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(54) Title: METHOD OF PRODUCING GELATIN FROM FISH

(57) Abstract: The present invention relates to the process of producing gelatin from fish. More particularly the invention relates to the method of producing gelatin from skin, bones, and scales. The present invention provides an economically viable process of producing high quality 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 70°C. Optionally, in the process step one, only boneless meat and other impurities are separated from skin, bones, scales, swim bladder and cartilage and in the process step two thereof mixture of skin, bones, scales, swim bladder and cartilage of the fish is soaked with protease enzyme while maintaining low temperature. A method of producing gelatin uses a complex mixture of skin, bones, scales of the topical fishes, and / or Surimi Processed Material. Such Surimi Processed Material may also contain swim bladder and cartilage of the fish.



TITLE: "METHOD OF PRODUCING GELATIN FROM FISH"**FIELD OF INVENTION:**

- 5 The present invention relates to the process of producing gelatin from fish. More particularly the invention relates to the method of producing gelatin from skin, bones, and scales. The present invention provides an economically viable process of producing high quality gelatin.

BACKGROUND OF THE INVENTION:

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Gelatin is not a naturally occurring protein (Jones, 1987). It is a water soluble, proteinaceous, collagen derivative, which finds extensive use in food, pharmaceutical and photographic industries. It is a mixture of peptides and proteins produced by partial hydrolysis of collagen extracted from the boiled bones, connective tissues, and other organs including intestines of
15 some animals such as domesticated cattle, pigs, and horses.

It is reported that Bovine gelatin has a potential risk of spreading bovine spongiform encephalopathy (BSE), widely known as 'mad cow' disease and foot-and-mouth disease (FMD) (*Jongjareonrak et al., 2005*). In addition to the health related issues, its use is vitally
20 limited by religious concerns. For instance, Hindus may not consume cow-related product. Similarly, Islamic people may consider all pork-related products to be prohibited to be consumed. Thus there is a need to research into the use of some alternative source of raw material for producing gelatin. In this context, the production of gelatin from fish is a topic that has gained much wider attention, especially from fish skin due to its properties and qualities.

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US Patent No. 5,093,474 has disclosed a process of preparation of gelatin from 'fish skins'. The process comprises the steps of cleaning the skins, treating the skins with dilute aqueous alkali; washing with water until the washing water is substantially neutral, treating with dilute aqueous mineral acid; washing with water until the washing water is substantially neutral; treating with
30 dilute aqueous citric acid and/or another suitable organic acid; washing with water until the washing water is substantially neutral; and extracting with water at elevated temperatures not above about 55° c., the washed citric acid-treated skins. The said process does not stipulate use of fish bones as source of collagen for gelatin production. The said process does not use any enzyme pretreatment methodology. The time required in this process is 48 hours for pre-
35 treatment.

US Patent No. 5,484,888 has disclosed a process for the preparation of gelatin from fish skins (uncooked fish skins that are readily available as a waste product e.g. commercial kosher fish including tilapia, snapper, carp, perch, Nile perch, and other warm water fish having kosher characteristics), and to a lesser extent from swim bladder. The process involves soaking the fish skins in an alkaline solution (lime water) for 3 to 60 days, removing excess alkaline hydroxide solution from the said fish skins, while maintaining said fish skins in alkaline state; and extracting gelatin from said alkaline fish skins. The said process does not stipulate use of fish bones and/ or fish scales as source of collagen for gelatin production. The said process does not use any enzyme pretreatment methodology.

US Patent No. 5,093,474 and U.S. Pat. No. 5,484,888 has disclosed methods for production of gelatin which require a longer duration of time.

