



KARAKTERISTIK SENSORI DAN KIMIA *BIOFLAVOR* BERBASIS LIMBAH KEPALA UDANG

SENSORY AND CHEMICAL PROPERTIES OF SHRIMP HEAD WASTE–BASED *BIOFLAVOR*

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Abstract

Shrimp head waste is a byproduct of the fishing industry that could be used as a raw material for natural flavorings. This study aims to determine the yield, chemical characteristics, and sensory acceptance of bioflavor powder derived from shrimp head waste as an alternative to MSG. The bioflavor production process includes drying, grinding, and sieving. Parameters analyzed include yield, moisture content, ash content, protein content, and organoleptic tests (color, aroma, texture, and appearance). The results of the study indicate that shrimp head bioflavor powder yields 47.7%, with a moisture content of 3.7%, an ash content of 29.84%, and a protein content of 50.93%, which meet the quality requirements of SNI fishmeal. The organoleptic test showed an average hedonic value of 8.24, placing it in the highly liked category for panelists. Based on these results, shrimp head waste-based bioflavor powder has good chemical and sensory qualities and shows potential as a natural food additive to replace MSG, making it nutritious and environmentally friendly.

Keywords: *waste, shrimp head, bioflavor, natural flavoring, MSG substitute*

Abstrak

Limbah kepala udang merupakan hasil samping industri perikanan yang berpotensi dimanfaatkan sebagai bahan baku penyedap rasa alami. Penelitian ini bertujuan untuk mengetahui rendemen, karakteristik kimia, dan tingkat penerimaan sensori bubuk bioflavor berbasis limbah kepala udang sebagai alternatif pengganti MSG. Proses pembuatan bioflavor meliputi pengeringan, penggilingan, dan pengayakan. Parameter yang dianalisis meliputi rendemen, kadar air, kadar abu, kadar protein, serta uji organoleptik (warna, aroma, tekstur, dan kenampakan). Hasil penelitian menunjukkan bahwa bubuk bioflavor kepala udang menghasilkan rendemen sebesar 47,7%, dengan kadar air 3,7%, kadar abu 29,84%, dan kadar protein 50,93%, yang telah memenuhi persyaratan mutu SNI tepung ikan. Uji organoleptik menunjukkan nilai hedonik rata-rata 8,24, yang termasuk dalam kategori sangat disukai panelis. Berdasarkan hasil tersebut, bubuk bioflavor berbasis limbah kepala udang memiliki kualitas kimia dan sensori yang baik serta berpotensi dikembangkan sebagai bahan tambahan pangan alami pengganti MSG yang bernilai gizi dan ramah lingkungan.

Kata Kunci : limbah, kepala udang, bioflavor, penyedap rasa alami, pengganti MSG



INTRODUCTION

Bioflavor is a compound or flavor product produced from natural ingredients through biological or biochemical processes, making it considered safer and more consumer-friendly. Natural flavorings (bioflavors) are flavorings derived from natural ingredients, including shrimp head waste. Shrimp heads have a strong flavor and aroma (bold flavor) that can influence the overall taste of food. Foods to which these ingredients are added have a strong and savory taste, due to the natural taste of glutamate found in shrimp heads. The glutamate in shrimp heads is formed from the protein hydrolysis process occurring in shrimp heads with the acid contained in dextrin (Santi, 2022). Shrimp are marine biota belonging to the decapoda class, and the shrimp's body is divided into three parts: the head, thorax, and abdomen. In general, only the thorax and abdomen are consumed, while the head is considered waste and often discarded, resulting in minimal utilization. Improper management of shrimp head waste can lead to environmental pollution due to its unpleasant odor and potential to become a source of disease (Puspitasari & Ekawandani, 2019).

Shrimp head waste constitutes approximately 36–49% of the total body weight of shrimp, indicating a significant potential for valorization. Shrimp heads contain various amino acids, including glutamic acid at approximately 20.45 mg; however, this potential has not been optimally utilized (Meiyani *et al.*, 2014). According to Luzyawati (2021), shrimp heads are rich in calcium and phosphorus, which contribute to bone and dental health. In addition, shrimp heads contain approximately 25–40% crude protein, 45–50% calcium carbonate, and 15–20% chitin. Shrimp head waste also exhibits antioxidant properties due to the presence of astaxanthin, which has been reported to inhibit free radicals up to ten times more effectively than fruits and vegetables (Hermanto & Nengseh, 2019).

