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"EXTRACTION OF COLLAGEN FROM BOS TAURUS AND ITS APPLICATION AS A PRESERVATIVE COATING IN FOODS"

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Abstract : Edible coating is a thin layer of edible material added to food goods to improve their quality, safety, and shelf life. These coatings can be formed of a variety of materials, including proteins, polysaccharides, and lipids.Edible bovine protein coatings, which are predominantly composed of collagen and gelatin, have gained popularity in the food sector due to their functional and nutritional properties. These coatings function as protective barriers that enhance moisture retention, improve flavor profiles, and extend shelf life by preventing oxidation and microbiological development. Bovine protein's versatility makes it suitable for use in a wide range of culinary products, including meats, snacks, and confections. According to research, these coatings have the ability to not only retain food quality but also improve its nutritious value. As consumer demand for natural and functional food ingredients increases, edible bovine protein coatings offer a long-term and effective alternative for increasing food preservation and sensory qualities. Future research could focus on improving formulation techniques and investigating customer acceptance in order to further integrate these coatings into mainstream food products.

Key words: Edible coating, bovine protein, collagen, gelatin, food preservation, shelf life, moisture retention, oxidation prevention, microbial protection, natural ingredients, food quality,proteins.

INTRODUCTION:

"EXTRACTION OF COLLAGEN FROM BOS TAURUS AND ITS APPLICATION AS A PRESERVATIVE COATING IN FOODS" Edible coatings are thin layers of edible ingredients applied to food surfaces for protection and preservation. The development of edible coatings has gained attention as an environmentally friendly alternative to standard plastic packaging, with the goal of extending food shelf life, improving food safety, and maintaining product quality. The use of proteins, such as those derived from beef, is particularly advantageous due to their excellent film-forming properties and high nutritional value.Edible beef coatings and films refer to thin layers made from beef-derived proteins, typically collagen or gelatin, applied to food products as protective barriers. These coatings are applied directly to food surfaces or molded into standalone films that can be wrapped around food items. The key difference between coatings and films lies in their form and application: coatings are applied directly to food surfaces via dipping, spraying, or brushing, while films are pre-formed sheets used similarly to conventional packaging.(Serrano, J., et al. (2008). Collagen, the most abundant protein in bovine connective tissues, is highly coveted for its film-forming ability. Gelatin, which is made from the partial hydrolysis of collagen, is another popular ingredient due to its versatility, transparency, and ability to make flexible, water-soluble films.Chi, H., Song, S., and Luo (2017). The success of edible beef coatings and films in culinary applications is determined by their functional qualities, which include barrier performance, mechanical strength, optical properties, and biodegradability. Each of these parameters has a significant impact on the usability of beef protein films for diverse food applications.

Historical Development of Edible Coatings:

Edible coatings have been used for ages, with the first instances reaching back to ancient China, when wax coatings were employed to preserve citrus fruits. However, recent research on edible coatings began in the mid-twentieth century, with an emphasis on food preservation. Over the last few decades, advances in food technology have enabled the development of more sophisticated coatings with improved functional properties such as antimicrobial activity, moisture barrier properties, and controlled release of bioactive compounds (Debeaufort, Quezada-Gallo & Voilley, 1998).

Types Biopolymers Used in Edible Coatings:

Edible coatings are typically made up of biopolymers such proteins, polysaccharides, and lipids, or a combination of these substances. The choice of biopolymer is determined by the coating's desired functional qualities, such as mechanical strength, water vapor permeability, and interaction with food components.

Proteins:

Protein-based edible coatings are extensively researched due to their superior film-forming ability, mechanical strength, and biocompatibility. Edible coatings have included whey protein, casein, gelatin, soy protein, and collagen (Krochta & De Mulder-Johnston, 1997). For example, whey protein films have been shown to have high oxygen barrier characteristics, making them.

Polysaccharides:

Like starch, cellulose, chitosan, and alginate are often utilized in edible coatings for their capacity to form films and act as gas barriers. Chitosan, a chitin derivative, is known for its antibacterial qualities, making it an ideal covering for perishable foods (Elsabee & Abdou, 2013). Alginate coatings made from seaweed are frequently used to create films that provide moisture barriers and improve food preservation (Tapia *et al.*, 2008).

Lipid-based coatings:

Such as waxes, fatty acids, and glycerides, are commonly employed to prevent moisture loss from food products due to their hydrophobic properties. However, lipid coatings often lack mechanical strength and flexibility, hence they are routinely mixed with polysaccharides or proteins to increase their functional qualities (Baldwin, 1994).

Functional properties:

Edible coatings are assessed for several functional qualities, such as mechanical strength, barrier properties, and bioactivity. These characteristics are crucial in determining the efficacy of coatings in food preservation.

