

Importance of Seafood Gelatin for Food Industry

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Abstract

The gelatin food industry is a very important biopolymer. It is widely used by various industries because of its functional and technological properties. The majority of industrial gelatin is obtained from mammals. But due to many sociocultural and religious reasons, there is an increasing demand for alternative sources. The gelatin obtained from by-products formed during the processing of seafood produces a serious potential for the industry. In this review, a general definition of gelatin is made and we will talk about the properties of the gelatin obtained from aquatic products and their production method.

Keywords: Seafood gelatin, Fish, Gelatin, Gelatin Market Analysis

Review article

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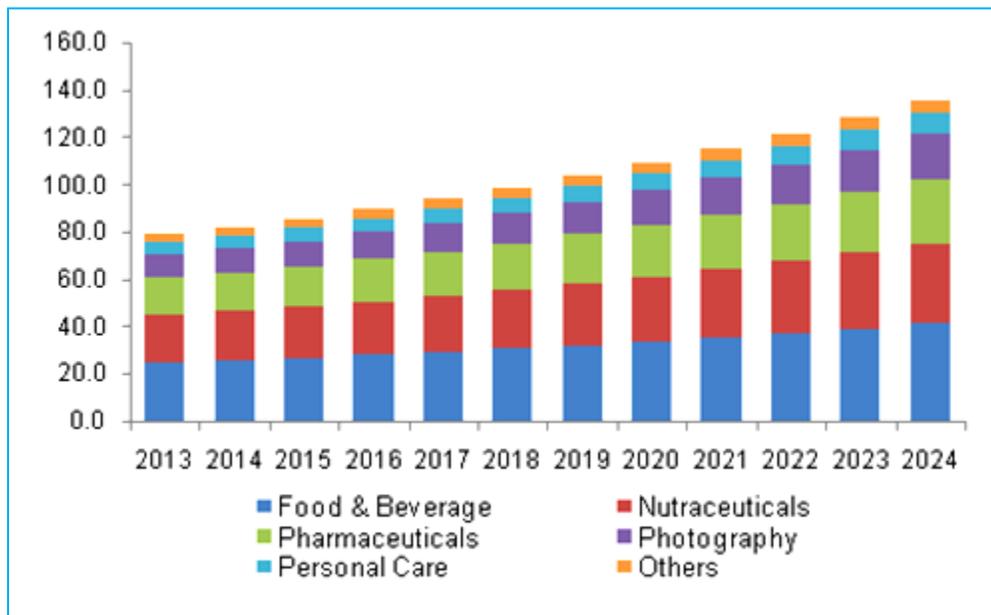
INTRODUCTION

Gelatin is an important biopolymer widely used in foods to improve elasticity, consistency, and stability. Gelatin is a substantially pure protein food ingredient, obtained by the thermal denaturation of collagen, which is the structural mainstay and most common protein in the animal kingdom (Bailey and Paul 1998). Gelatin is a form of protein that creates a gel when cooled and melts at below the body temperature. As such characteristic has not been observed in any carbohydrate or hydrocolloid to date, gelatin is considered the largest single food ingredient used (by weight) in the food industry (Gómez-Guillén and Montero, 2001).

Technically, the term gelatin, applies for a series of proteins obtained from collagen after partial hydrolysis, obtained from bones, skin, hides and cartilages, etc. (Gómez-Guillén and Montero, 2001). In the conversion process of collagen to gelatin, acid or alkali pretreatment hydrolyze the cross-linking bonds between polypeptides and irreversibly results in gelatin (Yang et al., 2008). The gelatin is water soluble and forms thermo-reversible gels with the melting temperature near to the body temperature (Norziah et al., 2009).