US Patent No. 6,368,656 B1 has disclosed an acid process for the preparation of fish gelatin from fresh or defrosted raw fish skins (selected from the group consisting of tuna, tilapia, Nile perch, salmon, sole, carp, Pollock, hake and mackerel, catfish, African sea catfish and north African catfish), which includes the steps of washing of the skins with an aqueous solution of an oxidizing agent, treatment with acid & hot extraction at an acidic pH. The starting material consists of fresh or defrosted fish skins obtained in large quantities when the fish is processed raw. More particularly, as per the said patent, the fish fillet obtained after heading and evisceration are cut up and peeled by hand or machine to leave the fillets on one side and the skins on the other. At this state, the skins are recovered and washed and can be frozen immediately for subsequent use. The skins are used as such or partially dried to a solid content of about 65 to 75 %. The said process does not stipulate use of fish bones and/ or fish scales as source of collagen for gelatin production. The said process does not use any enzyme pretreatment methodology.

The US Patent 2005/0124034A1 has disclosed a method of producing gelatin peptide from fish skin (derived from white meat fish such as codish or pollocks such as Alaskan Pollock or pacific cod). The said patent involves the steps of cleaning fish skin with salt water and fresh water, obtaining extract from hot water, subjecting the water to enzymatic digestion, activated carbon treatment of concentrated solution of the digest and drying the yield. The process of pretreatment of salt water as use in the said patent is suitable only for skin from Pollack such as Alaskan Pollack or Pacific cod. This process has not been proven to be feasible for raw material

with scales and fats and such embedded skins and bones of tropical fish. The said process does not stipulate use of fish bones and/ or fish scales as source of collagen for gelatin production. The said process does not use any enzyme pretreatment methodology. The said patent does not relate the tropical fish family. Moreover, the salt water and fresh water treatment of the said patent is not feasible for tropical fish parts.

Thus, the known process for production of fish gelatin have disclosed a pre-treatment of the insoluble collagen so that it is converted into soluble collagen by using various methods such as direct thermal pre-treatment, or acid pretreatment, or alkali pre-treatment, or alkali and acid pretreatment mechanism. According to the thermal pre-treatment method, gelatin can be produced from fish skin by heating with water at a high temperature of between 70°C to 100°C. But since the thermal pre-treatment is carried out under high temperature, it may ultimately cause adverse impact on the quality of the gelatin. In some cases, it is essential to remove the fatty material. In such cases, recovered fish skins are subjected to the successive steps of washing with water, treatment with dilute alkali, treatment with a weak acid and again washing with water prior to digestion with water at about 50°C to 60°C. Subsequently the extraction liquors are filtered, concentrated by vacuum evaporation and dried by dryer. The acid and alkali pre-treatment methods are considered to be advantageous over direct thermal pre-treatment method for producing gelatin. However, the collagenous material from fish skin is more susceptible to degradation during acid, alkali pretreatments and acid and alkali pre-treatment due to chemical reaction. The alkali pretreatment requires longer duration of time i.e. 3 to 60 days. Acid pretreatment requires about 48 hours.

The inventor has tried the acidic as well as alkali pre-treatments; however the desired results were not available. After considering the complexity of the raw material, the inventor tried the acidic and alkali pre-treatment and got the desired results. However, the said simultaneous acid and alkali process of pre-treatment took about 7 days to complete the process. The present inventor has also observed that such alkali and acid treatment requires strict temperature control compliances throughout the process, more electricity, and more labour cost, etc.

Fish skin is one of the potential sources of collagen for producing gelatin from certain type of fishes where skins can be easily separated from bones. The production of gelatin from fish

bones and scales is also considered as an additional source of fish gelatin. In fact, there are differences in the process of producing gelatin from fish skins, bones or scales due to differences in the characteristics of their individual composition. In most of the processes of producing gelatin from fish, the skin and bones of fish are separated through different processes such as by filleting and such requisite fish skin is separated/ isolated in advance e.g. the common process used in Pollock Surimi production includes different mechanical steps and the wastes parts are available through different processes. The heads, backbones and viscera are available after filleting or splitting. After that by mincing and deboning process skin and bones are removed separately. Thus as per common procedures used in Pollock and cod processing the waste products for further processing are available separately and therefore not very complex.

