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Formulation of a Flavor Enhancer Based on Milkfish and Shrimp Waste with Shiitake Mushroom Addition: An Organoleptic Assessment

Kristian Agung Nugraha*, **Hari Minantyo, Ivana Grasielda, Caecillia Hartadji, Johanes Marco Poillot**

Universitas Ciputra, Surabaya, Indonesia

**agung.nugraha@ciputra.ac.id*

Abstract

The objective of this study was to evaluate the development of a natural seasoning made from milkfish meat, shiitake mushrooms, and shrimp waste, as well as to assess its organoleptic properties. The research was conducted in Surabaya. The seasoning was prepared by drying and processing each ingredient into powder form, which was then mixed with other spices in varying formulations containing 0%, 10%, 15%, and 20% shiitake mushroom powder. The final products were subjected to organoleptic evaluation using a 4-point Likert scale by untrained panelists, who assessed the color, aroma, taste, and texture. Data were analyzed using Analysis of Variance (ANOVA) to identify significant differences among the samples. The results indicated that the 20% shiitake mushroom formulation enhanced the umami flavor without significantly affecting the color and texture ($p > 0.05$). However, aroma and taste were significantly influenced by the formulation ($p < 0.05$). This shows that the addition of shiitake mushroom powder contributes to flavor enrichment without altering the product's appearance. Therefore, the formulation shows potential as a natural and nutrient-rich alternative seasoning. Further research is recommended to improve the product's texture and shelf-life, making it more suitable for commercial production and market acceptance.

Keywords: milkfish, shiitake mushroom, shrimp waste, seasoning, organoleptic test.

A. Introduction

Indonesia, as an archipelagic country, is rich in diverse food resources, both from agriculture and marine products such as milkfish and shrimp. In the social and culinary culture of Indonesian society, milkfish is commonly known as a popular edible fish. Initially, milkfish farming was a side activity for fishermen who were not going out to sea (Muliawan et al., 2016). Milkfish production dominates compared to other brackish water fish species, such as catfish, with a production of 124,412 tons, and snapper, with 1,950 tons (Prakoso et al., 2022). The demand for milkfish has increased, partly due to its savory taste (Salam & Darmawati, 2017), which is attributed to its high protein content. Milkfish contains approximately 20–24% protein, including 1.23% glutamic acid and 2.25% lysine (Hafiludin, 2015; Prasetyo et al., 2015). Additionally, it is rich in omega-3 fatty acids, accounting for 14.2% of its total fat content (Nusantari et al., 2016).

Shiitake mushrooms (Lentinula edodes) are also considered a potential natural source of flavor enhancers. The caps and stems of these mushrooms contain essential and non-essential amino acids, fiber, carbohydrates, protein, calcium, and 5'-nucleotides, all of which contribute to a strong umami taste (Rifhani, 2019; Li et al., 2018). The shiitake cap contains 4.13 g/kg of 5'-GMP (Guanosine 5'-monophosphate) and 0.04 g/kg of 5'-IMP (Inosine 5'-monophosphate), resulting in an Equivalent Umami Concentration (EUC) of 728.54 g MSG/100 g (Li et al., 2018).

Indonesia is also known as the third-largest shrimp producer in the world (KKP, 2012). Shrimp waste still contains valuable nutrients such as protein, fat, calcium carbonate, chitin, pigments, and ash (R. Marguerite, 2012), making it a promising material for reuse, for instance, as a flavoring powder (Saleh et al., 2017; Rathore et al., 2018). Shrimp heads contain moisture (80.15%), protein (14.67%), fat (0.93%), and ash (2.64%), and they are capable of producing a savory or umami taste due to the presence of amino acids such as glutamate (Istikomah, 2020).

Shrimp waste still contains valuable nutrients such as protein, fat, calcium carbonate, and amino acids, making it a promising base for flavoring powder production (R. Marguerite, 2012; Saleh et al., 2017; Rathore & Yusufzai, 2018). Recent findings by Sukartini et al. (2023) also confirmed that shrimp waste can be processed into natural flavoring powder with acceptable organoleptic quality and potential for food applications.

