The Influence of Solvent Concentration and Long Soaking to Quality Gelatin Fish Scales Red Snapper (*Lutjanus camphecanus* Sp.)

Warlinda Eka Triastuti*, Elly Agustiani, Agus Surono, Rensi Dwi Cahyasani, Avidata

Departemen Teknik Kimia, Fakultas Teknologi Industri, Institut Teknologi Sepuluh Nopember
Kampus ITS Sukolilo Surabaya 60111
Telp/Fax : 031-5937968,5994251-54 (Hunting) Pabx: 1274 Fax: 031-5965183
*Email: warlindaekatriastuti@gmail.com

Abstract. Gelatin have been successfully isolated from skin of brownstripe red snapper (*Lutjanus campechanus* sp.) by citric acid immersion and hydrolysis process. Variation of citric acid are 1%, 3%, and 5% (%v/v) for 1,2,3,4 and 5 days. Gelatin was analyzed Fourier transform infrared spectroscopy (FTIR); proximate analysis which includes yield and moisture content; analysis of physical properties - chemical include viscosity and acidity (pH); Organoleptic test (Color, smell, and taste). FTIR spectroscopy was conducted on gelatin from skin of brown stripe red snapper with citric acid immersion. FTIR analysis of gelatin shows O-H, C-H, C=O, N-H dan C-C aromatic groups which are exactly same with that the comercial gelatin. The best results obtained in the immersion gelatin with 1% citric acid with gelatin viscosity from 1.82 to 2.22 cp, gelatin moisture content of 13.6 -33.7%, and pH of gelatin about 6.32 to 6.82.

Keywords : *gelatin, sisik ikan, FTIR, hidrolisis*

I. INTRODUCTION

Snapper is a marine fish that live in groups in the basics of coral or reefs. Snapper is often utilized as a fillet products. In the product section of the fillet of snapper used is part of the flesh. Red Snapper-sized 400-1,000 Gr. can produce meat fillet as much 41.5% and waste in the form of bones and scales as much as 58.5%. Both the waste and waste as long as it is less put to good use. Fish scales and bones is very potential for making gelatin because it includes 10-20% of the body weight of fish (Surono et al. 1994). Water containing fish scales 69,6% 26,9%, protein, fat and ash 2.5% 0.7%. Gelatin is a product of partially hydrolyzed collagen consists of a mixture of monomers polidispersi with a molecular weight more than 30 kDa. Gelatin is widely used for various industrial purposes, both the food industry as well as non-food because it has a distinctive nature, that can be changed are reversible forms of sol to gel, expands in cold water, can form a film, affect the viscosity of a material, and can protect the colloidal system. Food industry that needs gelatin industry, among others, konfeksioneri, jelly, milk, margarine and industrial food supplement. Gelatin is also used in non-food industry such as the pharmaceutical industry, photography, cosmetics, and paper industry. Gelatin can be used in the manufacturer of capsule, tablet Binder and pastilles, gelatin sponge, surgical powder, suppositories, medical research, a plasma expander, and mikro enkapsulasi in the field of pharmacy. (Ward and Court 1977).

Use of gelatin that is large enough to cause growing needs from year-to year. As long as this needs gelatin in Indonesia are met through imports from various countries such as USA, France, Germany, Brazil, Korea, China and Japan. the main source of the traditional gelatin in the world are from pig and cow. The production of gelatine from raw pork rinds 41%, 28.6% cow leather, 30% of the bone and the other portion is 0.4%. Use of gelatin from mammalian sources has some limitations and barriers from the religious aspect, social and health. Jews and Muslims have abstinence to consume materials from pigs. The presence of bovine spongiform encephalopathy (BSE) disease or known mad cow (madcow) is a constraint the wearing of gelatin from cattle. In addition the devout Hindus do not consume materials from cattle. Therefore, alternative search gelatin which is not sourced from pork and beef is urgently needed. In this case the fish gelatin is a potential alternative to replace the role of mammalian gelatin in some use.