Umami taste compounds, particularly glutamic acid and nucleotides, play a crucial role in flavor formation in food products. Monosodium glutamate (MSG) has long been widely used as a flavor enhancer to improve taste. However, increasing consumer awareness regarding the use of natural food additives has encouraged the development of bioflavors as alternatives to MSG. Therefore, this study aims to evaluate the sensory and chemical characteristics of shrimp head-based bioflavor to ensure its quality and consumer acceptability.

RESEARCH METHODS

This study employed experimental and descriptive methods, consisting of two main stages: (1) the production of bioflavor powder from shrimp head waste, and (2) chemical and organoleptic testing. Primary data were collected to analyze the composition and characteristics of shrimp-head bioflavor.



Tools

The equipment used in this study included a food dehydrator, trays, a digital balance, a condenser, a muffle furnace, Erlenmeyer flasks, a mesh sieve, a blender, porcelain crucibles, a desiccator, wax paper, Kjeldahl flasks, volumetric flasks, filtration flasks, a furnace, a distillation apparatus, and dropper pipettes.

Materials

The materials used in this study included shrimp head samples, selenium mix, sulfuric acid (H_2SO_4), distilled water, boric acid (H_3BO_3), methyl red, methylene blue, ethanol, cotton, hydrochloric acid (HCl), methanol, litmus paper, filter paper, and sodium hydroxide (NaOH).

Procedure

Bioflavor Powder Production

Shrimp heads were thoroughly washed under running water to remove impurities. The cleaned shrimp heads were then dried in a food dehydrator at $70^\circ C$ for 9 hours, starting with an initial weight of 200 g. After drying, the shrimp heads were ground using a blender and sieved through a 60-mesh sieve to obtain fine bioflavor powder. The resulting bioflavor powder was subsequently analyzed for moisture, ash, and protein content, as well as sensory properties.

Chemical Analysis

Chemical analyses included moisture, ash, and protein content. Moisture and protein analyses were conducted in accordance with Indonesian National Standard SNI 01-2973-2011, while ash content was analyzed in accordance with SNI 3751-2018.

Sensory (Organoleptic) Evaluation

Organoleptic evaluation is a method for assessing food products based on consumer preference or acceptance. Organoleptic testing, also called sensory or sensory evaluation, uses the human senses as the primary tools to determine product acceptability. The organoleptic evaluation in this study was conducted in accordance with the Indonesian National Standard SNI 01-2346-2006.

RESULTS AND DISCUSSION

Shrimp Head Bioflavor Powder

The use of shrimp head waste as a natural flavoring powder represents an innovative approach to value-added, sustainable fisheries processing. Shrimp heads, previously considered waste, are rich in protein, free amino acids (particularly glutamic acid), nucleotides, and volatile compounds that contribute to umami flavor. These components make shrimp heads a promising raw material for natural flavor enhancers that can substitute for MSG. The production process included washing, drying, grinding, and sieving. Washing played an essential role in removing impurities, blood residues, and excessive fishy odors. Drying was performed at $70^\circ C$ for 9 hours



using a food dehydrator, based on optimal conditions identified in previous studies. The drying and powdering processes for shrimp heads are shown in Figures 1 and 2 below.



Gambar 1. Alat Pengering Food Dehydrator



Gambar 1. Bubuk Bioflavor kepala udang

Chemical and Sensory Characteristics of Shrimp Head Bioflavor Powder

The chemical characteristics of shrimp head bioflavor powder are influenced by the composition of the raw material and processing conditions. Shrimp heads contain high protein levels, which may undergo denaturation and partial degradation into peptides and free amino acids during heating and drying. Free amino acids, particularly glutamic acid, contribute significantly to the umami taste that characterizes natural flavor enhancers. The characteristics of shrimp head bioflavor powder across various parameters are shown in Table 1.

Table 1. Characteristics of Shrimp Head Bioflavor Powder

Parameter	Jumlah sampel	Nilai (%)	SNI*
Rendemen	200 g	47,7 %	-
Kimia			
- Kadar Air	200 g	3,78	6-12 %
- Kadar Abu	200 g	29,84	20-30%
- Kadar Protein	513 g	50,93	50-60%
Organoleptik			
- Warna	30 Panelis	8,27	
- Aroma	30 Panelis	7,93	Min 7
- Tekstur	30 Panelis	7,87	
- Kenampakan	30 Panelis	8,90	

* SNI 2715-2013 (Fishmeal quality requirements)

Based on the results in Table 2, the drying, grinding, and sieving processes yielded 47.7%. The yield of shrimp head powder is influenced by several factors, particularly the initial moisture content of the raw material, pretreatment conditions, and the drying method applied. Fresh shrimp heads have a relatively high moisture content; therefore, a substantial weight loss occurs during the drying process due to water evaporation. This finding is consistent with Situmorang *et al.* (2024), who reported that longer drying times reduce product yield due to greater water loss, which decreases dry matter mass and lowers the final powder weight. Natipulu *et al.* (2012) also explained that drying intensity and duration affect yield by accelerating the loss of moisture and a portion of dry solids.



