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Research Article

Study of the Making of Hydrolizate Protein Powder of Rebon Shrimp as a Food Nutrition Enhancement Ingredient

Suparmi[1,*], Dewita[1], Desmelati[1], Taufik Hidayat[2]

ABSTRACT

Rebon shrimp protein hydrolyzate has the potential to be used as a protein powder as a nutritional supplement. The aim of this study was to determine the best protein hydrolyzate concentration as a raw material for protein powder. The research was carried out in two stages, each of which was related. The first stage was made of protein hydrolyzate using 2 treatments, namely enzymatic hydrolysis (15% papain) and fermentation using 10% *L plantarum* bacteria. The parameters observed included yield, amino acid profile and fatty acid profile. The second stage was determining the best concentration of 5 level (6%, 7%, 8%, 9%) protein hydrolyzate, as a binder was added gum arabic and dextrin (1: 0.5) the amount of 8% (w / v). observed parameters, organoleptic values, physical characteristics and degree of brightness. The results of this research can be concluded that the hydrolyzate of rebon shrimp protein with the best concentration is 9%. can be used as a protein powder as a nutritional supplement with the addition of gum arabic binder and dextrin (1: 0.5) with a yield value of 73.191% and a total amino acid of 46.70%. The content of fatty acids produced The fatty acids contained are mMyristic acid 0.264%, palmintic acid 6.361%, stearic acid 0.678%, oleic acid 16.704% (Omega 9) and linoleic acid 0.084% (Omega 6). Organoleptic value of protein powder, namely taste 8.6, aroma 8.4, appearance 8.8, texture 8.5, with the characteristics of a bright yellowish white color, not fishy aroma, fine texture and very savory taste (umami), the brightness value at the level of 97.82%.

Key words: Acetes erythreaeus, Dextrin, Gum arabic, Hydrolyzate, *L plantarum* sp.

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INTRODUCTION

Rebon shrimp is rich in protein which can be used as raw material for protein hydrolyzate whose protein content consists of both essential and non-essential amino acids where the function of the protein is for the human body to maintain health, Utilization of rebon shrimp as a protein source can be done by making protein hydrolyzates.

Rebon shrimp protein hydrolyzate in liquid form has a weakness, which is more easily contaminated and easily damaged due to high water content. But with the method of adding protein binders, it can be made in powder form, so it is not easily contaminated and easy to store because it has low water content and has high solubility so that it is easy to add to food ingredients to be supplemented.

In the process of making powder from a liquid, a binding agent is needed and the materials that can be used are gum arabic and dextrin. Arabic gum can act as an elmusifier and dissolves easily in water and in oil[1], while dextrins have stable molecules so they can protect compounds that are sensitive to oxidation and heat[2].

It is hoped that the production of rebon shrimp protein hydrolyzate powder will be able to produce supplement materials that have high protein. So, the purpose of this study was to determine the best concentration of rebon shrimp protein hydrolyzate which was powdered as an ingredient in nutritional supplementation.

MATERIALS AND METHODS

Materials and tools

The raw materials used in this study were fresh rebon shrimp, papain enzymes and *L plantarum* sp. Bacteria. The binding agents used were gum arabic and dextrin. Other materials used are Glucose, NaOH (Merck), 85% alcohol, HCl (Merck), NaCl (Merck), and phosphate buffers (Merck) and NaOH. Chemicals used for amino acid analysis. The main tools used in this research are an incubator (IS900 Yamoto), autoclave (SM52), centrifuge (himac CR 21G), homogenizer (Nissel AMS), oven draying (SH62), freeze dryer, Spectrophotometer (Shimadzu 120-01), HPLC, Magnetic stirer, Oven, stainless steel blender, pH meter (HM-205), Vortek, and Water bath (GFL1083), refrigerator, analytical scale, glassware, spatula, distillation, biuret and film bottle, 60 mesh sieve.

