Physicochemical Characteristics of Freshwater Mussel 
(Pilsbryoconcha sp.) Shell from Sungai Paku Village Riau Province Indonesia

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Abstract. Freshwater mussel (Pilsbryoconcha sp.) shell is an untapped solid waste. Information about its nutritional value is necessary to investigate. Therefore, this research aimed to determine the physicochemical characteristics of freshwater mussel shell flour from Sungai Paku Riau Province Indonesia. The freshwater mussel shell was taken from Sungai Paku village. The sample preparation of freshwater mussel shell was made into flour and analyzed for physical characteristics (a yield, water absorption, whiteness degree) and chemically analyzed (moisture, ash, fat, protein, carbohydrate, crude fiber, and calcium content). Based on physical characteristics the freshwater mussel shell flour contained a yield 58%, water absorption 1.67%, whiteness degree 35.49% \( (L^* = 35.81, a^* = 2.66, b^* = 5.86) \), meanwhile based on chemical characteristics the freshwater mussel shell contained moisture, ash, fat, protein, carbohydrate \( \text{(by difference)} \), crude fiber, and calcium content was 0.41%, 93.01%, 0.18%, 3.44%, 2.97, 1.89%, 61.39%, respectively. It was found that the freshwater mussel shell from Sungai Paku, Riau contained the nutritional value, especially high in calcium content.

1. Introduction

Freshwater mussel (Pilsbryoconcha sp.) or ‘Kijing’ we called in Indonesia is one of the types of freshwater mussels from mollusk phylum that are often found in freshwater, especially in lakes, rivers or aquaculture ponds. Sungai Paku Village is one of the villages in Kampar Kiri Subdistrict, Kampar Regency which has a privilege compared to other villages because it has abundant fishery products. Fisheries production in this village includes catches in rivers and has developed very rapidly. Among the species produced in this village are kijing, which are freshwater mussels that develop naturally along the Sungai Paku River and which are kept in fishponds intercropping to utilize food scraps that are not eaten by fish that fall into the bottom of the waters.

The freshwater mussel usually lives at the bottom of the waters or attaches to the substrate in waters. According to [1] state that freshwater shells are included in the mollusk phylum and the Bivalvia class, where these shells live in rivers and lakes and are valuable as focal species for conservation assessments, and they are management considerations for their ecosystem functions and distributions in imperiled habitats. Moreover [2] augment that Mollusks also play an important role in the accumulation of nitrogen, carbon, and calcium. Furthermore, [3] explain a mussel is a simple, soft-bodied animal enclosed by two shells (hence bivalves or shellfish) connected by a ligament. The shells are formed out of dissolved minerals, largely calcium carbonate (limestone), extracted from their...
The freshwater mussel has been used as a source of protein for fish feed and also as a side dish for people who live around the Sungai Paku village. However, utilization is still limited to the use of meat only, while the freshwater mussel shell (Figure 1) has not been utilized. Shell of Freshwater mussel is one form of solid waste that is rich in calcium minerals [4], [5]. According to [2], state that the calcium content found in bivalve shells is 37%, and calcium in freshwater mussel shells is 26% [6], and 383631 µg/g DW [7].

Figure 1. Freshwater mussel (Pilsbryoconcha sp.) shells

The high calcium content in mussel shells means that the freshwater mussel shell in the Paku river water is one of the sources of functional food products, and calcium is one of the essential minerals that have an important role in the body where calcium is very beneficial for the fulfillment of nutrition which is not only for children but also adults. According to [8], the body contain 98% calcium in the bones; furthermore, calcium is essential to maintaining total body health, building strong bones and teeth, blood clotting, nerve impulse, transmission, regulating heartbeat and fluid balance within cells. The requirements are greatest during the period of growth such as childhood, during pregnancy, when breastfeeding. Long term calcium deficiency can lead to osteoporosis in which the bone deteriorates and there is an increased risk of fractures. Eating well can provide all nutrients and help prevent calcium deficiency. [9] taught in children and adolescents, low intake or low absorption of calcium may limit their natural growth, and it is necessary to supply sufficient quantities during the critical growth phases. Therefore, this research aimed to determine the physicochemical characteristics of freshwater mussel (Pilsbryoconcha sp.) shell flour from Sungai Paku Riau Province Indonesia.

2. Materials and Methods

This research was conducted from April until August 2019. The freshwater mussel shell was taken from Sungai Paku village. The sample preparation of freshwater mussel shell was made into flour and analysed for physical characteristics (a yield, water absorption, whiteness degree) and chemically analysed (moisture, ash, fat, protein, carbohydrate, crude fiber, and calcium content). The observation was done in Fisheries product technology laboratory Universitas Riau and Research Center for Bioresources and Biotechnology (RCBIO) IPB University.

