

Gel Strength, Viscosity and Amino Acid Profile of Gelatin Extracted From Fish Skin of Lencam (*Lethrinus lentjan*)

Deska Lafairi Rera*, Eddy Suprayitno**

*Department of Fisheries Technology
Faculty of fisheries and Marine Science,
University of Brawijaya,
Indonesia.
deskaka46@gmail.com

**Department of Fisheries Technology
Faculty of Fisheries and Marine Science,
University of Brawijaya,
Indonesia.
eddysuprayitno@ub.ac.id

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Abstract- Gelatin is a polymer of amino acids that are found in collagen on skin tissue and animal bones. The skin of lencam (*lethrinus lenjan*) is one of gelatin source. Gelatin can be obtained from collagen by acid treatment (type A) or with base treatment (type B). Gelatin from fish skin generally obtained by acid treatment, because the collagen tissue of fish skin is softer than tissue on bones. Gelatin from lencam skin is extracted by phosphoric acid in concentrate 1%, 2%, and 3%. For the higher gel strength 14,04 N, viscosity 6,8% and the higher amino acids is Glycine 24,48%. Overall, there are 15 amino acids profile that contain in fish skin gelatin. Amino acids composition determined by UPLC (*Ultra Performance Liquid Chromatography*).

Keyword: Gelatin, Gel Strength, Viscosity, Amino Acids Profile

I. INTRODUCTION

Gelatin is a polymer of amino acids that obtained through hydrolysis of skin tissue and animal bones. Gelatin can be hydrolyzed using an acids or base solution which will be denatured. Gelatin consist of 85-92% proteins, while the rest is water and mineral salts that are left after drying.¹ Gelatin made of partial hydrolysis of collagen. Collagen is a kind of protein that sometimes encountered in animals and humans. Collagen is proteins that arrange gelatins. The composition of amino acids that contained in gelatin is almost similar to collagen, which is 2/3 amino acids are dominated by glycine.²

Gelatin contains amino acids that are connected by peptide bonds to form long polymer chains. The gelatin compound is a linear polymer composed of amino acids Glycine-Proline-Proline or Glycine-Proline-Hydroxyproline. Amount of Glycine (Gly) is abundant in gelatin. Amino acids in gelatin are influenced by gel strength and viscosity where the higher the gel strength and viscosity, the higher the amino acid level.¹

Gel strength and viscosity are important parameters in gelatin. The gel strength of the gelatin gel is an important parameter in determining the best gelatin treatment because one of the important properties of gelatin is being able to convert liquids into solids or turn the solids into reversible gels. The high and low of gel strength suspected because there are differences in amino acids content and the type of fish.³ While the viscosity test is carried out to determine the level of viscosity of gelatin as solution at a certain concentration. The quality of viscosity is influenced by two factors such as treatment when processing gelatin and the raw materials.⁴

II. MATERIALS AND METOD

Material needed are lencam skin (*lethrinus lenjan*) that was acquired from PT. Alam Jaya Surabaya, phosphoric acid (H_3PO_4), aquadest, aluminum foil and calico fabric.

The method used in this study is an experimental method. The treatments are used in this study is variation of the concentration of phosphoric acid solution (H_3PO_4). The experimental design used in this study was a completely randomized design with 3 treatments and 6 replications. The phosphoric acid concentration used were 1%, 2% and 3%.

III. RESULT

Results of the study showed that the higher concentration of acid caused the strength of the gel strength and viscosity increase. The highest gel strength was 13.88N and the highest viscosity was 6.67 cP at 3% phosphoric acid concentration. While the lowest gel strength was 5.77N and the lowest viscosity was 4.0 cP at a concentration of 1%. The results of the amino acid profile test showed that the highest amino acid of lencam gelatin was Glycine at 28.84% and the lowest was L-Tyrosine at 0.76%.