The research of manufacture of gelatin from leather waste Red Snapper with immersion in acetic acid ever done by setiawati (2009. The best gelatin obtained from a combination of long soaking 18 hours with the concentration of acetic acid 3%. Physical chemistry analysis consists of an analysis of the proksimat with the results of 10,19% moisture content, ash levels of 0.4%, 0.33%, fat content and protein 88,88%; power gel 312.5 bloom; 17.4 viscosity cP; pH 5.45; gel point 10.15 º C; melting point 27.26 º C; isoelectric point 8; the degree of white 34.7%; While heavy metals Pb and Hg were not detected. Results of organoleptic gelatin skin Red Snapper is still lower than the commercial gelatine and gelatine standards laboratories, especially in terms of flavor. But in terms of color, Red Snapper skin gelatin is better than commercial gelatin and gelatin sightings of Red Snapper skin better than gelatin standard laboratory. In addition, the resulting gelatin produces a fishy odor and the smell of sour. So more research needs to be done to eliminate fishy odor and the smell of sour on Red Snapper skin gelatin to make it more easily applied on various products and more acceptable to the community.

Important stages in the manufacture of gelatine, IE 1) preparation of raw materials, 2) conversion of collagen into gelatin, and 3) purification as well as acquisition of gelatin in the form of dry. Preparation phase, carried out the process of washing or cleansing of the skin. The next stage is development process (swelling) that aims to eliminate impurities and converts the collagen becomes gelatin (Charley 1982). This stage is done by soaking the skin in a solution of organic acids, inorganic acids, and alkalis. Organic acids commonly used are citric, acetic acid, ascorbic, Malic, fumaric, succinic, tartaric acid, and other safe and not nose piercing. Inorganic acids used are hydrochloric acid, phosphate, chloride and sulfate. Alkaline solvents that can be used is sodium carbonate, sodium hydroxide, potassium carbonate, potassium and hydroxide. Strong acids such as sulfuric acid, hydrochloric acid and phosphoric acid are not worthy of being used to extract gelatin from skin because it will produce black color and smell the piercing on the resulting gelatin (Pelu et al. 1998). To produce a good quality of gelatine, preferably used inorganic acids and lye in the range 0.05-0.3% (w/v), whereas for the solution of organic acids in the range 0.5-5% (w/v) (Grossman and Bergman, 1991). The last process is pemekatan and drying of gelatin. This research will be conducted on the manufacture of gelatin from snapper fish scales with soaking in citric acid.

II. RESEARCH METHODS

The equipment used in the penelitia this is the scales, tools measuring flask, glass, stirrer, waterbath, heater, thermometer, pH paper universal indicator, measuring cup, pipette volume. The materials used in the study include Red Snapper fish scales, Aquades, and citric acid.

The first stage of the manufacture of gelatin that is washed the snapper fish scales to remove dirt, then soaked in water for 30 minutes at a temperature of 100 ° c and dried. Scales snapper marinated in citric acid solution with a concentration of 1 – 5% (v/v) for citrate for 1, 2, 3, 4 and 5 days. After formed ossein and then filtered. The next stage i.e. the hydrolysis is carried out by soaking in water-temperature 80 ° c, while stirring with a speed of 300 rpm for 4 hours. Immersion aims to hydrolyze gelatin so formed. The gelatin is formed then cooled, then separated using sentrifuge. After that put in the oven at a temperature of 50 ° c for 24 hours. The last stage that is drying in the oven, and then done the resulting Gelatin is then analyzed, FTIR analysis of proksimat include the yield and moisture content, physical properties-chemical analysis include pH, viscosity and organoleptic (color, appearance and taste).

III. RESULT AND ANALYSIS

The results of this research on the gelatin Manufacturing using raw material leather Red Snapper (Lutjanus camphecanus SP.) by using a solution of citric acid concentrations of 1%-5% and long soaking i.e. 1, 2, 3, 4 and 5 days. Figure 1 is the structure of gelatin.

FTIR Analysis

FTIR analysis aims to prove whether a compound obtained from this research is the gelatin. Gelatine-like proteins generally have structures consisting of carbon, hydrogen, hiroksil (OH), the carbonyl Group (C = O), and the cluster Amine (NH).

Infrared spectra in Figure 2 shows the presence of functional groups OH stretching vibrations at wavenumbers 3428.16 cm-1. Bending and streching CH shown in the area of 3000-2800 cm-1 is indicated by the number 2818, 41cm wave-1. Streching C = O is shown by the number of waves of 1651.30 cm-1 region its number was 1670 1640 cm-1. Spectra of the C-C aromatics shown in regions of wavenumbers 1416.42 cm-1. While the peak of the N-H streching not found because the Summit clouded by OH. Functional group-functional group O-H, C-H, C = O, N-H and C-C aromatics Spectra is found in the commercial beef and fish gelatin. Spectra of the compounds obtained in this study demonstrate the functional groups present on the structure of gelatin. So, it can be concluded that a compound obtained from this research is the gelatin.