Thus, in view of the prior art, there is no motivation to a person skilled in the art to use enzyme pretreatment method for production of gelatin from fish as per the present invention. Also, there is no motivation for a person skilled in the art to use 'complex material' such as 'fish waste material' including 'Surimi Processed Material' comprising of fish skin, bones, and scales (embedded together) or fish skin, bones, scales, cartilage and swim bladder as the case may be derived from tropical fishes as a source of collagen to manufacture/ produce food grade gelatin having high quality and bloom strength.

SUMMARY OF THE INVENTION:

The present invention has provided a new and technically and / or economically significant method of producing gelatin from fish parts including skin, bones, and scales, Such that the said parts are cleaned and embedded together to form a complex material. Optionally, the present invention has provided a new and technically and / or economically significant method of producing gelatin from fish parts including skin, bones, scales, swim bladder and cartilage such that the said parts are cleaned and embedded together to form a complex material. As per the preferred embodiment of the present invention the fishes includes tropical fishes.

Generally, the present invention provides a method for pretreatment (demineralization and partial hydrolyses of collagen protein) of said fish parts whereby the requisite time for a method of producing gelatin is reduced to greater extent. In order to reduce the time span the inventor has tried the enzyme over the raw material and got final product with better quality, yield and better physical properties within 24 hours. The present invention has provided a method to

produce gelatin from the said fish parts within relatively shorter span of time by using *inter alia* enzymatic pretreatment methodology. The enzyme usage makes the process cheaper and more predictable as constant quality of the product is ensured. The enzyme which is used in the pretreatment is not present in the final product. The pretreatment of the said fish parts is carried out by using the protease enzyme followed by alkali and acid treatments

One of the objects of the present invention is to provide an economically significant and environmental friendly technical solution in furtherance of utilization of huge amounts of 'fish waste material' such as 'Surimi Processed Material' produced by the Surimi processing. The process of producing gelatin from 'Surimi Processed Material', ultimately result in revenue generation by optimal utilization of the fish waste material for producing food grade gelatin, and an economical and environment friendly fish waste material disposal management system.

The present invention has provided a simple and economically viable process to isolate and transform collagen from the said fish parts into fish gelatin such that the gelatin is almost devoid of characteristic fish smell.

DETAILED DESCRIPTION OF THE INVENTION:

The present invention may be more readily understood by reference to the following detailed description as more readily brought out step wise, which is only illustrative and in no way limit the scope of the invention.

- 5 As per the present invention 'Surimi Processed Material' comprising of fish skin, bones and scales (embedded together) derived from tropical fishes as a source of collagen to manufacture/ produce food grade gelatin having high quality and bloom strength. The said fish waste material/ processed fish parts mixture is a very complex composition. Optionally the 'Surimi Processed Material' may comprise of fish skin, bones, scales, cartilage, and swim bladder
- 10 (embedded together) derived from tropical fishes as a source of collagen to manufacture/ produce food grade gelatin having high quality and bloom strength.

- The functional properties of gelatin such as [gel strength, viscosity, setting behavior and melting point depend on their molecular weight distribution and the amino acid composition
- 15 (Johnston-Banks, 1990). The amino acid composition of gelatin is mainly dependent on the source species (*Muyonga et al., 2004*). Gelatin with high levels of amino acids proline and hydroxyproline tends to have higher gel strength and melting point.

- As per the present invention, it is observed that the tropical fish contains high protein
- 20 components and gave high gel strength and viscosity. It is also observed that (as compared with cold water species the protein contents of tropical fishes are higher

- The time required for producing fish gelatin from parts of cold water fish is comparatively lesser than time required for producing gelatin from parts of warm water fish.
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- As per the present invention skins, bones and scales from tropical fish species such as but not limited to Pink Perch, Lizard, Oil Sardine, Lesser Sardine, Croaker, Big Eye etc. having protein contents, more collagenous properties has been used for production of gelatin having characteristics of less sensitive to temperature changes.
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The Common process used in Pollock Surimi production includes different mechanical steps and the wastes parts are available through different processes. The heads, backbones and viscera are available after filleting or splitting. After that by mincing and deboning process skin

and bones are removed separately. Thus as per common procedures used in Pollock and cod processing the waste products for further processing are available separately.