Flavor enhancers are food additives used to improve the taste of food (Parwati, 2019). Natural flavor enhancers are usually derived from plant or animal sources through enzymatic, physical, or microbiological processes (Tamaya et al., 2020). This study aims to develop a natural flavor enhancer based on milkfish meat, shiitake mushrooms, and shrimp waste to expand the variety of seasoning products available in the market.

B. Literature Review

Utilization of Milkfish as a Source of Flavor and Nutrition

Milkfish (Chanos chanos) is a widely consumed aquaculture commodity in Indonesia due to its savory taste and high protein content. Previous studies have shown that milkfish contains between 20–24% protein and amino acids such as glutamate, which play a crucial role in developing umami flavor (Hafiludin, 2015; Prasetyo et al., 2015). Furthermore, its high omega-3 content adds significant health value (Nusantari et al., 2016). Production data indicate that milkfish dominates the yield of brackish water fish species (Prakoso et al., 2022), supporting its potential as a primary ingredient in flavor enhancer formulations.

The Role of Shiitake Mushrooms in Enhancing Umami Flavor

Shiitake mushrooms (Lentinula edodes) are known to contain 5'-nucleotides such as 5'-GMP and 5'-IMP, which synergistically enhance umami flavor. The nutritional and bioactive compound content in these mushrooms not only improves taste quality but also contributes significant nutritional benefits (Rifhani, 2019; Li et al., 2018). The use of shiitake mushroom powder as an additive in flavoring formulations aims to enrich flavor profiles without drastically altering the product's appearance. Yang et al. (2019) further reported that the drying method significantly affects the content of free amino acids and nucleotides, contributing to the overall umami intensity of shiitake-based products.

Potential of Shrimp Waste in Flavor Enhancer Formulations

Shrimp waste, which often still contains protein, fat, calcium carbonate, and chitin, has been identified as a valuable resource for use in processed food products. Studies on shrimp waste have shown that its nutritional components contribute to enhanced savory or umami flavors (Istikomah, 2020; R. Marguerite, 2012). In addition, data from the Ministry of Marine Affairs and Fisheries (KKP, 2012) highlight Indonesia's status as one of the world's largest shrimp producers, making the utilization of shrimp waste for flavor enhancer production aligned with sustainability principles and economic efficiency.

Strategies for Developing Natural Flavor Enhancers

The development of natural flavor enhancers through drying and processing of raw materials has been extensively researched, particularly in terms of processing technologies and organoleptic quality evaluation. Drying methods using a dehydrator followed by grinding into powder are effective approaches for preserving the nutritional and bioactive quality of the ingredients (Tamaya et al., 2020). Additionally, organoleptic testing using the Likert scale has been employed to evaluate sensory attributes such as color, aroma, taste, and texture, providing data that can be statistically analyzed using ANOVA to determine significant differences among formulations (Pusuma et al., 2018; Saepudin et al., 2017).

C. Research Methods

Tools and Materials

This study utilized various tools such as a dehydrator machine (Getra), risopan (Jawa), grinder (Philips), and oven (Nayati), among others. The main ingredients included milkfish fillet, lime juice, ginger, turmeric, garlic, shiitake mushrooms, shrimp waste, and several seasonings such as garlic powder, ginger powder, ground pepper, salt powder, and sugar powder.

Procedures

Milkfish drying process are: (1) Milkfish meat was marinated for 30 minutes using a mixture of lime juice, turmeric, ginger, and crushed garlic; (2) The marinated meat was then steamed for 15 minutes at 100°C, mashed, and dried using a dehydrator at 80°C for 120 minutes; (3) Once dried, the milkfish was ground and sieved to obtain fine powder.

Shiitake Mushroom drying process are: (1) Shiitake mushrooms were soaked in boiling water for 60 minutes, then squeezed and sliced to a thickness of 0.5 mm; (2) The mushroom slices were dried using a dehydrator at 80°C for 120 minutes, then ground and sieved into powder form.

