Study on the Quality of Natural Flavor Powder made from Shrimp Waste

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Abstract. The aims of this study are to determine the quality of natural flavor powder from shrimp waste and obtain new application technology for application of processing shrimp waste for natural flavor powder. This study using Completely Randomized Design non factorial. The treatment is adding wheat flour in three steps, they are without adding wheat flour (R0), adding wheat flour 1:1 (R1), and adding wheat flour 1:2 (R2) with three replications. This study results yield about 369.185%. Different quantity of wheat flour give effect to organoleptic value (flavor and aroma), the best treatment is R0 with flavor value is 4.17 and aroma value is 4.28%. Threshold value for taste is 8% at ratio 1:8 and threshold odor value for aroma is 12% at ratio of 1: 9. When dilution ratio is increase, the taste and aroma of shrimp in flavor powder is decreases until it is not detected. Shrimp flavor powder contains 17 types of amino acids, consisting of 9 essential amino acids and 8 non-essential amino acids. The highest essential amino acid is leucine which is equal to 0.362% and the highest non-essential amino acid is glutamate acid which is equal to 0.913%.

1. Introduction
Shrimp is one of the fisheries export commodities as important role in Indonesia's foreign exchange earnings. Foreign exchange obtained from fisheries sector about 34% comes from shrimp exports. The exported shrimp products are in various forms. The most popular is processed form such as frozen shrimp, this will produce shrimp waste about 30% - 75% of shrimp weight. The increasing amount of shrimp waste is a problem that needs to be sought for its utilization. This not only give added value to the shrimp processing business, but also can overcome the problem of environmental pollution caused, especially the odors issues and environmental aesthetics that not good [1].

One of the utilization from by-products of shrimp processing is processed into food natural flavor powder. As known, flavor is one of the attributes of food or food products that important in acceptance or rejection food by consumers. According to [2] Food taste actually consists of three components, they are aroma, taste and mouth stimulation. Flavor generator beside synthetic compounds that cause aroma, also produces synthetic compounds that cause good taste, the type of flavor generator material is amino acids. According to [3] the flavor components include free amino acids which consist of glycine, arginine, taurine, and proline. Flavor is depends on amino acid component of the original ingredient. For example, the glycine amino acid has sweet taste while the glutamic amino acid gives savory taste like meat.

2. Methodology
2.1. Ingredients and Methods
Raw material in this study is 5 kg of shrimp waste, they are skin, head and claws. Additional ingredients are dextrin, tween 80, sugar, salt, garlic, wheat flour and other chemicals for chemical analysis. The equipment are plastic containers, pan, knife, stove, sieve with size 60 mesh, filter, stirrer, spoon, blender, digital scale, drying oven, HPLC and other tools for analysis.

The research method is experimental method with non-factorial Completely Randomized Design (CRD) where the treatment is adding wheat flour with three steps. They are without adding wheat flour ($R_0$), adding wheat flour 1:1 ($R_1$), and adding wheat flour 1:2 ($R_2$) with repeated three times in each treatment.

2.2. Production of natural flavor powder from shrimp waste

The production process consists of two steps. The first process is produces filtrate: Shrimp waste was washed and then drained. After that, weighed the shrimp waste then blending using water with ratio 2:1 (v/b) for ± 5 minutes to reduce the size. After that it was heated at 90ºC for 30 minutes, then filtered with a filter cloth and the filtrate is taken. The filtrate was evaporated until the volume becomes 50% from the first volume.

The second process is produces shrimp flavor powder. First, concentrated 200 ml shrimp concentrates, added 2% (b/v) garlic, 1% (w/v) salt, 5% (w/v) sugar and then blend for 60 seconds. Added 15% (w/v) dextrin, 1% (v/v) tween 80 and then formed to foam using maximum speed mixer for 10 minutes. Dried at temperature 70ºC for 20 hours. After that it was crushed with dry blender, then sieved with 60 mesh sieve and shrimp flavor powder is obtained. The analyzed parameters are observations of yield, organoleptic assessment, threshold odor test, and amino acid analysis.

3. Results and Discussion

Observations results of the yield, organoleptic values of the threshold odor test and amino acid analysis in shrimp flavor powder.

3.1. Yield

Yield of shrimp flavor powder is calculated based on ratio between weight of shrimp flavor powder and weight of shrimp waste. Yield amount from process of making shrimp flavor powder is 39.185% indicate that production of flavor powder from shrimp waste is still effective and efficient, so the shrimp flavor powder has economic value.