5 The Surimi process includes steps of receiving raw fish and sending the material to De-scalar for descaling through conveyer. During the process of descaling the scales are separated from fish; near about 60% of scales are separated in descaling process and remaining 40% would go with skin and bones. After rotary washer the descaled material is sent to Meat Separators. Here in meat separation the required part of fish i.e. meat is separated from skin and bones. The meat is taken further to Leaching tanks and the residual material skin, bones and scales after de-
10 scaling are sent through separate conveyer to Hydrolyzed Gelatin process plant. Thus the raw material is a mixture of skin, bones and scales of fish which are embedded together. Optionally, the raw material for gelatin production is a mixture of skin, bones, scales, swim bladder and cartilage of fish.

15 Processing:

The step one (1), involves cleaning the fish at low temperature and separating the boneless meat, cartilage, swim bladder and other impurities from skin, bones, scales of the fish whereby the meat and / or cartilage and / or swim bladder and / or other impurities are removed. Optionally, Step one (1), involves cleaning the fish at low temperature and separating
20 the boneless meat and other impurities from skin, bones, scales, cartilage, and swim bladder of the fish whereby the meat and / or other impurities are removed.

In step two (2) referred herein, the product / mixture obtained in step 1 above is/are treated with enzyme while maintaining low temperature. As per the present invention the temperature may
25 be 4 to 15°C. The enzyme includes protease enzymes. It is observed that the use of such enzymes helps to achieve higher purity and the better physical properties of the final gelatin product. The enzyme treatment of the complex embedded material comprising of the fish skin, bones, scales, swim bladder, and cartilage of the fish provides for easily separation of fats and non-collagenous material at the same time its exposure to collagenous material for extraction.

30 In accordance with the present invention, enzymatic pretreatment has some advantages in terms of better quality, time management, and improvement in the purity, physical properties, and yield of the end product (gelatin) in contrast to mere alkali and / or acid pretreatments. Time required for enzymatic pretreatment is also shorter if calculated from introduction of enzymes to the mixture of step 1 till enzymatic process is complete. Accordingly, as per one of
35 the embodiment of the present invention, it is about 2 hrs. As per another embodiment of the

present invention, time required for enzymatic pretreatment may be at least 2 hours. As per another embodiment of the present invention, the time required for enzymatic treatment could be maximum up to 4 hours. As per the preferred embodiment of the present invention, the time required for enzymatic pretreatment is at least 2 hours, or up to 4 hours, if calculated from the time of introduction of enzyme to the mixture of step 1 till Enzymatic process is complete.

In step three (3) referred herein, the enzyme treated mixture of step 2 above is washed with normal water at low temperature.

In step four (4) referred herein, the said mixture of step (3) above is further soaked with dilute aqueous alkali for at least 2 hours up to at low temperature. Optionally, as per one of the embodiment of the present invention, the said mixture of step (3) above may be soaked with dilute aqueous alkali for at least 2 hours or up to 4 hours at low temperature. As per the present invention the alkali may be selected from the group of NaOH, KOH, or Lime $[Ca(OH)_2]$ and concentration of alkali is between 2%-5%. The said mixture of step (4) referred herein is soaked in a generally 2-5% aqueous solution of sodium hydroxide at 10°C temperature. The solution is replaced periodically. This process lasts for at least 2 hrs. It may be carried out for about 2 to 4 hrs. It is designed to saponify the fats, destroy the horny layer of the skins and bones.

In step five (5) referred herein the said mixture of step (4) above is washed with normal water at low temperature until the 'washed out water' has about neutral pH. The alkali treating process is followed by a complex washing with water, which is designed to remove all traces of alkali and adjust the pH before further treatment. The washings being tested for neutrality and the washing steps being terminated when neutrality is established.

