of the films increased and the elongation at break and heat seal strength of the films decreased. The 50-50 film had favorable properties for use as a pouch. The acid index and peroxide content of the oils stored in the bags after 14 days showed significant differences ($p<0.05$) between the films. The barrier properties of the film, including water vapor permeability and oxygen permeability of the film, increased from 1.21 to 4.95 × 10−11 g m−1 Pa−1 s−1 and from 48 to 97 cm3 mμ/m2 d kPa. Increasing PG resulted in dark, red, yellow, and opaque films. Fourier transform infrared (FTIR) spectra confirmed a broad peak at approximately 2500 cm -1. Therefore, a simple change of FG with PG makes it suitable for oil bag packaging applications in the food industry.

Keywords: WVP; Sachet; olive oil; Peroxide index

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Introduction

Mammalian gelatin (MG) is rapidly becoming an important tool in the pharmaceutical, food, and cosmetic industries due to its physicochemical and rheological properties and favorable film formation [1]. These types of gelatin are traditionally derived from the bones and connective tissue of bovine and porcine species. However, health concerns and religious restrictions that increase the risk of prion infection have limited their use. Therefore, in the last decade, the global gelatin consumption in various industries has been trending upward every year [2]. In this connection, other sources such as seawater and poultry have been introduced. Common health, religious, and cultural concerns regarding the consumption of gelatin-containing products can be stated as follows: Judaism and Islam forbid the consumption of pork, while Hinduism prohibits the consumption of beef. Consumption of the product is prohibited. On the one hand, the issue of halal in Islam raises the question of how to find sources of kosher for the world's Muslim, Jewish and Hindu population in the next 20 years (population growth rate is projected to be 53%, reaching about 3.7 billion).). On the other hand, expensive and time-consuming techniques such as chromatography, chemical absorption and mass spectrometry are used to determine the origin of gelatin species [3].

Due to the lower imino acid content (proline + hydroxyproline) compared to MG, cold-water fish gelatin has lower rheological properties such as lower melting and gelling temperatures and lower gel strength. However, gelatin obtained from the skin of warm-water fish species (tilapia, tuna, black carp) has an amino acid content similar to that of pig and cattle skin. Flowering or gel strength (220-600 g), melting point (11-21 °C), but these amounts are 20-28 and 20-27 °C (gel point) for PG and MG respectively, 75-27 818 and 100-300 g (gel strength), and 27-42 and 28-31 °C (melting point). The low temperature of FG makes it suitable for producing complex coacervations at temperatures above ambient, but as mentioned earlier, this defect limits its application in other cases. From an economic and environmental point of view, FG obtained from fish by-products such as fish skin, bones, scales and cartilage is valuable in the seafood processing industry [4].

On the other hand, FG's properties of being able to form good films and its natural occurrence make it a preferred raw material in the production of biodegradable packaging. However, many studies have been done to improve the properties of FG films, such as adding various compounds to FG, such as: phycocyanin, hydroxytyrosol, 3,4-dihydroxyphenylglycol and anthocyanin, titanium dioxide-doped silver nanoparticles, and polyphenol-containing chitosan nanoparticles and agar [5].

In addition, many research studies focus on modification of His FG by enzymatic methods such as microbial transglutaminase (MTGase), chemical modifications such as phosphorylation, phenolic and physical modifications. The above methods have been successfully used to modify FG to improve its gel and rheological properties, but the high cost of enzymatic methods and the use or preparation of toxic reagents by chemical methods have been cumbersome. It requires complexity and has some other drawbacks. A dramatic change in the structure of high-molecular-weight polymers and FG significantly increases the melting point and strength of the FG gel, resulting in strength and hardness of the gel. Thermoreversibility may even be lost. The simplest and most widely used method to improve the properties of FG gels is through physical modifications such as the addition or mixing of electrolyte and non-electrolyte salts [6].

The main advantages of PG are strong gel strength and stable gel structure comparable to MG, so it is expected to be widely used. In contrast, the main drawback of FG, especially in cold water, is its weaker gel strength and less stable gel structure than MG, which limits its use. Therefore, adding PG to FG can improve the weak structure [7].

Result

Characteristics of composite film for thermal sealing

The average thickness of the produced films shows no significant difference between the samples ($p>0.05$). This is due to the same properties of the two compounds used to make the film, both of which are gelatin in nature [8]. All foils had a thickness of 0.114–0.125 mm. Film thickness did not change with increasing concentration or decreasing gelatin content. The mechanical properties of hydrocolloid films are usually studied using the following her three parameters: Tensile strength (TS), Young's modulus (YM), elongation at break (EB). Quantities of TS, EAB and Young's modulus of PG/FG films combined with PG and FG at different levels. In general, all films incorporating PG showed a higher TS ($p<0.05$) than the control (FG), indicating more pronounced interactions between protein chains resulting in a stronger film network. I'm here. TS corresponds to the measured force (N) required to break a section of film [9]. EB% is the ratio of displacement to length of the reference sample. It is expressed as a percentage based on the relative flexibility of the film. YM (MPa) is the parameter corresponding to the slope of the linear stress-strain curve at small strains [10].

Oxygen transparency

Oxygen permeability results showed that as the concentration of PG in the FG film increased, the oxygen permeability also increased significantly ($p<0.05$). The FG film had the lowest OP and the PG film had the highest OP [11]. Polymer chemistry, molecular cohesion, and degree of cross-linking are among the most important factors affecting oxygen layer permeability [12]. The amount of certain amino acids in the protein can interfere with α-helix formation and affect the dynamic properties of gelatin [13]. Proline and hydroxyproline increase the strength of the α-helical structure by forming hydrogen bonds. Fish gelatin has low levels of proline and hydroxylproline, resulting in a lower OP. Confirm that cross-linking by chemical or natural compounds in the structure of gelatin leads to OP reduction [14].

Viscosity of gelatin solutions in a global view, the graph does not have slices, so measurements will never be the same at any given second. Pure FG is the least viscous of all, with beef having a higher viscosity on the scale of about 5 cP. Both PG-FG 50-50 and PG100 have almost twice the viscosity of bovine, with the slight difference that FG is slightly higher (approximately 10 cP higher than FG100), which is better for poultry and fish gelatins. It shows that it can exhibit a high viscosity. Also, the viscosity of PG at the end of the graph is almost the same as that of beef at the beginning. The difference in viscosity between PG100 and PG-FG is highest at the beginning, lowest during (50-100 seconds) and increases slightly towards the end. For all gelatins, the measured viscosity decreases first, after which the velocity becomes nearly constant. In cattle, the greatest drop is seen in the first 10 seconds and the lowest at FG100 [15].

Conclusion

The manufacture of easy-to-use, biodegradable and edible films is still being explored. In this application, the use of alternative MGs (PG and FG) is mixed and their properties are synergistic. They were able to successfully enhance each other's better quality in the films produced. With poultry gelatin having good film-forming properties and good structure of the gel, the results were: Combinations of 50-50 of these gelatins are suitable for industrial food applications as they can form films that can be used as packaging for virgin olive oil for 14 days without acid or peroxide loss.

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