3.2. Organoleptic Assessment

Based on the results, known that adding different wheat flour can affect the physical properties. Generally, taste and aroma of the flavor powder have organoleptic values for each treatments are presented in Table 1.

| Parameters | Treatments |
|------------|------------|
|            | $R_0$      | $R_1$      | $R_2$      |
| Taste      | $4.17 \pm 0.02^a$ | $3.67 \pm 0.02^b$ | $3.04 \pm 0.01^a$ |
| Odor       | $4.28 \pm 0.02^a$ | $3.71 \pm 0.02^b$ | $3.20 \pm 0.02^a$ |

$R_0$ (without wheat flour), $R_1$ (with wheat flour 1:1), $R_2$ (with wheat flour 1:2)

Treatment of adding wheat flour in different quantity gives real effect in taste and aroma of shrimp flavor powder. Adding wheat flour has effect in quality of shrimp flavor powder. Increasing addition quantity of wheat flour make taste and aroma of shrimp in shrimp flavor powder decreases. The highest average value is treatment $R_1$ (4.28), while the lowest value is treatment $R_2$ (3.04). This is caused of increase quantity of wheat flour that does not taste and smell, so increase quantity of wheat flour cause the product tasteless and also component of flavor compounds such as peptides increasingly undetectable.
According to [4] relationship between scale of the impression with concentration of a material is directly proportional. The higher concentration of material, the higher magnitude of impression. The intended impression is taste and aroma detected by taste buds to assessing a food taste [4].

3.3. Threshold Odor Test
Threshold test is category that include in sensory analysis with specific function that is to determine the threshold. Threshold is defined as the lowest concentration which is a sensory can detected. Threshold odor test use to determine whether there is desired component in food [5]. Threshold odor test values of shrimp flavor powder are presented in Figure 1.

![Figure 1. Threshold odor test values of shrimp flavor powder.](image)

Based on results of threshold test, taste of shrimp flavor powder not detected by the panelists at dilution ratio 1:9. The detection limit known at dilution ratio 1:8, so threshold value of shrimp flavor powder is 8%.

Threshold value of aroma of shrimp flavor powder not detected by panelists at dilution ratio 1:10, so threshold value of shrimp flavor powder to taste is 12% at dilution ratio 1:9. Generally, the graph of threshold odor test on aroma decrease until 10th dilution, but at dilution ratio 1:4, the odor threshold value is higher than dilution ratio at 1:3. About this deviating [6] explain that each person has different sensitivity level of aroma’s food products because several factors, such as sex, health conditions and age.

3.4. Analysis of Amino Acids
Amino acid is an organic component that contains amino groups and carboxyl groups. Not all amino acids can be made in our body. When reviewed from their formation, amino acids are divided into two groups, they are exogenous amino acids and endogenous amino acids.

Exogenous amino acids also called essential amino acids and endogenous amino acids also called non-essential amino acids. Essential amino acids are amino acids that cannot be made in the body and must be obtained from proteins food which also called exogenous amino acids, while non-essential amino acids are amino acids that can be made in the body [2]. Amino acids often called and known as builder substance which are the end result of protein metabolism. Amino acids in shrimp flavor powder are presented in Table 2.
Table 2. Amino acid in shrimp flavor powder

| Amino Acid Type | Amino Acid Content (%) |
|-----------------|------------------------|
| Aspartate       | 0.271                  |
| Glutamate       | 0.913                  |
| Serin           | 0.282                  |
| Glycine         | 0.147                  |
| Histidine *     | 0.162                  |
| Arginine *      | 0.214                  |
| Treonin *       | 0.197                  |
| Alanin          | 0.413                  |
| Proline         | 0.151                  |
| Tyrosine        | 0.077                  |
| Valine *        | 0.158                  |
| Methionin*      | 0.144                  |
| Cysteine        | 0.057                  |
| Isoleucine*     | 0.126                  |
| Leucine*        | 0.362                  |
| Phenylalanine*  | 0.158                  |
| Lysine*         | 0.255                  |

*Essential amino acids

Shrimp flavor powder in this study contains 17 types of amino acids, they are 9 types of essential amino acids and 8 types of non-essential amino acids. Essential amino acids in shrimp flavor powder are histidine, arginine, threonine, valine, methionin, isoleucine, leucine, phenilalanin and lysine.

Leucine is the highest type of essential amino acid in shrimp flavor powder. Leucine can stimulate brain function, help reduce excessive sugar levels, help bones healing, muscle tissue and skin [7].