Table 1. Gel Strength

Treatment	Unit	Result
1%	N	5,77
2%	N	9,33
3%	N	13,88

Table 2. Viscosity

Treatment	Unit	Result
1%	cP	4,00
2%	cP	4,67
3%	cP	6,67

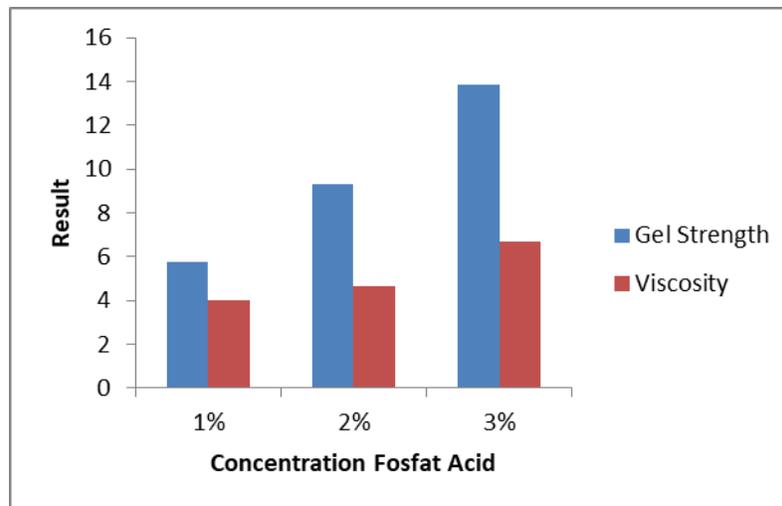


Figure 1. Diagram of Gel Strength and Viscosity

Table 3. Amino Acids Profile

Parameter	Unit	Result
L-Serin	%	3,37
L-Asam glutamate	%	6,96
L-Fenilalanin	%	3,74
L-Isoleusin	%	0,93
L-Valin	%	2,01
L-Alanin	%	8,84
L-Arginin	%	12,79
Glisin	%	28,84
L-Lisin	%	2,10
L-Asam Aspartat	%	3,52
L-Leusin	%	2,43
L-Tirosin	%	0,76
L-Prolin	%	11,78
L-Threonin	%	3,29
L-Histidin	%	1,19
Total		92,55