In step six (6) referred herein, the said mixture obtained in step five (5) above is soaked with dilute aqueous acid for at least 2 hours at low temperature. As per the present invention the said acids may be selected from weak organic acids such as HCl, H_2SO_4 , citric acid, acetic acid, etc. The said acid may be any other weak organic acid.

In step (6) referred herein the organic acid used is acetic acid. The said mixture is immersed in an organic acid having concentration of about 2-5% for a short time between 2-4 hours. The acid is drained away; the material is then washed again till the pH is almost neutral.

In step seven (7), the said mixture of step six (6) referred herein is washed with normal water at low temperature until the 'washed out water' has about neutral pH. All pretreatments methods (step 1 to 7 above referred herein) are carried out at low temperature. The temperature in step 1 to 6 above may be about 4°C to 15°C, more preferably between 4°C to 10 °C to make the raw materials ready for the main extraction step and to remove impurities which may have negative effects on physiochemical properties of the final gelatin product.

In step eight (8), the said mixture of step seven (7) referred herein above is extracted with water at about neutral pH at a temperature between 40°C-60°C. This process facilitates dissolving of hydrolyzed collagen into water. The gelatin obtained from the said extraction process soluble in water. In step (8), after pre-treatment i.e. reducing cross linkages between collagen components and removing some of the impurities such as fat and salts, partially purified collagen is converted into gelatin by extraction with water at appropriate temperatures between 50°C to 60°C, and at almost neutral pH. The concentration of gelatin extract is in the range of 2% to 3.5% the yield is about 2% to 3.5%

In step (9) the extract/ solution obtained in step 8 is subjected to filtration through various types of filters in order to eliminate the particles in suspension, coagulated albumens and the last traces of fat.

In step (10) extracted material in step (9) above is then filtered and vaccum evaporation is carried out and dried thereafter by passing through continuous dryer.

One of the advantages of the present invention is that the gelatin can be extracted in relatively shorter time which can be measured from the time commencement of step 1 (one). Practically, the pretreatment methods comprising step one (1) to step seven (7) refereed herein above may be completed in about twelve to sixteen hours. As per one of the preferred embodiment of the present invention, the pretreatment methods comprising step one (1) to step seven (7) refereed herein above may be completed, in about up to twelve (12) hours. As per the present invention the step eight (8) as referred above of extraction of gelatin can be completed within 4 hours i.e. step Eight (8) As per the present invention the time required to obtain the final product namely gelatin is less than 24 hours. As per one of embodiment of the present invention the time required (up to step 8 referred herein above) to obtain the final product namely gelatin is 18-24 hours.

In accordance with the present invention, based on the pretreatment of collagen material derived from the skin, bones, scales, swim bladder, cartilage of fish, it is observed that length of time of the pretreatment is shorter than the known chemical treatment (acid and/ or alkali) methods.

The process of present invention is further illustrated by an example. However, the examples in no way limit the scope of the invention.

Example 1:

30 kg. of skins, bones and scales along with swim bladder and cartilage from Pink Perch were thoroughly cleaned with excess usually 30 liter normal water at low temperature to remove impurities and then soaked in 1ml of protease enzyme diluted to 100ml., the soaking period was 4 hrs. After that the enzyme was washed away by normal water at low temperature. The enzyme treated skin-bones and scales is then treated with 2×1000 ml. aqueous sodium hydroxide solution, each soaking 2 hrs total alkali treatment 4 hours and pH of the bath maintained nearly 10 and checked each an hour during the pretreatment. The said mixture then washed with normal water at low temperature before acid treatment to reduced pH nearly about neutral and soaked in 2 liter of acetic acid solution for about 4 hours. The acid treated skins and scales were washed with water until the washings had pH about neutral. The above pre-treatments were carried out at temperature of 10°C.

The skins and scales treated in this way were placed in a vessel containing normal water controlled at a temperature within the range of 50°C-60° and provided with agitation.