2.1. Materials and Equipment

The material used in this study was freshwater mussel shells, H2SO4, Copper complexes, H2O, Phenolphthalein Indicator, 50 % NaOH, 2% H2O2, Methyl Red-Methylene Blue indicator, 0.1 N HCl, and dietil eter. The equipment used in this study includes porcelain, desiccator, oven, furnace, Kjeldahl flask, Fume hood, Volumetric Flask, Erlenmeyer, soxhlet extractor, water bath, and Chroma meter.
2.2. Production of Freshwater Mussel Shell Flour
The freshwater mussel shell was taken from Sungai Paku village cleaned, reduced the size of about 1-2 cm and processed into flour (Figure 2).

![Manufacturing Process of Freshwater Mussel Shell Flour](image)

2.3. Physicochemical Analysis
The sample preparation of freshwater mussel shell was made into flour and analyzed for physical characteristics (yield, water absorption, whiteness degree) and chemically analyzed (moisture, ash, fat, protein, carbohydrate, crude fiber, and calcium content) according to [10].

2.4. Data Analysis
Data physical and chemical characteristics of freshwater mussel shell flour were presented in tabular and figure form. The data were analysed with descriptive analysis and compared to previous research.

3. Results and Discussions
3.1. The yield of freshwater mussel shell
Yield is a comparison between end products (freshwater mussel shell flour) with the main raw material (freshwater mussel shell). The yield of the product can be used as a very important parameter to know the economic value of a product. The yield of freshwater mussel shell flour from Sungai paku village was 58%. The results of the yield analysis of freshwater mussel shell flour from sungai paku village were higher (42.82%) than the research conducted by [11]. It is shown that the waste of freshwater mussel shells from Sungai Paku village has considerable potential to be developed but its utilization is not yet optimum, because the higher the yield of a product can be said that the product has a high economic value.
3.2. Water absorption
The freshwater mussel flour from Sungai Paku village contained water absorption 1.67%. Water absorption is a parameter that indicates the amount the ability of a material to attract water around it to bind to particle ingredients or stick to the pores between material particles.

3.3. Whiteness degree
The whiteness degree of freshwater mussel shell 35.49% (L*=35.81, a*=2.66, b*=5.86). The resulting flour has a slightly blackish white color. The color of the flour produced is thought to come from the natural color of the freshwater mussel shell.

3.4. Chemical content
The chemical content of freshwater mussel shells from Sungai Paku village can be seen in Table 1.

| Parameter      | Average value (%) |
|----------------|-------------------|
| Moisture       | 0.41              |
| Protein        | 3.44              |
| Fat            | 0.18              |
| Ash            | 93.01             |
| Carbohydrate   | 2.97              |
| Crude fiber    | 1.80              |
| Calcium        | 61.39             |

Table 1 shows that the freshwater mussel shell from Sungai Paku village contained 0.41% of moisture content. This result a little higher than the moisture content of the Blood cockle (*Anadara granosa* Linn) shell in Kenjeren Surabaya 0.31% [12]. The relatively low water content in the bivalve shell is thought to be caused by shell characteristics that have a solid texture and are composed of lime. Other than that, the low moisture content due to the shell had been dried under sunlight in sample preparation.

The calcium content of freshwater mussel shells from Sungai Paku village was 61.39%. The highest calcium content in the shell also reported by [13] in freshwater clam (*Egeria radiata*) shell 61.78%. However, calcium content was found to be higher than a shell of *Sinanodonta woodiana* 26.6% [6], Asian moon scallop (*Amusium pleuronectes*) 28.25% and Green mussel (*Perna viridis*) 29.35%. As well as the ash content also was found to be higher in freshwater mussel shell 93.01% than Asian moon scallop (*Amusium pleuronectes*) 58.50% and Green mussel (*Perna viridis*) 58.80%. Meanwhile for moisture content was found to be lower 0.41% than a shell of Asian moon scallop (*Amusium pleuronectes*) 0.83% and Green mussel (*Perna viridis*) 0.65% [14].

The freshwater mussel shell from sungai paku village contained a fat content of 0.18%. These results are not much different from the fat content of crab shell flour 0.19% [15]. The fat on freshwater mussel shells thought to originate from the periostracum layer but the amount was not too high. The periostracum is the leathery outer layer of the shell, which protects the calcified shell surface from erosion and environmental factors It is thin and uncalcified which is consists mostly of organic materials [16].

4. Conclusion
The freshwater mussel (*Pilsbryoconha* sp.) shell from Sungai Paku village Riau province contained the nutritional value, especially high in calcium content. Therefore, it can be used for further processing.
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