Yield

Yield is one of the important parameters in the manufacture of gelatine. Yield is calculated on the basis

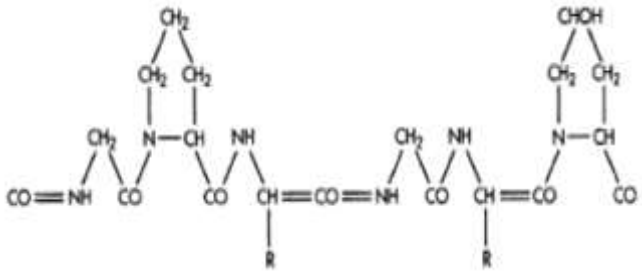

Figure 1. The Structure of Gelatin.

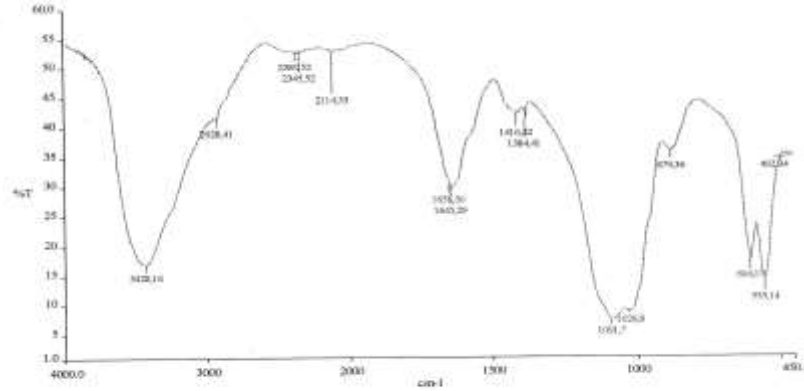

Figure 2. Infrared spectra and gelatin results soaking with citric acid.

of a comparison between the gelatin powder is produced with red snapper skin weights after clean up. Of Figure 3 is generally seen a tendency that the longer soaking and the higher concentration of citric acid, then the resulting higher yield. High yield generated due to the influence of the number of H ion hydrolysis of the collagen triple helix of the chain into a single chain. This tendency reaches its limits when the excess H ions hydrolyze collagen further so that changing physical and chemical properties.

According to Ward and Court (1977) conversion of collagen is affected by temperature, pH, and warming time. On some variable yield decline occurred because of excessive acid concentration may cause hydrolysis the presence of advanced so most degraded gelatin and gelatin's numbers decline.

Acidity (pH)

The pH or acidity degree gelatin gelatin is one of the important parameters in the standard quality of gelatine. The measurement of the pH value of the gelatin is important due to the gelatin solution pH affects other properties such as viscosity and gel strength, as well as will effect also on the application of gelatin in the product. Ph gelatine produced in this research approach is neutral. The gelatin with a neutral pH will be stable and its use will become more extensive (Astawan 2002).

From Figure 4 gelatin results soaking with citric acid 1% meet the criteria of gelatin type b. addition of citric acid concentration increases the pH of the resulting gelatin. Hinterwaldner (1977) States that the pH value of the gelatin process related. The process of soaking in an acid pH tend to produce gelatine with low (Tourtellote, 1980), therefore the process of penetralan ossein laundering way in the production of gelatine has an important role so that the gelatin obtained valuable economically. Laundering aimed to remove remaining citric acid and avoid further parsing against ossein, marked with a neutral pH in water wash and ossein. Leaching is not optimal, potentially leaving an excess of citric acid in ossein cavity, so the gelatin obtained has a lower pH and does not meet the standards.

Viscosity

Viscosity depending on temperature, pH, and concentration of aqueous gelatin (Ward and Courts in 1977). From Figure 5 the longer soaking, then the chain of amino acids that form the more short. Viscosity of gelatin in this study revolves around 1.82 – 2.22 cp. Long immersion tend to lower the viscosity of gelatin. Citric acid concentration higher, causing acid cation which caught in ossein more and more, so the lower the measured pH (acid) and hydrolysis of collagen will continue on the process of decomposition of the