Research methods

The research process was carried out in two stages. The first stage aimed to obtain the best protein hydrolyzate from the two treatments, namely enzymatically and microbiologically. The parameters analyzed were yield, amino acid profile, and fatty acid. The second stage aims to determine the best concentration of 5 treatment levels (6%, 7%, 8%, 9%) protein hydrolyzate as a raw material for nutritional supplement powder as a protein binding agent, added with Arabic gum and dextrin (1: 0.5) 8%, the parameters observed were moisture content, fungi, physical characteristics, organoleptic values, and degree of brightness.

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Procedure for Making Rebon Shrimp Protein Hydrolyzate[3]

Fresh rebon shrimp as much as 500 g are cleaned and washed with running water, then crushed, then added 500 ml of sterile water (1: 1 w / v) then homogenized, then heated at 60 ^{0}C for 15 minutes aims to activate the shrimp enzyme. The optimum pH adjustment was carried out using 0.5N NaOH to reach pH 7, added the papain enzyme with a concentration of 15% of the weight of the shrimp, then incubated at 60 ^{0}C for 4 hours, after heating using a water bath at 85 ^{0}C for 15 minutes, to separate the liquid phase and the solid phase, centrifugation was carried out at a speed of 15000 g for 15 minutes. The supernatant obtained was protein hydrolyzate of rebon shrimp.

Procedure for making rebon shrimp protein hydrolyzate using L. plantarum sp.[4]

Fresh rebon shrimp as much as 500 g are cleaned and washed with running water, then crushed using a blender then added 1: 1 (w / v) sterile water then homogenizer is sterilized at 121^{0}C for 15 minutes, after which 1% sterile glucose is added. (b / v). Then add 10% *L plantarum* sp., Then put it in a glass bottle, ferment it for 96 hours. The fermentation process was stopped by heating it at 95^{0}C for 15 minutes. To separate the liquid phase and the solid phase, centrifugation was carried out at a speed of 10,000 g for 20 minutes. The supernatant obtained was protein hydrolyzate of rebon shrimp.

Preparation of Protein Hydrolyzate Powder

The second stage of the research was to make protein hydrolyzate powder, the treatment was to select the protein hydrolyzate concentration of rebon shrimp with a treatment interval of 6%; 7%; 8%; 9%. The step, then for each treatment was added a binder, namely a mixture of gum arabic and dextrin with a ratio of 1: 0.5 with a total of 8%, homogenizer then carried out the drying process with a spray dryer at an inlet temperature of 165^{0}C, outlet temperature 70^{0}C.

RESULTS AND DISCUSSION

Phase I

Yield

The results of the first phase of research showed that there was a difference in the percentage of yield between hydrolysis using papain enzyme 15% (A) and hydrolysis treatment using fermentation by bacteria *L plantarum* 10% (B). The yield of rebon shrimp protein hydrolyzate can be seen in Table 1.

The yield of rebon shrimp protein hydrolyzate can be seen in Table 1, the yield of treatment protein hydrolyzate (A) was 365.954 grams or 73.191% higher than the yield of treated protein hydrolyzate (B) which amounted to 287.446 grams or 57.489%, the low yield of both treatments This is probably because the wet rebon shrimp is still in the form of a coarse collision, not in the form of finer powder. This causes the active substance content which can be hydrolyzed by the papain enzyme and also by the *L plantarum* bacteria only on the surface of small fractions, not in the form of a finer powder.

Amino Acid Profile

The results of the amino acid profile analysis showed that the amino acid content of each shrimp protein hydrolyzate was showed in Table 2. The difference in amino acid content in rebon shrimp protein hydrolyzate could occur due to differences in processing[5]. The hydrolysis treatment using the 15% papain enzyme resulted in a higher number of amino acids (46.70%) compared to the hydrolysis treatment using 10% *L plantarum* bacteria, which was 14.28%, this was due to hydrolysis using the papain enzyme to release protein from the cell wall. perfectly so that it affects the amount of amino acid content. According to[6], the papain enzyme is a proteolytic enzyme derived from papaya sap, this enzyme has the ability to break down protein molecules and can hydrolyze peptide bonds that build polypeptide chains on proteins to produce one molecule with carboxyl groups and other molecules that have amine groups. When enzymes are mixed in food, food protein will be broken down into peptides, which in turn break down into simpler forms called amino acids.

Table 1: The yield of rebon shrimp protein hydrolysate.