Following 4 hour extraction in this manner, the mixture was filtered through various types of filters; vacuum evaporated and was passed through a continuous dryer to make gelatin powder.

Example 2:

The procedure followed in above example is repeated by substituting lime after caustic. The example showed same results as in example 1.

1000 kg. of raw material were washed with 1000 liter normal water at low temperature to remove all impurities including fats and minerals and then soaked in 2.5 liter of protease enzyme diluted in 1000 liters of water, the soaking period was 4 hrs. after that the enzyme was

washed away by normal water. The enzyme treated skin-bones, scales along with swim bladder and cartilage is then soaked in 7 liter aqueous sodium hydroxide (NaOH) solution of 50% concentration which is diluted in 1000 liters of water for about 4 hours; pH of the material maintained nearly 10 and checked during whole treatment. Further these alkali treated skins after washing with water to normal pH were treated with 15 kg. lime of 50% concentration which is diluted in 1000 liters of water for about 4 hrs. and again washed with normal water at nearly neutral pH and finally soaked in 14 liter acetic acid solution for about 4 hours. The acid treated skins were washed with water until the washings had pH about neutral. The above pre-treatments were carried out at temperature of 10°C. The pre-treated raw materials are now treated with hot drinking water and extracted in several stages. The temperature of the hot water was 50°C -60°C.

Example 3:

In this batch caustic was omitted and only lime were used remaining chemicals were same, here the similar results are obtained to that in example 1.

1200 kg of skin-bones and scales from Lizard were cleaned with fresh water usually 1200 liters and then soaked in 1ml 0.1% of protease enzyme at low temperature of about 10°C, the soaking period was about 3 hrs. after that the enzyme was washed away by normal water at low temperature, then it was subjected to lime 15kg lime of 50% concentration which is diluted in 1200 liters of water. at about 10°C and finally after washing at low temperature at nearly neutral pH soaked in 2 liter acetic acid solution 50% concentration which is diluted in 1200 liters of water for about 4 hours at about 10°C. The acid treated skins-bones and scales were washed with water until the washings had pH about neutral. The skin-bones and scales treated in this way were put in normal water vessel which temperature was controlled within the range of 50°C-60° and provided with agitation followed by 4 hour extraction in this state.

Example 4:

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Repeating conditions of the example 1 except that the enzyme treatment was omitted. The results showed requirement of remaining each treatment carried out for 3 days to obtain the results similar to example 1.

300 kg fish skins and fish bones and scales were cleaned with 600 liter water at low temperature and then soaked in 3 liter aqueous sodium hydroxide solution of 45%-50% concentration which is diluted 600 liters of water the soaking period was 3 days and pH was maintained nearly 10 in this way and checked each time during treatment. The alkali treated skins then washed with normal water before acid treatment to reduced pH nearly neutral and soaked in 2 liter acetic acid solution of 50% concentration which is diluted in 600 liters of water for 3 days hours. The acid treated skins were washed with water until the washings had pH about neutral. The above pre-treatments were done at temperature of about 10°C and then regular extraction was carried out.

Example 5

Trial of another type of protease enzyme usage showed similar results

At 10°C temperature 15kg of skin-bones and scales, washed with excess 20 liters water and then soaked in 0.05% of protease enzyme, the soaking period was 4 hrs. after that the enzyme was washed away by normal water at low temperature. The enzyme treated skin-bones and scales are then treated with 2×2 liters aqueous sodium hydroxide solution of 45-50% concentration which is diluted in 20 liters of water, each soaking 2 hrs. total alkali treatment 4 hours. The alkali treated skin-bones and scales then washed with normal water before acid treatment to reduced pH nearly neutral and soaked in 2 liter acetic acid solution of 50% concentration which is diluted in 20 liters of water for 4 hours. The acid treated skin-bones and scales were washed with water until the washings had pH about neutral. The skins treated in this way were subjected to extraction similar to above examples.

Example 6:

The use of mineral acids like HCl or H₂SO₄ instead of organic acid acetic acid also showed satisfactory results.