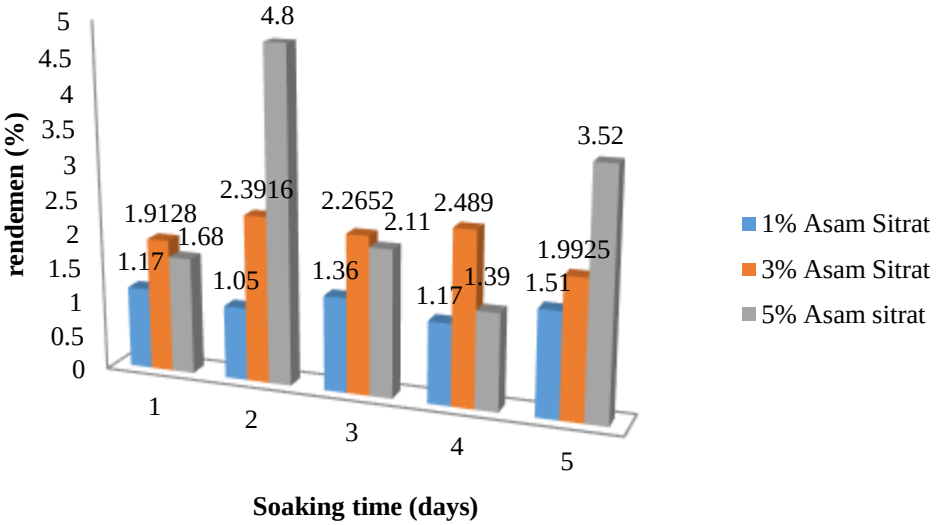

Figure 3. Charts the influence of long soaking against yield gelatin

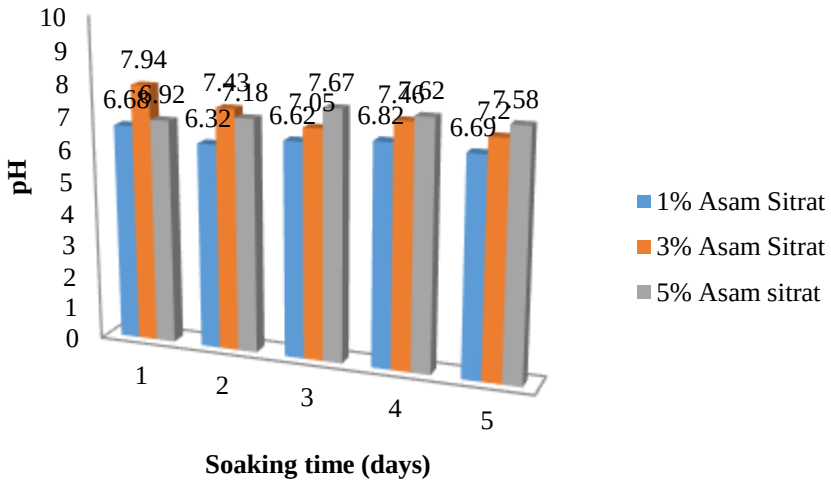

Figure 4. Charts the influence of long soaking against pH gelatin.

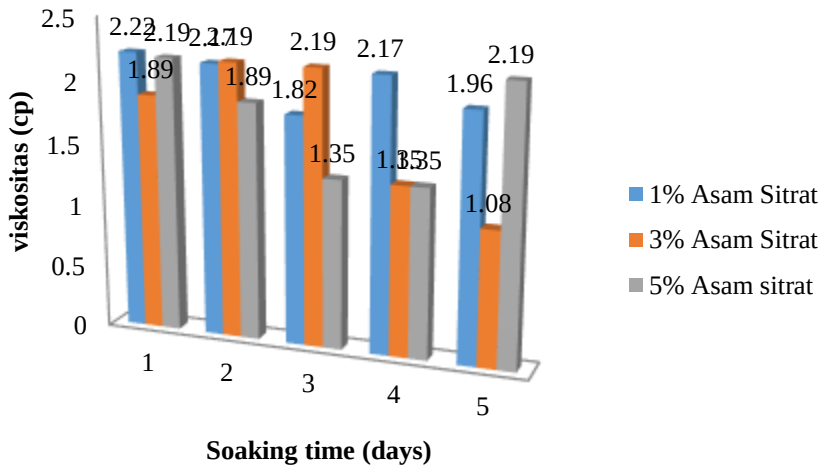

Figure 5. Charts the influence of soaking for long against the viscosity of gelatin.

