



## **Utilization Of Shrimp Shell Waste As A Flavor Enhancer: An Outreach Program At Penang Malaysia**

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**Abstract.** *Penang, one of the 13 states in Malaysia, is renowned for its shrimp farming, which generates a substantial amount of waste, primarily in the form of shells, heads, and other inedible parts. High shrimp production, such as the 10,477.62 metric tons produced in 2015, significantly contributes to the local economy but also poses environmental challenges like water pollution, foul odors, and disease risks if the waste is not properly managed. This protein and glutamate-rich shrimp waste can be processed into natural flavor enhancer powder to replace MSG, reducing waste while providing economic and educational benefits to the community. The processing involves cleaning, boiling with salt and sugar, grinding, straining, and drying until it becomes a fine powder. From 2 kg of raw materials, about 500 grams of dried or powdered shrimp flavor enhancer can be produced, depending on the level of drying and final processing. This program aims to reduce pollution, increase community income, and serve as an educational reference.*

**Keywords:** *Shrimp Waste, Flavor Enhancer, Waste Reduction, Community Education, Food Innovation.*

### **INTRODUCTION**

Penang is one of the 13 states in Malaysia, located near the northwest coast of Peninsular Malaysia. The state of Penang consists of two parts: Penang Island and the mainland, Seberang Perai. The island has an area of 285 square kilometers and is connected to Seberang Perai by ferry and two bridges, the Penang Bridge (13.5 km long) and the Sultan Abdul Halim Mu'adzam Shah Bridge (24 km long) (Official Portal Penang State Government, n.d.).

Penang produces a significant amount of shrimp waste due to its large shrimp farming activities. Brackish water shrimp farming is the largest contributor in terms of

value. Penang is the second-highest shrimp producer in the country after Sabah and has the highest wholesale value of shrimp production in the nation. In 2015, Penang produced 10,477.62 metric tons of Hawaiian white shrimp worth RM268.970 million (Vaghefi, 2017).

This high volume of production generates a substantial amount of shrimp waste, including shells, heads, and other inedible parts. The waste from the shrimp industry can pose environmental challenges if not managed properly. Uncontrolled waste disposal contributes to water pollution, creates foul odors, reduces soil quality, increases the risk of disease for nearby communities, and can damage natural habitats such as mangroves.

Shrimp waste, which includes heads, shells, and tails, can be turned into high-value products. Shrimp waste can be used in the medical field for wound dressings and cosmetics; in agriculture as fertilizer; in food as flavor enhancers; in animal husbandry as feed; and in the environment for water purification. Processing shrimp waste reduces the amount of waste disposed of in the environment, decreasing potential pollution and ecosystem damage. Additionally, products made from shrimp waste have high economic value and can create new business opportunities and jobs for local communities. Nguyen et al (2014) mentioned that shrimp heads and shells can be processed into broth that adds a savory flavor to dishes.

Penang Island is rich in fish resources. The marine sector is a source of economic livelihood for the villages around Penang Island, leading to a significant amount of waste in the marine sector, particularly shrimp heads and shells. Shrimp heads are rarely utilized and are often considered waste, typically used as animal feed. Shrimp shells are a source of chitin, containing 20-30% chitin by dry weight. Additionally, shrimp heads are rich in nutrients, with a protein content of 43.12% (Rathore, 2018). Shrimp head waste can be used as a flavor enhancer, replacing MSG.

Shrimp heads and shells can serve as alternative ingredients to replace MSG. Shrimp has a delicious and strong umami flavor that enhances the overall taste of food. This strong and savory flavor is due to the glutamic acid in shrimp. The glutamate in shrimp is formed from the hydrolysis of proteins in shrimp heads with the acid contained in dextrin. The hydrolysis process yields glutamine, which deaminates into glutamate, giving the food a savory taste (Meiyana et al., 2014). Therefore, shrimp can be used as a natural flavor enhancer in food.

Observations have shown that in Penang Island, shrimp waste management is not well managed. Therefore, to utilize the existing waste, a community service team is motivated to provide education on the use of shrimp heads and shells as natural flavor enhancers.

Based on the explanation and observations above, the objectives and benefits of the activity are:

**Objectives:**

1. To identify the utilization of shrimp waste from the marine sector in Penang, Malaysia.
2. To serve as an effort to make use of shrimp waste from the marine sector in Penang, Malaysia.
3. To educate the general public on processing shrimp waste into something useful for daily use or even for business development.

**Benefits:**

## For Students

1. Enhancing knowledge and skills, particularly related to the creation of natural seasonings.
2. Serving as a reference for other students.