Gelatin is used in shampoos, face masks, and other cosmetics as a thickener for fruit gelatins and puddings in candies, marshmallows, cakes, ice cream, and yogurts; on photographic film and in vitamins as a coating and as capsules, and it is sometimes used to assist in “clearing” wines. Gelatine is widely used in various fields of food industry due to its stabilizing, gelling, clarification, balancing, foaming, emulsion forming and stabilization, and film forming properties. Gelatine is also used for clarification of wines and juices, in meat and milk products and also since gelatin is a pure protein, it is also used in the supplementary nutriment and drinks that are used by sportsmen. The global gelatin market size was 412.7 kilo tons in 2015. The increasing application of the product in food & beverage and pharmaceutical applications on account of exhibiting excellent stabilizing characteristics and good binding features is expected to remain a favorable factor for growth over the forecast period (Gelatin Market Analysis By Raw Material 2015).

Over the past few years, polysaccharides are being increasingly used as an important constituent in healthcare and food & beverage applications on account of providing excellent hydrolyzing enzymatic properties. Therefore, industry presence of polysaccharide is expected to pose a substitutional threat to gelatin market over the next eight years (Gelatin Market Analysis By Raw Material 2015).



(Gelatin Market Analysis By Raw Material 2016)

As the global demand for gelatin is continuously on the rise, many potential sources are being sought for derived from pig skin, bovine hides, bones and others sources contributing 46%, 29.4%, 23.1% and 1.5%, respectively. Due to the fact that half of the production is harvested from porcine source, concerns about Halal or Kosher market strongly dominate. Moreover, in the case of bovine gelatin, the prevalence of spongiform encephalopathy necessitates a look up for possible alternatives (Karim and Bhat, 2009). Pig skin was the majorly used raw material, accounting for 40.6% of the market volume in 2015 owing to the high level of collagen content. However, increasing occurrences of seasonal disorders associated with swine is expected to refrain gelatin manufacturers for procuring pig skin as a raw material (Gelatin Market Analysis By Raw Material 2015). Bovine hides are also used as a raw material on account of the presence of high levels of peptide and fibrous content. Cattle bones release protein rich collagen which is boiled and filtered repeatedly post which it is ground into a powder. Consumption of this powder helps in improving digestion and connective tissue. As a result, cattle bones are expected to witness the fastest growth at a CAGR of 4.9% from 2016 to 2024, in terms of volume (Gelatin Market Analysis By Raw Material 2015). The increasing popularity of halal foods in food & beverage industry of Middle East countries is expected to promote the usage of cattle bones as raw materials to produce gelatin over the forecast period (Gelatin Market Analysis By Raw Material 2015). Fish skin, horse hair, and sheep covering are other raw materials which are used for the production of gelatin. Technological advancement for the development of fish gelatin in China is expected to open new markets over the next eight years (Gelatin Market Analysis By Raw Material 2015). Gelatin is normally obtained from collagen, which is one of the major structural components of vertebrates and invertebrates. Collagen is mainly found in the skin, bones and connective tissues of animals. Gelatin, on the other hand, is a class of protein fractions derived from the parent protein collagen using procedures that destroys it, which is later extracted in hot water. This process separates the natural protein chains and breaks the peptide bonds that makh as skin, scales and bones have drawn much industry interest (Ladislaus et al., 2007). This is

partly due to the need to comply with the requirements for Kosher- and Halal-certified products. In recent years studies on collagen and gelatin obtained from by-products of processed seafood. Gelatin is a high molecular weight polypeptide and an important hydrocolloid, which has proved popular with the general public and finds its uses in a wide range of food products largely because of its gelling and thickening properties. It differs from other hydrocolloids because most of them are polysaccharide, whereas gelatin is a digestible protein containing all the essential amino acids except tryptophan. The amino acid composition particularly with respect to proline and hydroxyproline can vary from species to species, as a result of exposure to a wide range of environmental conditions, particularly temperature (Ladislaus et al., 2007).

Fish gelatins have lower rheological properties than mammalian gelatins. The gelatin properties are influenced by two main factors: the characteristics of the initial collagen and the extraction process. Different fish species vary greatly in the amino acid composition of collagen. However, the extraction process is very important because it determines the molecular weight distribution of gelatin (Alexandre et al., 2014). The collagen from fish bones, has greater microbiological stability due to an increased incidence of cross-links, when compared to the collagen of other tissues such as skin. All types of gelatin have a similar composition, that is, water, small amounts of minerals and pure protein of connective tissue. However, depending on the material used, on the pretreatment process employed and the intensity of hydrolysis, various types of gelatin with different properties can be obtained (Alfaro At et al., 2012).