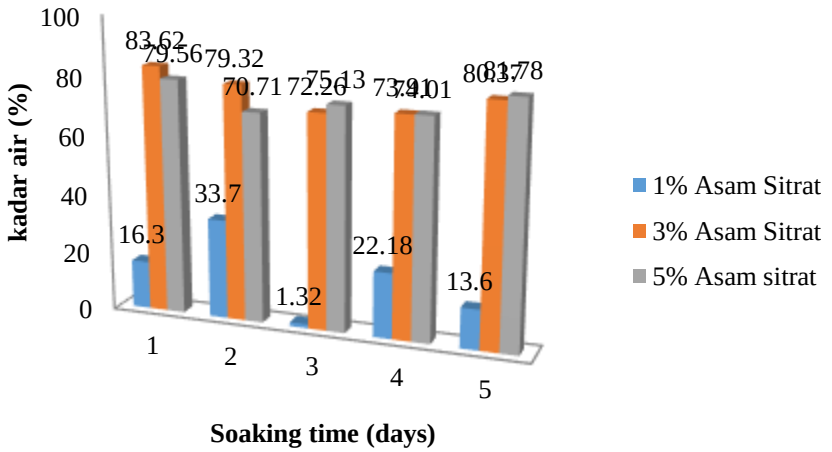

Figure 6. Charts the influence of long soaking against moisture content of gelatin

polymer collagen. Decomposition of the polymer molecular weight can be acquired (BM) a lower polydispersity (Stainsby, 1977; Sperling, 1985 in Pelu et al., 1998) or formed polymer derivative which resulted in low viscosity.

Moisture Content

Water is an important content in a food. The role of water in food is one of the factors that influence the activity of the metabolism such as enzyme activity, microbial activity, and chemical activity, namely the onset of rancidity and the reactions of non-enzimatis giving rise to changes in the properties of the organoleptik and the value of its nutrition value. Testing water content against gelatin intended to find out the content of the water contained in gelatin. Figure 6 shows that the gelatin results soaking in citric acid 3% and 5% have a high water content. Moisture content of gelatin will power to save, because it is intimately connected with the activity of the metabolism that occurred during the gelatine are stored. The high moisture content is caused due to insufficient drying process with a temperature of 50 ° C for 24 hours so that the moisture content in the gelatin still much. In this case it means that for each sample takes on a different sample in order to become dry. The importance of the sample is dried to make it easier in the process penepungan the gelatin sheets into the gelatin powder.

IV. CONCLUSIONS

Based on the research that has been done can be taken among other conclusions: FTIR Analysis Results showed that extraction of gelatin from Red Snapper fish scales can be done by soaking in a solution of citric acid; The longer soaking and the higher concentration of citric acid, then the resulting yield higher; Ph gelatine produced in this research approach is neutral and the addition of citric acid concentration increases the pH of the resulting gelatin; Viscosity of gelatin in this study revolves around 1.82 – 2.22 cp. Long soaking and the increasing concentration of citric acid tends to lower the viscosity of gelatin; Moisture content of gelatin on the soaking citric acid 1% of 13.6-33.7%, while for soaking 3 and 5% citric acid moisture content high enough gelatin i.e. > 70%.

ACKNOWLEDGEMENTS

The authors wish to acknowledge the LLPM of ITS for their financial support on this research project.

REFERENCES

Ali, Mahrus dkk.(2010). Ekstraksi kolagen dari sisik ikan kakap merah (*lutjanus* sp.).*Prosiding seminar nasional pengolahan produk dan bioteknologi kelautan dan perikanan*hal 95 - 102

Grossman S, Bergman M. 1991.Process for the Production of Gelatin from Fish Skins. European: *Paten Application 0436266 A1*.

I.,Ratnasari, etc. (2013). Extraction and characterization of gelatin from different fresh water fishes as alternative sources of gelatin. *International Food Research Journal* 20(6):3085-3091

J., Irwandi, etc. (2009). Extraction and characterization of gelatin from different marine fish species in Malaysia. *International Food Rese*arch 16: 381 – 389

Jongjareonrak, Akkasit et al. (2005). Isolation and characterisation of acid and pepsin solubilised collagens from the skin of Brownstripe red snapper (Lutjanus vitta). *Food Chemistry* 93 pp 475–484

Setiawati, Ima Hani. (1999). Karakterisasi mutu fisika kimia gelatin kulit Ikan kakap merah (*lutjanus* sp.)

Hasil proses Perlakuan asam. *Skripsi*.Institut Pertanian Bogor. Bogor

Yuliwardi, F., Syamsira, E., Hariyadi, P., Widowati, S. 2014. Pengaruh Siklus *Autoclaving-cooling* terhadap Kadar Pati Resisten Tepung Beras dan Bihun yang Dihasilkan. Artikel Pangan 23(1): 43-52.