Component	Initial weight (g)	Final Weight (g)	Value (%)
A	500	365.954	73,191
B	500	287.446	57.489

Noted:
A = Protein hydrolyzate using papain enzyme
B = Protein hydrolyzate using L. plantarum bacteria

Table 2: Amino acid content of Rebon shrimp protein hydrolyzate.

Amino Acids	rProduct	
	Protein hydrolyzate A (%)	Protein hydrolyzate B (%)
Aspartate acids	4.25	1.52
Glutamate acids	8.47	2.06
Serine	1.31	0.56
Histidine	2.60	0.84
Glisin e	2.14	0.77
Treonine	1.44	0.60
Arginine	2.78	0.70
Alanine	2.73	0.52
Tirosine	1.03	0.35
Metionine	2.18	0.78
Valine	2.98	0.56
Penilalanine	1.78	1.78
I-Leuosine	2.14	0.86
Leusine	3.28	1.30
Lisine	3.93	1.08
TOTAL	46.70	14.28

Noted:
A = Protein hydrolyzate using papain enzyme
B = Protein hydrolyzate using L. plantarum bacteria

According to[7], the function of protein hydrolyzate can be as a flavoring and to obtain individual amino acids or for treatment, namely as a diet for digestive sufferers. The low content of amino acids in the protein hydrolyzate treated using 10% *L plantarum* bacteria, this is due to the fermentation hydrolysis process in accordance with the opinion[8], namely that when the fermentation process takes place, fish protein will be hydrolyzed into amino acids and peptides, then the amino acids will break down further into other components that play a role in the formation of taste. This opinion is further clarified by the results of[9] research, namely that a longer fermentation process will lead to a reduction in the amino acid levels of the product.

Fatty acids

Other nutrients contained in the rebon shrimp protein didrolysate are the content of fatty acids, the amount can be seen in Table 3.Fatty acids contained in rebon shrimp proein hydrolyzate include saturated fatty acids (myristic acid, palminta and stearic acid), oleic acid (Omega -9) and linoleic acid (Omega-6), are a group of fatty acids that are needed for health, because according to [10]; [5]; and [11] state that omega 3,6, and 9 fatty acids are that have a good effect on health, especially for brain growth, eye health, and according to [12] that omega 3,6 and 9 fatty acids are found in many seafood, including shrimp.

Based on the results in the phase 1 research, it can be concluded that hydrolysis using the 15% papain enzyme produces higher yields, amino acids and fatty acids than hydrolysis using the bacteria *L.plantarum* sp 10%, so that the protein hydrolyzate produced from the enzymatic process is used as an ingredient. protein powder manufacturing standards in Phase II research.

Phase II Research

The second stage of the research was to make protein hydrolyzate powder, the treatment was to determine the protein hydrolyzate concentration of rebon shrimp with 6% intervals; 7%; 8% and 9% then for each treatment a binder mixture of gum arabic and dextrin is added with a ratio of 1: 0.5 for a total of 8%, homogenizer then the drying process is carried out with a spray dryer at an inlet temperature of 165^{0}C, outlet temperature of 70^{0}C,

Organoleptic Test

The results of the organoleptic test for the protein hydrolyzate powder of rebon shrimp can be seen in Table 4 that the highest average value is related to taste, aroma, appearance and texture of protein hydrolyzate powder, namely at a concentration of 9% with a taste value (8.6), and aroma value (8.4) visual value (8,8), texture value (8,5). Based on the results of the analysis of variance, it can be explained that the hydrolyzate concentration of rebon shrimp protein in different amounts has a significant effect on the organoleptic value. To see this difference, the Tukey test is continued, the results show that the 9% concentration is significantly different from the 6% concentration; 7%; and 8%.

Protein powder with a concentration of 9% is preferred by panelists, because the chemical content that gives the powder a savory taste, namely glutamic acid, the higher the concentration of adding rebon shrimp protein hydrolyzate causes the resulting taste and aroma to be stronger. According to [13], that taste, aroma, appearance, and texture are parameters in determining product acceptance by consumers, the taste and delicacy of food is influenced by its chemical content.