Shrimp Waste drying process are: (1) Shrimp waste was soaked in a boiling solution of lime juice, ginger, turmeric, and garlic for 30 minutes to reduce the fishy odor; (2) The mixture was then squeezed and dried using a dehydrator at 80°C for 120 minutes, followed by grinding and sieving into powder.

Preparation of Flavor Enhancer

Milkfish powder, shrimp waste powder, and shiitake mushroom powder were mixed with seasonings based on the following composition:

Table 1. Composition of Flavor Enhancer Based on Milkfish and Shrimp Waste with the Addition of Shiitake Mushrooms Evaluated through Organoleptic Testing

Ingredient	0% Shiitake	10% Shiitake	15% Shiitake	20% Shiitake	Unit
Milkfish Powder	500	500	500	500	Gram
Shiitake Mushroom Powder	0	10	15	20	Gram
Shrimp Waste Powder	0	20	20	20	Gram
Garlic Powder	20	20	20	20	Gram
Nutmeg Powder	10	10	10	10	Gram
Ground Pepper	10	10	10	10	Gram
Salt	15	15	15	15	Gram
Chili Powder	10	10	10	10	Gram

Source: Analysis Results (2025)

Observation and Data Analysis.

This study employed Analysis of Variance (ANOVA) to test hypotheses regarding the significance of differences among samples based on organoleptic test results, which were statistically analyzed. If the significance value (Sig) exceeds 0.05, it indicates no significant difference between the samples. Conversely, a Sig value below 0.05 indicates a statistically significant difference among the tested samples (Wolf, 2020:143).

The flavor enhancer formulations, developed from milkfish meat, shrimp waste, and shiitake mushrooms, were subjected to organoleptic evaluation by ... randomly selected and untrained panelists. The panelists were asked to assess their level of preference for the color, aroma, taste, and texture of the seasoning samples. The purpose of this organoleptic test was to determine the panelists' preferences and to evaluate the overall quality of the product (Pusuma et al., 2018; Saepudin et al., 2017).

The assessment was conducted using a Likert scale ranging from 1 to 4, where: a score of 1 indicated “strongly dislike,” 2 indicated “dislike,” 3 indicated “like,” and 4 indicated “strongly like.” The results of the organoleptic test were analyzed using ANOVA to evaluate the influence of the formulations on the panelists’ ratings of color, taste, aroma, and texture. If the resulting significance value is greater than 0.05, the results are considered consistent; whereas a value below 0.05 indicates that the treatment had a significant influence on the panelists' evaluations. The data analysis was conducted based on the ANOVA results to identify the best sample among the various treatments and concentrations used.

D. Result and Discussion

The results of the milkfish powder preparation experiment showed a pleasant aroma without any fishy smell, a savory taste, and a smooth texture. The shiitake mushroom powder experiment produced a distinctive mushroom aroma, a rich umami taste, and a fine texture. The shrimp shell waste powder experiment yielded a fragrant aroma with no unpleasant odor, a savory flavor, and a soft texture. The resulting powders are presented in Figure 1.

Figure 1. Milkfish Powder, Shiitake Mushroom Powder, and Shrimp Waste Powder.
Source: Analysis Results (2025)

The results presented in Figure 2 show the appearance of the flavor enhancer made from milkfish with the addition of shiitake mushroom powder, based on the assigned sample codes. Sample A0 served as the control and did not contain any added shiitake mushroom powder.