Another content of amino acids is arginine. According to [8] arginine is amino acid formed in liver and some of it is found in kidneys. Arginine is useful for increasing endurance or lymphocyte production. Shrimp flavor powder also contains threonine. Threonine can improve the ability of the intestine and digestive process, maintain balance of protein, important in the formation of collagen and elastin, help function liver, heart and central nervous system and prevent epileptic seizures.

Valine is branched chain amino acid that functions as glucogenic precursor. Valine is very important for growth and maintaining muscle tissue. Valine also stimulate mental ability, spur muscle coordination, help repair damaged tissue and maintain nitrogen balance, methionine is important for fat metabolism, maintain liver health, calm tense nerves, prevent fat accumulation in liver and arteries especially those that supply blood to the brain, heart and kidney, it is important to prevent allergies, osteoporosis, rheumatic fever, and detoxification of harmful substances in digestive tract. Methionine gives metal group for synthesis of choline and creatinine. Methionine also needed by the body to form cysteine [7].

There are eight types of non-essential amino acids in shrimp flavor powder, they are aspartic acid, glutamic acid, serine, glycine, alanine, tyrosine and cysteine. Glutamic acid in shrimp flavor powder is the highest type of amino acid. Glutamic acid contains glutamic ion which can stimulate several types of nerves in human tongue. Glutamic acid and aspartic acid give flavor in seafood, but in form of sodium salt, that is, MSG will give umami taste [9]. Glutamic acid is the most important component in the formation of flavors in seafood.
Generally, the most common amino acid in marine mollusks is glutamic acid, aspartic acid, glycine and alanine [10].

4. Conclusion
Based on the results in this study, it is concluded that adding wheat flour in different quantity gives effect on the quality of shrimp flavor powder based on organoleptic values (taste and aroma). Threshold odor value of shrimp flavor powder to flavor is 8% at ratio 1:8 and threshold odor value of shrimp flavor powder to aroma is 12% at ratio 1:9. The greater dilution ratio, the less taste and aroma of shrimp in shrimp flavor powder until undetected.

Yield value from process of making shrimp flavor powder is 39.185%. Shrimp flavor powder contains 17 amino acids consisting of nine essential amino acids and eight non-essential amino acids. The essential amino acids found in shrimp flavor powder are histidine, arginine, threonine, valine, methionin, isoleucine, leucine, phenylalanine and lysine. Non-essential amino acids found in shrimp flavor powder are aspartic acid, glutamic acid, serine, glycine, alanine, proline, tyrosine and cysteine. The highest content of essential amino acids in shrimp flavor powder is leucine 0.362% and the highest non-essential amino acid content is glutamic acid 0.913%.

References
[1] F Swastawati, I Wijayanti, and E Susanto 2008 Utilization of Shrimp Waste Into Edible Coating To Reduce Environmental Pollution. Researchgate 4 101-106.
[2] F G Winarno 2004 Food and Nutrition Chemistry (Jakarta: Gramedia)
[3] P Wirawan 2015 Utilization of White Shrimp Shell Flour (Litopenaeus vannamei) As a Flavor with the Addition of Dextrin and Its Application on Taro Chips (Pekanbaru: Faculty of Fisheries and Marine Sciences, Riau University).
[4] K Y Monfatmanaba 2009 Taste Threshold Testing, Ministry of Health of the Republic of Indonesia. Mataram Health Polytechnic.
[5] H Q Aini 2014 Sensory Evaluation of Threshold Tests (Threshold). (Purwokerto: Jendral Sudirman University).
[6] A Fauzi 2010 Identification of the Quality of Processed Shrimp Products. (Yogyakarta: Faculty of Science and Technology, Sunan Kalijaga State Islamic University).
[7] M Harli 2008 Essential Amino Acids. http://www.suparmas.com. [18 Agustus 2019].
[8] MC Linder 1992 Biochemical Nutrition and Metabolism by Chemical Use. (Jakarta: UI Press).
[9] Uju, T Nurhayati, B Ibrahim, W Trilaksani, and M Siburian 2009 Protein Characterization And Recovery From Minced Fish Washing Water With Membrane Resrved Osmosis. J Fisheries Product Processing 12 115-127.
[10] Chairunisah 2011 Characteristics of Amino Acid in Tofu Shellfish (Meretrix sp), Snow Clams (Pholas dactylus) and Tiger Conch (Babylonia spirata). (Bogor: Bogor Agricultural Institute).