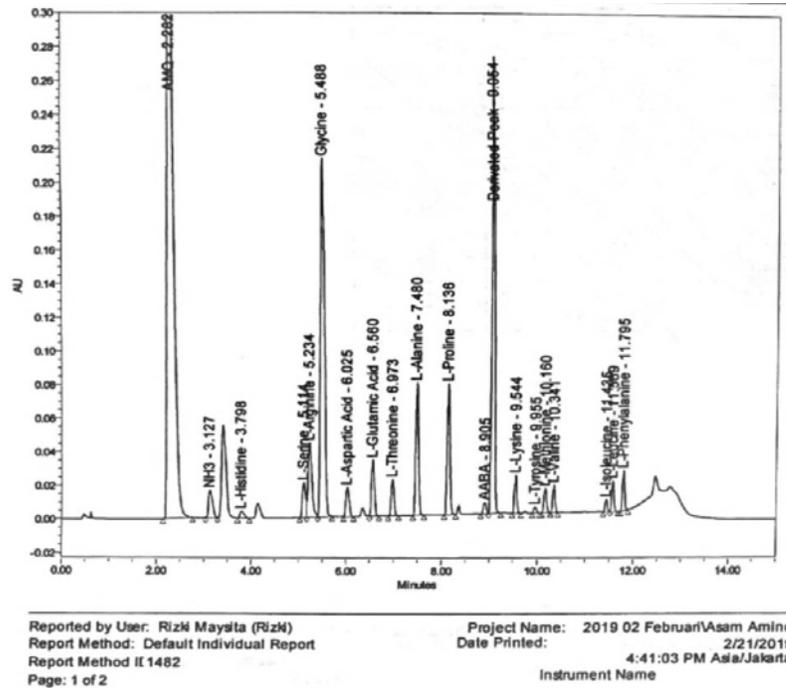


Figure 2. Chromatogram of Amino Acid Profile

IV. DISCUSSION

The gel strength of the lencam gelatin was showed differences in each concentration. At 1% phosphoric acid concentration showed the gel strength was 5.77 N or 250.63 g/bloom; at 2% concentration the gel strength was 9.33 N or 393.57 g/bloom and 3% concentration had 13.88 N or 575.75 g/bloom in gel strength. Gel strength has increased with increasing concentration of phosphoric acid solution. The gel strength with 1% phosphoric acid treatment (250.63 g/bloom) in this study appropriate to the standards which set by the *Gelatin Manufactures Institute of America* (2012), which is 50-300 g/ bloom. While the strength of the gel with a concentration of 2% and 3% had a gel strength higher than GMIA standard.⁵ Based on the ANOVA results, the gel strength of fish skin gelatin was found to be significantly different ($P < 0.05$) so that it was concluded that the concentration of phosphoric acid had an effect on the gel strength of the lencam gelatin. Based on Tukey's advanced test, the gel strength of lencam gelatin with phosphoric acid concentration of 1%, 2% and 3% were significantly different and influential on other treatments.

The viscosity of lencam gelatin showed differences in each concentration. At 1% phosphoric acid concentration showed a viscosity of 4.0 cP; 2% concentration of 4.67 cP and 3% concentration of 6.67 cP. Viscosity increased with increasing concentration of phosphoric acid solution. The value of viscosity with the treatment of 1%, 2% and 3% phosphoric acid produced in this study appropriate the standards set by the *Gelatin Manufactures Institute of America* (2012), which is 1.5-7.5 cP.⁵ The results of the study of lencam gelatin viscosity with a concentration of 3% was 6.67 much higher than commercial gelatin according which was 5.9 cP.⁴ The difference in the value of viscosity could be caused by the extraction process and the composition of the raw materials that used. Each material had different levels of cross-linking strength of the trophagenagen.⁶ Based on the ANOVA results, the viscosity of fish skin gelatin was found to be significantly different ($P < 0.05$) so that it was concluded that the concentration of phosphoric acid had an effect on the viscosity of the lencam gelatin. Based on Tukey's advanced test, the viscosity of lencam gelatin with phosphoric acid concentration of 1%, 2% and 3% were significantly different and influential on other treatments.

The highest amino acid levels in the lencam gelatin that treated with 3% phosphoric acid was Glycine at 28.84% and the lowest amino acid was L-Tyrosine at 0.76%. This was because glycine was the most common amino acid found in gelatin. This type of amino acid accounts for 23% of the total amino acids. It has known that thermal stability is influenced by the number of amino acids. Gelatin is made from the partial hydrolysis of collagen. The alpha chain in collagen generally has repeated sequences of Glycine-X-Y. Proline often occurs at X position and Hydroxyproline almost always at Y position so amino acids are most abundant in gelatin. The composition and sequence of amino acids in gelatin different from one another depending on the species and type of tissue but always contain high percentage namely Glycine, Proline, Hydroxyproline. The gelatin compound is a linear polymer of amino acids. In general, the polymer chain is a loop of the amino acid Glycine-Proline-Proline or Glycine-Proline-Hydroxyproline. This amino acid analysis aims to determine the type and amino acid composition of gelatin products from fish skin with a soaking process using different types of acids.⁷ The amino acid level of gelatin with acid extraction resulted the loss of amino acids during hydrolysis of collagen at acidic immersion.⁸

V. CONCLUSION

The best fish skin gelatin was obtained at 3% phosphoric acid concentration with gel strength 14.04% and viscosity 6.8%. In addition, the highest amino acid content was glycine 28.84% and the lowest amino acid was L-Tyrosine 0.76%.

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AUTHORS

First Author – Deska Lafairi Rera, Department of Fisheries Technology, Faculty of fisheries and Marine Science, University of Brawijaya, deskaka46@gmail.com

Second Author – Eddy Suprayitno, Department of Fisheries Technology, Faculty of fisheries and Marine Science, University of Brawijaya, eddysuprayitno@ub.ac.id