Mechanical Properties:

Edible coatings' mechanical strength protects food surfaces from damage during handling and storage. Protein-based coatings, such as those derived from whey protein or gelatin, have stronger tensile strength and flexibility than polysaccharide-based coatings. However, mixing different biopolymers or adding plasticizers can improve flexibility while decreasing brittleness (Debeaufort & Voilley, 2009).

Barrier Properties:

Extends food shelf life. For example, lipid-based coatings have good water vapor barrier characteristics, making them appropriate for high-moisture meals. Protein and polysaccharide coatings, on the other hand, are better at preventing oxygen and can help prevent oxidation in foods like fruits and meat (Cagri, Ustunol, & Ryser, 2004).

Antimicrobial Properties:

Adding antimicrobial compounds to edible coatings has been a focus of research. Coatings having antimicrobial qualities can prevent the growth of spoilage bacteria and foodborne pathogens, lowering the risk of contamination. Chitosan, for example, is naturally antibacterial and has been found to prevent bacterial and fungal growth on fresh fruits and vegetables (Dutta et al., 2009). Essential oils, organic acids, and nanoparticles have also been added into edible coatings to improve their antibacterial properties (Lin & Zhao, 2007)

Coating for various foods:

Edible coatings have been put to a wide range of food products, including fresh fruits and vegetables, meat, chicken, fish, and baked goods. The use of edible coatings varies according to the food product's specific requirements, such as moisture retention, oxidation prevention, or microbial suppression**.**

Beef collagen:

Structural protein found in animal connective tissues, is a valuable raw resource for industrial uses such as edible films, medicines, cosmetics, and culinary products. Beef bones, which are frequently considered a byproduct of the meat industry, are high in collagen. In recent years, substantial study has been performed to investigate the extraction, characteristics, and applications of collagen derived from beef bones. This review of the literature summarizes major results about beef bone collagen, focusing on its extraction methods, physicochemical qualities, applications in the food and packaging industries, and possible sustainability benefits.

Collagen Extraction from Beef Bones:

Collagen can be extracted from beef bones through several processes, including acid solubilization, enzymatic hydrolysis, and alkaline treatments. The method of extraction greatly affects the yield, quality, and functional properties of the collagen obtained.

• Acid and Alkaline Treatments: Acid and alkaline extraction methods are commonly employed to break down the collagen from bone matrices. Acid extraction is typically used to isolate type I collagen, the predominant type in bones and skin. This method involves treating the bones with weak organic acids, such as acetic acid or citric acid, to solubilize the collagen (Duan *et al.*, 2018). Alkaline treatments, on the other hand, are employed to remove non-collagenous proteins and improve the purity of the final product (Liu *et al*., 2015).

Enzymatic hydrolysis, which selectively breaks down the bone matrix with enzymes like pepsin or trypsin, produces high yields of collagen with minimal structural damage. Research indicates that enzymatically extracted collagen retains its triple-helical structure, which is crucial for its functional properties (Nagai & Suzuki, 2000).

Physicochemical Properties of Beef Bone Collagen:

Beef bone collagen's molecular structure, consisting of three polypeptide chains forming a triple helix, contributes to its mechanical strength and thermal stability, making it a versatile material.

• Molecular Structure and Amino Acid Composition: Beef bone collagen is rich in glycine, proline, and hydroxyproline, amino acids that are critical for maintaining the stability of the collagen triple helix. The high content of hydroxyproline is particularly important because it contributes to the thermal stability of collagen, allowing it to maintain its structure at higher temperatures compared to other proteins (Muyonga, Cole, & Duodu, 2004).

• Beef bone collagen films have high tensile strength and flexibility, making them ideal for edible films and coatings that need durability and elasticity to protect food during storage and handling (Jongjareonrak *et al.*, 2006)..

Applications of Beef Bone Collagen:

Collagen from beef bones has gained considerable interest in the food industry, especially for developing edible films and coatings, as well as in the pharmaceutical and cosmetic industries. These applications are driven by collagen's biocompatibility, biodegradability, and functional versatility.

- Edible Films and Coatings: One of the principal uses of cattle bone collagen is in the manufacture of edible films and coatings. These coatings exhibit excellent barrier qualities against oxygen and can assist prevent lipid oxidation in food products, therefore extending shelf life (Limpisophon *et al.*, 2010).
- Pharmaceutical and Biomedical Applications: Due to its biocompatibility and ability to support cell growth, beef bone collagen is widely used in wound dressings, tissue engineering, and drug delivery systems. In tissue engineering, collagen scaffolds are used to support the growth of new tissue due to their structural properties and ability to mimic the extracellular matrix (Gelse, Pöschl, & Aigner, 2003). Collagen's ability to promote cell adhesion and proliferation makes it a suitable candidate for biomedical applications.
- Cosmetics: Collagen is a popular cosmetic ingredient due to its skin-enhancing properties. Hydrolyzed collagen derived from beef bones is commonly used in creams, serums, and supplements designed to improve skin elasticity, hydration, and wrinkle reduction. The high content of glycine and proline in collagen promotes skin health by supporting the natural regeneration process (Sionkowska et al., 2020).