Studies related to the use of fish to obtain gelatins have reported that the applicability, functionality and commercial value of this type of product are essentially dependent on their physical (viscosity, gel strength and stiffness, intumescence capacity and thermal stability) and chemical characteristics (moisture, ash and pH). These characteristics or properties can be especially affected by the amino acid composition, molecular weight and proportion of a chains (Alexandre et al., 2014).

Production stages of fish gelatin

In step one, cleaning the fish at low temperature and separating the boneless meat, swim bladder, cartilage and other impurities from skin, bones, and scales of the fish.

In step two, soaking the mixture of skin, bones, scales, of step one with protease enzyme while maintaining low temperature for about up to 4 hours

In step three, washing the mixture of step two with water at low temperature.

In step four, soaking the mixture of step three with alkali for at-least 2 hours while maintaining low temperature.

In step five, washing the mixture of step four with water at low temperature.

In step six, soaking the mixture of step five, with acid for at least 2 hours while maintaining low temperature.

In step seven, washing the mixture of step six with water at low temperature.

In step eight, extracting gelatin from the mixture of step seven at about neutral pH at temperature of about 40°C to (World Intellectual 2012).

Gelatin application areas

Cosmetic

Collagen peptides are natural collagen peptides that can be used in such cosmetics applications as skin and body care. In creams, lotions and masks, they add the amino acids that are essential for properly functioning skin cells.

Health

In addition to joint and bone diseases, these include obesity and malnourishment. Collagen peptide can help prevent these disorders or alleviate their effects.

Food

Gelatine is a high-quality ingredient and has many positive properties as a foodstuff. Thanks to its gelling abilities, gelatine is indispensable in modern cuisine. For example, foam formation, stabilisation and texturising are essential properties in the creation of tasty desserts. Gelatine is also an important source of protein. It can effectively replace carbohydrates and fat in many foods and is thus better suited to meet nutritional needs.

Medicine

Gelatine is an important raw material for the production of hard and soft capsules as well as film-coated and effervescent tablets. Manufacturers make use of its unique adhesive, gelling and film-building properties. Orally administered medicines and dietary supplements in particular are protected by gelatine-containing capsules or tablets from light, moisture and oxygen and given a long shelf life.

Photo and print

Thanks to gelatine, amateur films, colourful paper, graphic films and X-ray films can be produced on an industrial scale. Silver photography forms the basis for analogue picture development for both black-and-white films as well as X-ray films. Silver-salt photographic material is composed of film or paper with up to 15 layers of a coating that contains gelatine. In this, the gelatine acts as a binding agent for the light-sensitive silver halides.

Animal feed

Gelatine, collagen peptides and the pure by-products that are generated during their manufacture such as fats, proteins and minerals play a crucial role in the preparation of highly nutritious animal feeds.

CONCLUSION

The rapid increase of world population; It raises a number of global problems such as insufficient natural resources and environmental pollution, and raises a number of new searches for their solution. Perhaps the most important of these problems is the decrease in the available natural resources and their inability to use them at the optimum level. Considering the fact that animal production wastes are left to the environment without being evaluated in many countries even today, and developed countries are considered as animal feed at best, it is seen that gelatin obtained from animal wastes such as skin and bone has an important added value when considering the functional and technological advantages mentioned in this review. Therefore, although gelatin has been obtained from animal by-products such as pigs and cattle to date, fish and by-products have been tried to be evaluated in recent years and the researches have started to focus on this subject. At this point, fish gelatin is an excellent source for businesses that want to produce Kosher and Halal standards. In the future, fish gelatin may be a competitive alternative biopolymer on the market; However, expanding its use is mainly related to higher technological development and improvement of its functional properties.

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