## For the Community

1. Reducing the amount of shrimp waste and maximizing its benefits.
2. Educating the general public on the utilization of shrimp waste as a natural flavor enhancer.
3. Incorporating the findings of this activity into small businesses to increase community income

**METHODS**

This Independent Overseas Collaborative KKN program was created by the Institute for Research and Community Service (LP2M) of Universitas Islam Negeri Sunan Gunung Djati Bandung, which was held for 4 weeks from the 1st to the 28th of July 2024. The location of this KKN service covers several areas around Gelugor, Bukit Jambul, Bayan Lepas to Teluk Bahang, Penang Province, Malaysia. The method of implementing this KKN activity is as follows: (1) Survey potential by reviewing articles and browsing on the internet related to the potential of shrimp waste around Penang, Malaysia. After arriving in Penang, we observed areas with considerable shrimp waste potential and made observations in several areas, especially coastal areas. (2) Creating an activity plan by starting to process shrimp waste into something more useful. (3) Implementation by conducting socialization to the community around Penang Island about the potential utilization of shrimp waste in the environment around them. (4) Discussion and Evaluation about the results.

**1. Cycle I: Potential Analysis and Observation**

The first cycle of the independent collaborative KKN provided by LP2M UIN Sunan Gunung Djati began with an analysis of the potential of durian waste through various sources, both direct and indirect. This analysis and observation covered several aspects:

- a. Resource Potential: Based on the data found, Penang is one of the areas with considerable marine resources, especially in coastal areas.
- b. Waste Composition: We examined the composition of shrimp waste, especially the skin and head, which has nutritional content and potential to be processed into flavoring products.
- c. Processing Methods: This includes estimating the methods that can be used to process shrimp waste that can be done by various groups of people and can be a home-based product.
- d. Direct vendor interviews: We visited seafood restaurants on the coast. We also conducted interviews with the restaurant owners to obtain information on how the waste is usually disposed of or utilized.
- e. Sample collection: It is important to ensure that the waste collected is viable and can be tested as a flavoring ingredient.

## 2. Cycle II: Product Creation

**Materials:** The production of flavor enhancers from shrimp heads and shells requires several tools such as a blender or food processor, a large pot, stove, strainer, plastic containers/storage, kitchen scale, knife, cutting board, and spatula. The necessary ingredients include shrimp heads, shrimp shells, shallots, garlic, cornstarch, salt, sugar, pepper, and other optional seasonings.

### Production of Flavor Enhancer

1. Preparation of Ingredients  
Clean the shrimp heads and shells under running water to remove dirt and any remaining flesh, then drain until no water drips.
2. Boiling  
Place the shrimp heads and shells into a large pot and add 3 liters of water. Boil the mixture until it reaches a rolling boil for about 30 minutes. During boiling, add salt and sugar according to taste, as well as any additional seasonings if used. Stir occasionally to ensure all ingredients are well mixed.
3. Grinding  
Once boiling is complete, remove the pot from heat and allow it to cool slightly. Then use a blender or food processor to grind the boiled shrimp heads and shells until they form a smooth paste.
4. Straining  
Strain the mixture to separate the liquid and solid parts. The liquid can be used directly as a liquid flavor enhancer, while the solid part is reserved for the next step.
5. Drying  
Spread the strained solids on a drying tray. Dry them using an oven at 60°C for several hours until completely dry, or sun-dry them under direct sunlight until dry, making sure to turn the mixture occasionally to ensure even drying.

#### 6. Final Grinding

Once dry, grind the material again using a blender or food processor until it becomes a fine powder. Sift the powder to ensure there are no lumps remaining.



**Figure 1.** Processing shrimp shells and heads into flavor enhancers involves several steps, including cleaning, drying, and grinding.

Using this method with 2 kg of raw materials (1 kg shrimp heads and 1 kg shrimp shells), 3 liters of water, 100 g of salt, and 5 g of sugar, it is estimated that approximately 500 grams of dried or powdered shrimp flavor enhancer can be produced, depending on the level of drying and final processing.

#### 3. Cycle III: Product socialization

Product socialization was carried out around Penang by all KKN group members aimed at the Penang community. This socialization explains how to process shrimp waste into flavoring, and the benefits of utilizing shrimp waste. This socialization is expected to increase public awareness about the importance of processing waste creatively and productively. This socialization was carried out by distributing brochures, presentations, and discussions.

#### 4. Cycle IV: Discussion and Evaluation about the results

The socialization of shrimp waste processing activities carried out received a positive response from the Penang community. The results of the shrimp waste processing, as well as various responses from the community, were evaluated to review each stage in the processing of durian waste, from collection, processing, to the final product. We used qualitative tests that measured the quality of the processed products, the efficiency of the processing process, and the community response.

## RESULTS AND DISCUSSION

This study aimed to identify the utilization of shrimp waste from the marine sector in Penang, Malaysia. We successfully processed shrimp shells and heads into a flavor enhancer that can be used in various dishes. Additionally, this effort was aimed at making use of shrimp waste from the marine sector in Penang, Malaysia, as part of waste reduction and food innovation.



**Figure 2.** Distribution of brochures about shrimp waste processing to the community around Universiti Sains Malaysia.

We conducted outreach to the community around Universiti Sains Malaysia (USM) by distributing brochures containing information on how to process this waste. The brochures were distributed to about 25 people. The response from the audience was quite positive, showing significant interest in this innovation. This education aimed not only to reduce waste but also to teach the general public how to process shrimp waste into something useful for daily use or even for business development.