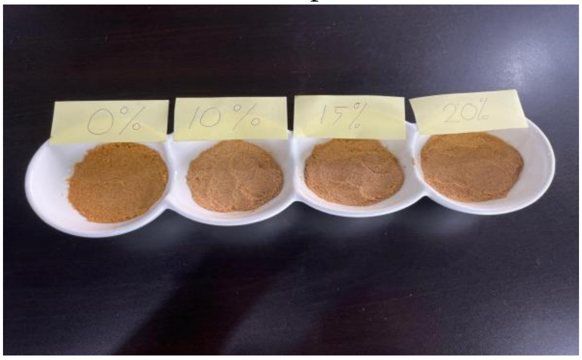

Figure 2. Flavor Enhancer Results (0%, 10%, 15%, and 20% Shiitake Mushroom Powder)
Source: Analysis Results (2025)

Samples with higher concentrations of shiitake mushroom powder exhibited a noticeably paler color compared to those with lower concentrations. The higher the concentration of shiitake mushroom powder, the paler the resulting color, as shiitake mushroom powder has a lighter natural hue compared to milkfish powder (Figure 1). In terms of aroma, all samples were predominantly characterized by the scent of milkfish. However, as the concentration of shiitake mushroom powder increased, the intensity of the milkfish aroma slightly decreased, though not significantly. Samples with lower shiitake concentrations retained a stronger milkfish aroma compared to samples A3 and A4. This is likely due to the inherently stronger smell of milkfish powder, which is not easily masked by the relatively mild aroma of shiitake mushroom powder at lower concentrations.

Regarding taste, all samples maintained a base savory flavor derived from the milkfish. The addition of shiitake mushroom powder did not significantly affect the taste of the seasoning; thus, the flavor profile remained largely dominated by the milkfish component despite the variation in mushroom powder concentration.

In terms of texture, a higher concentration of shiitake mushroom powder contributed to a finer texture in the seasoning. However, it also introduced a slightly gritty sensation in the mouth. Sample A1 showed no noticeable change in texture, while Sample A2 began to exhibit early signs of texture alteration. Samples A3 and A4 showed more pronounced changes in texture, including lower expansion capacity and a higher presence of fibrous granules.

Table 2. Recapitulation of Organoleptic Test Results
Source: Analysis Results (2025)

Sampel Code	Color	Aroma	Taste	Texture
A1	3,25 ± 0,60	2,79 ± 0,74	3,25 ± 0.81	3.33 ± 0,66
A2	3,17 ± 0,52	2,88 ± 0,70	3,21 ± 0,71	3,35 ± 0,63
A3	3,12 ± 0,76	2,90 ± 0,83	3.08 ± 0,77	3.27 ± 0,71
A4	3,29 ± 0,71	3,04 ± 0,68	3.20 ± 0.76	3,37 ± 0,64

Source: Analysis Results (2025)

Based on Table 3, Sample A4, which contained 20% shiitake mushroom powder, showed the least color deviation compared to the control sample. This indicates that the addition of 20% shiitake mushroom powder had minimal impact on the color. Similarly, Sample A2, with a 10% addition of shiitake powder, also displayed a color that closely resembled the control. In contrast, Sample A3, containing 15% shiitake mushroom powder, showed the most significant color difference, suggesting that the 15% concentration had a greater effect on altering the sample’s color.

The aroma of each sample also changed progressively with increasing concentrations of shiitake mushroom powder—at 10%, 15%, and 20%. Sample A4 (20%) exhibited the most noticeable change in aroma compared to the control, although the overall difference remained relatively subtle. As the concentration of shiitake mushroom powder increased, the aroma of the sample became more distinct from the control, with Sample A2 (10%) being the most similar in scent. These results suggest that the addition of shiitake mushroom powder alters the aroma of the seasoning powder, with higher concentrations resulting in a more pleasant and enriched fragrance.

D. Conclusion

The addition of shiitake mushroom powder to the milkfish-based seasoning did not significantly affect the product’s color, aroma, taste, or texture. As the concentration of shiitake mushroom powder increased, the seasoning's color became lighter due to the naturally paler hue of shiitake mushroom powder compared to milkfish powder. Sample A4, containing 20% shiitake mushroom powder, exhibited the least noticeable color difference compared to the control, while Sample A3, with 15%, showed the most pronounced color change. In terms of aroma, all samples were still dominated by the scent of milkfish. However, the more shiitake mushroom powder was added, the more the milkfish aroma diminished, although the difference was not substantial.

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