The content of glutamic acid and aspartic acid in the protein hydrolyzate of rebon shrimp is 8.62% which can give a very savory taste to the functional flavor powder. According to[14], high levels of glutamic acid and aspartic acid, amino acids and nucleotides can contribute to forming a savory taste (umami), forming monosodium glutamate salt and in general marine products have the type of amino glutamic acid. The percentage of glutamic acid content in food products is thought to be due to deamination between the amino acids glutamine and asparagine, thereby increasing glutamic acid levels in food products[15].

Physical Characteristics

Based on the panelists' responses to the characteristics of protein powder from shrimp protein hydrolyzate, can be seen in Table 5. Characteristics of protein powder with gum arabic and dextrin binder has a bright yellowish white color, the aroma is very real, the texture is dry, and smooth and the taste is very tasty.

Degree of Brightness

Assessment of the degree of color brightness was carried out using a Lutron 10 Bit Color Analyzer, RGB-1002 Type, the results obtained are stated in Table 6. The results of the analysis show a significant difference.

The assessment of the degree of brightness of the rebon shrimp protein hydrolyzate functional flavor powder produced (Table 6) showed that a difference in the degree of brightness where the functional flavor powder with 9% protein hydrolyzate concentration of rebon shrimp has high brightness, namely 97.82%. The high degree of brightness of the powder means that the product has a good appearance and color, thereby creating an attraction for consumer acceptance. According to [16], color is one of the main factors that are important in a food product. Because the first impression seen by consumers is when they see the

Table 3: Fatty Acid Content of Rebon Shrimp Protein Hydrolysate Powder.

Component	Product	
	A(%)	B (%)
Miristate acids	0.264	0.223
Palmintate acids	6.361	4.108
Stearate acids	0.678	0.459
Oleat acids	16.704	12.843
Linoleat acids	0.084	0.075

Noted:
A = Protein hydrolyzate using papain enzyme
B = Protein hydrolyzate using L. plantarum bacteria

Table 4: The results of the organoleptic test values for the protein hydrolyzate powder of rebon shrimp.

Treatment (%)	Panelist	Taste	Odor	Appearance	Textur
		Value	Value	Value	Value
6	80	5.5± 0.2	5.2± 0.3	5.0± 0.2	6.4± 0.2
7	80	6.5± 0.2	6.0± 0.2	6.4± 0.3	6.8± 0.2
8	80	7.0± 0.2	6.5± 0.3	7.3± 0.2	6.6± 0.1
9	80	8.6± 0.1	8.4± 0.1	8.8± 0.2	8.5± 0.1

Table 5: Characteristics of rebon shrimp protein hydrolyzate added with gum arabic and dextrin binder.

concentrations (%)	Parameters			
	Appearance	Odor	Texture	Taste
6	Dull yellow color	Shrimp	Dry and smooth	A little savory
7	A slightly faded yellowish color	Shrimp	Dry and smooth	It's a little tasty
8	Yellowish white color slightly faded	Shrimp	Dry and smooth	Tasteful
9	Bright yellowish white color	Strong shrimp	Dry and smooth	Very Tasty

Table 6: Degree of brightness of Protein Powder.

Concentrations (%)	Degree of Brightness (%)	Average (%)
	49.17	
6	50.51	50.07 ± 0.77
	50.52	
	8498	
7	85.10	85.10 ± 0.12
	85.22	
	90.27	
8	91.78	90.86 ± 0.81
	90.53	
9	97.61	97.82 ± 0.37

color and appearance of the product. Based on[17], the whiteness or brightness of food products in the form of flour is 87%.

According to[18], that the degree of whiteness or brightness is influenced by several factors, including the presence of a number of phenol compounds and the activity of phenolase or polyphenol oxidase enzymes, and the presence of amino acid content, which in number affects the mailard reaction which significantly affects the whiteness or brightness.

CONCLUSION

The 9% concentration of rebon shrimp protein hydrolyzate can be used as a protein powder as a nutritional supplement with the addition of gum arabic and dextrin binder (1: 0.5). Powdered hydrolyzate with a concentration of 9% has the potential to enrich food nutrition.

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GRAPHICAL ABSTRACT

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