Protein-Based Edible Coatings and Methods:

Proteins have long been recognized as versatile biopolymers for creating films and coatings due to their excellent mechanical properties and biodegradability. Research on protein-based films has explored a wide range of sources, including soy protein, whey protein, gelatin, and more recently, collagen from animal by-products. According to (Gómez-Guillén et al. (2011), protein-based films offer superior mechanical strength and flexibility compared to other biopolymers, as well as effective barrier properties against gases such as oxygen.

In the food industry, protein-based edible coatings have been applied to a variety of food matrices, ranging from fresh produce to meat products, to extend shelf life by preventing moisture loss and microbial spoilage. For example, Soazo et al. (2015) found that whey protein films had lower water vapor permeability than synthetic films, despite having some hydrophobicity limitations.

Functional Properties of Beef Bone Protein Coating: The functional properties of edible coatings and films derived from beef bone protein have been a central focus of research, with mechanical strength, water vapor permeability, and antimicrobial properties being key areas of interest. Studies have consistently shown that beef bone protein films exhibit significant tensile strength and flexibility, making them suitable for various food packaging applications (Li et al., 2017). Additionally, these films offer effective moisture and oxygen barrier properties, which are essential for maintaining food quality and extending shelf life (Tongnuanchan et al., 2016).

The antimicrobial properties of beef bone protein films are another important feature, particularly for applications in food preservation. Microbial assessments in several studies have demonstrated that these films can reduce spoilage and enhance food safety, either due to inherent antimicrobial activity or by acting as carriers for antimicrobial compounds (Rawdkuen & Benjakul, 2012).

Conclusion:

Bovine protein edible coatings, primarily derived from gelatin and collagen, are gaining traction in the food sector due to their capacity to improve food storage. These coatings form a protective layer that extends shelf life, retains moisture, and acts as a barrier to oxygen and microbes. They are made with bovine protein and other additives and can be used on a variety of food such as fruits, vegetables, meats, and dairy products. The development and deployment of bovine protein edible coatings is a long-term solution for increasing food quality and minimizing waste. These coatings are economically viable, particularly as consumer demand for natural preservation methods increases. Their ability to maintain freshness and safety distinguishes them as an important invention in food technology. Overall, bovine protein coatings not only extend product life but also reflect the growing emphasis on sustainability in food practices.

Reference:

[1] Bigi A, Cojazzi G, Panzavolta S, Rubini K, and Roveri N. (2001). Mechanical and thermal properties of gelatin films with various degrees of glutaraldehyde crosslinking. Biomaterials, 22(8),763–768.

[2] E. A. Baldwin, et al. (2011). "Edible coatings and films to improve food quality." Critical Reviews of Food Science and Nutrition. This article investigates the role of edible coatings in improving food quality and shelf life.

[3]Bhatnagar, R., and Goyal, A. (2012). A survey of recent trends in edible fruit and vegetable coverings. Food Research International, 45(1), 10–22.

[4] Chi, H., Song, S., Luo, M., Zhang, C., Li, W., and Li, L. (2017). The effect of gelatin/agar ratio on edible films' structure, mechanical, and barrier qualities. Coatings, 7(10):153.

[5] Campos, C. A., Gerschenson, L. N., and Flores, S. K. (2011). Development of edible films and coatings with antibacterial properties. Food and Bioprocess Technology, 4(6), 849–875.

[6]Cagri A, Ustunol Z, & Ryser E. T. (2004). Antimicrobial edible film and coatings. Journal of Food Protection, 67(4), 833–848.

[7]Dunshea F. R. et al. (2014). "Bovine protein: Sources, composition, and health benefits." Nutrients. This article discusses the many sources of bovine protein and their nutritional benefits.

[8]Devries, T. J. and Chapman, D. (2019). "Protein quality and amino acid composition of bovine milk: A review." Journal of Dairy Science. This research looks at the amino acid profile and nutritional value of bovine milk protein.

[9]Duan, R., Zhang, J., Du, X., Yao, X., & Konno, K. (2018). Properties of collagen from skin, scale and bone of carp (Cyprinus carpio). Food Chemistry, 112(3), 702-706.

[10]Debeaufort, F. and Voilley, A. (2009). Edible films and coatings: Properties, formation, and applications. Innovations in Food Packaging (pg. 233-270). Academic Press.

[11]Garcia, M. L., & Martínez, A. (2001). Edible coatings: A summary of current advancements. Food Science and Technology International, 7(6), 489–499.

[12]Gómez-Estaca, J., Montero, P., Fernández-Martín, F., and Gómez-Guillén, M. C. (2010). Physical and chemical properties of fish gelatin-based edible films and lipid emulsions. Food Hydrocolloids, 24(5), 484–491.