Moisture content is a critical parameter because it greatly affects shelf life, microbiological stability, texture, and overall product quality. Materials with high moisture content are more susceptible to deterioration due to microbial growth and chemical reactions, whereas lower moisture content can extend product shelf life. In this study, the moisture content of shrimp head bioflavor powder was 3.7%, which met the quality requirement of the Indonesian National Standard for fish meal (SNI 2715-2013), which specifies a maximum moisture content of 4%. This result is consistent with the findings of Sintya *et al.* (2023), who reported a moisture content of 3.5% after 60 minutes of roasting. Lower moisture content in shrimp waste-based seasoning powders contributes to a longer shelf life. Maulina *et al.* (2024), reported the lowest moisture content (3.93%) after pretreatment with frying at 100°C for 30 minutes, followed by roasting and frying for 60 minutes. These results indicate that longer roasting durations reduce the moisture content of powdered broth products. Prolonged drying processes increase water evaporation due to extended direct heat exposure, reducing the material's moisture content (Sari, 2016). In addition, higher drying air temperatures further reduce moisture content (Amanto *et al.*, 2015).

In addition to moisture content, ash and protein contents are important parameters in the chemical or proximate analysis of food products. The ash content obtained in this study was 29.84%, indicating that shrimp head bioflavor powder met the quality standard specified in SNI 2715-2013. In the food industry, particularly in flour production, ash content determination is a critical parameter for evaluating product quality. Ash content is directly related to the mineral content present in food materials (Estiari *et al.*, 2016). According to Salmahaminati *et al.* (2021), ash content analysis is commonly used as an indicator in quality evaluation because it provides information regarding product purity and potential nutritional value. Protein content analysis is also essential for assessing the quality and nutritional value of food products. The ash content obtained in this study also complied with the Indonesian National Standard for food quality (SNI No. 3751-2018).

Protein content analysis in food products is essential for determining nutritional value, ensuring product safety and quality, and supporting the development of new food products (Herliyana, 2021). The results of this study showed that the shrimp head waste-based bioflavor powder contained 50.93% protein. This indicates that the protein content of shrimp head bioflavor powder meets the Indonesian National Standard for fish meal. Protein levels above 45% can be classified as high-protein materials, making them highly relevant for nutritional applications and food processing. Cahu *et al.* (2012), reported that protein hydrolysates derived from *Litopenaeus vannamei* shrimp heads contained approximately 44% protein, with essential amino acids accounting for 41% of the total amino acid profile.

The bioflavor powder produced in this study had a fine, granular appearance and uniform particle characteristics. Shrimp head (*Litopenaeus vannamei*) bioflavor powder possessed a distinctive savory aroma characteristic of dried shrimp. To determine consumer acceptance, sensory (organoleptic) evaluation was conducted. The results of the organoleptic test showed that the hedonic scores for all sensory attributes, including color, aroma, texture, and appearance, yielded an average value of 8.24, which falls within the category of "highly liked" by panelists.



The range of organoleptic scores for shrimp head bioflavor powder was 7.87–8.90, which can be rounded to 9, indicating that the product was categorized as “very highly liked.” The obtained sensory scores exceeded the minimum organoleptic standard specified in SNI 01-2346-2006. Hedonic testing was conducted to assess panelists’ preference for the bioflavor product (Tarwendah, 2017).

CONCLUSION

Based on the results of this study on the production of bioflavor powder from shrimp head waste, a yield of 47.7% was achieved, influenced by the initial moisture content of the raw material, pretreatment, and drying method and duration. Chemical analysis showed a moisture content of 3.7%, ash content of 29.84%, and protein content of 50.93%, all of which met the quality standards of SNI 2715-2013 for fish meal. The organoleptic evaluation yielded an average hedonic score of 8.24, categorized as “highly liked,” and exceeded the minimum sensory standard specified in SNI 01-2346-2006. Therefore, it can be concluded that shrimp head waste–based bioflavor powder has good chemical and sensory quality and strong potential to be developed as a safe, economically valuable alternative food additive to replace MSG.

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