10 kg skin and bones and scales were first washed with 20 liter fresh water at low temperature then subjected to enzyme 0.1% Protease enzyme in similar way that in example 2 then placed in 2×2 liter aqueous sodium hydroxide solution of 50% concentration which is diluted in 20 liters of water, each soaking 2 hrs., total alkali treatment 4 hours. The alkali treated skins then washed with normal water before acid treatment to nearly neutral pH and soaked in 2 liter hydrochloric acid of 30% concentration which is diluted in 20 liters of water solution for 4

hours. The acid treated skins were washed with water at low temperature until the washings had pH about neutral. The skins treated in this way were subjected to extraction similar to above examples.

- 5 As per the present invention the enzyme pre-treatment stage is observed to have given surprisingly better results for gelatin extraction and thus better quality of final product. As per the present invention, the enzymatic pretreatment helps to degrade collagen proteins and also effectively degrades other non-collagenous matters. As per the present invention, use of enzyme provides for easy separation of fats and other non-collagenous material. The objective
- 10 behind the enzymatic pre-treatment is inter alia to break down collagen linkage chains and destroy chemical cross linkages present in Collagen.

- The use of enzyme at digestion stage is for bringing together the collagenous protein and separating out the non-collagenous factors. Enzymatic digestion is carried to
- 15 convert extracted gelatin into hydrolyzed gelatin/ gelatin peptide.

CLAIMS:

1. A method of producing gelatin from skin, bones, scales, swim bladder, and cartilage of the fish comprising :
 - 5 (a) 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;
 - (b) soaking the mixture of skin, bones, scales, of step (a) with protease enzyme while maintaining low temperature ;
 - (c) washing the mixture of step (b) with water at low temperature;
 - 10 (d) soaking the mixture of step (c) with alkali for at least 2 hours while maintaining low temperature;
 - (e) washing the mixture of step (d) with water at low temperature;
 - (f) soaking the mixture of step (e) with acid for at least 2 hours while maintaining low temperature;
 - 15 (g) washing the mixture of step (f) with water at low temperature; and
 - (h) extracting gelatin from the mixture of step (g) at about neutral pH at temperature of about 40°C to 70°C.
2. A method of producing gelatin of claim 1 above, wherein in the process step (a) only
20 boneless meat and other impurities are separated from skin, bones, scales, swim bladder and cartilage and in the process step (b) thereof mixture of skin, bones, scales, swim bladder and cartilage of the fish is soaked with protease enzyme while maintaining low temperature.
- 25 3. A method of producing gelatin of claim 1 or 2 above, wherein the process steps (b) to (g) are carried out at temperature between 4°C to 15 °C , preferably between 4°C to 10 °C.
4. A method of producing gelatin of claim 1 or 2 above, wherein in step (d) the mixture is soaked with a diluted solution of alkali.
- 30 5. A method of producing gelatin of claim 1 or 2 above, wherein in step (f) the mixture is soaked with a weak acid.
6. A method of producing gelatin of claim 1 or 2 above, wherein in step (d) the mixture is
35 soaked with in step (h) the extraction is carried out at about 60 °C.

7. A method of producing gelatin of claim 1 or 2 above, wherein in the step (b) the enzyme is used in the range of 0.1% to 0.25% of the mixture obtained in step (a).
- 5 8. A method for production of gelatin of claim 1 or 2 above, wherein the alkali used in the step (d) is selected from the group of NaOH, KOH, or Lime $[Ca(OH)_2]$ and concentration of alkali is between 2%-5%.
9. A method of producing gelatin of claim 1 or 2 above, wherein the acid used is selected
10 from the group of hydrochloric acid (HCL), acetic acid, citric acid, sulfuric acid (H_2SO_4) or other organic acids and concentration of acid is between 2%-5%.
10. A method of producing gelatin of claim 1 to 9 above, wherein skin, bones, scales, swim bladder, and cartilage of the fish is Surimi Processed Material.

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