Thus, this study not only successfully identified ways to utilize shrimp waste but also provided practical solutions that are easy to implement at home, thereby increasing public awareness and participation in waste management.

### **Results of Shrimp Waste Processing into Flavor Enhancer**

Shrimp waste, particularly the heads and shells, is rich in valuable components such as protein, amino acids, and minerals, making it an ideal material for flavor enhancers. Utilizing this waste not only reduces environmental issues but also adds economic value (Akbar & Riyadi, 2017). The process of making flavor enhancers involves cleaning, boiling, grinding, filtering, drying, and final grinding. From 2 kg of raw material, consisting of 1 kg of shrimp heads and 1 kg of shells, 500 grams of flavor enhancer powder are produced.

The process begins with cleaning the shrimp heads and shells to remove dirt and any remaining meat. Then, the shrimp heads and shells are boiled in 3 liters of water for 30 minutes to extract the flavors. Salt, sugar, red onion, and garlic are added to enrich the taste. After boiling, the mixture is cooled and ground into a fine paste, which is then filtered to separate the liquid and solid parts. The resulting liquid can be used as a liquid flavor enhancer, while the solids are reserved for the drying stage.

The filtered solids are dried using an oven at 60°C or sun-dried until completely dry. Drying aims to reduce moisture content, making the product more durable and easier to process. Oven drying produces a reddish-white color with a savory, salty taste and a slight shrimp aroma. Once dried, the solids are ground again into a fine powder, creating a homogeneous and high-quality flavor enhancer. This process ensures there are no remaining lumps, maintaining the quality and stability of the final product.

### **Effectiveness of Shrimp Flavor Enhancement Products**

Basically, the flavor of this product is not too perfect, since this product is made by a processed waste. But for us, it is better than nothing impact at all since the waste that can be recycle is great for our environment.

However, based on nutrition, this product contain quite good nutrition, such as protein, chitin, calcium carbonate, and others. This product has a long life of up to 6 months when stored in a right condition such as dry place and sealed. (Saman et al, 2024)

### **Impact on Environment and Society**

The processing of shrimp shells and heads has a significant impact on the environment and society. From an environmental perspective, this processing helps reduce pollution and we can utilize bioactive compounds such as chitin, protein, lipids, carotenoids, and minerals found in the waste. Waste from shrimp ponds with the production of shell less shrimp that can pollute the air, and reduce oxygen levels, will endanger aquatic life, and disrupt the ecosystem. Additionally, this process can reduce greenhouse gas emissions resulting from the decomposition of organic waste. For society, processing shrimp waste enhances economic welfare by creating new jobs and additional sources of income. Good waste management also improves public health by reducing the risk of disease due to polluted environments. Furthermore, this program raises public awareness and education about the importance of waste management and sustainability, and encourages the development of new

technologies in waste processing. Thus, processing shrimp waste not only reduces environmental pollution but also provides significant economic and health benefits to society (Nirmal et al, 2020).

### **Society Response and Acceptance**

According to our product distribution to people in Penang, this product was accepted enthusiastically. Whenever we were doing this distribution, several people seemed to be enthusiastic for accepting the product and brochure, several even asked how we came up with this great idea to utilize shrimp waste. Some even responded with giving an idea for developing this idea further if we have more time and resource.

Eventually, society's response is very good about our project. This shows a great potential to be developed further and probably this product can be accepted widely in the market.

### **Challenges and Opportunities in Shrimp Waste Processing**

The processing of shrimp waste faces several challenges that need to be addressed to achieve greater success. One of the main challenges is the limited technology and facilities available in the local area. Most communities still rely on traditional methods that are not always efficient in processing shrimp waste into high-value products. For instance, drying and grinding processes that require specialized equipment are often not locally available, thus hampering production capacity. Additionally, the lack of awareness and knowledge about the economic benefits of shrimp waste processing poses a significant barrier. Many community members still see shrimp waste as something to be discarded rather than a resource that can be processed (Saiya & Katoppo, 2015)

Despite these challenges, there are significant opportunities to develop the shrimp waste processing industry. With the growing global awareness of the importance of sustainable waste management, shrimp waste processing can become an innovative solution that attracts attention from investors and governments. New technologies, such as the use of enzymes to break down shrimp waste components into high-value materials, open up opportunities for further research and development. Additionally, with support from the education and training sectors, local communities can be empowered to adopt more efficient waste processing practices. Partnerships between government, academia, and the private sector can also drive the growth of this industry, creating new job opportunities and boosting the local economy (Nguyen et al, 2014).

## **CONCLUSION**

In this study, we successfully processed shrimp shells and heads into a flavor enhancer that can be used in various dishes. We conducted outreach to the community around Universiti Sains Malaysia (USM) by distributing brochures containing information on how to process this waste. The brochures were distributed to about 25



people. The response from the audience was quite positive, showing significant interest in this innovation. Besides being a form of waste reduction, processing shrimp shells and heads into a flavor enhancer is also easy to do at home, making it a practical solution for household waste issues.

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