

Implementation of Fish Pellet Production Using Palm Kernel Waste in Merangin Village, Kampar

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Abstract The community of Merangin Village, Kampar Regency, predominantly relies on fish farming for sustenance and has been facing notable challenges in cultivation, particularly concerning the costly factory-made pellets, which constitute a significant portion of production expenses. To address this, an alternative solution was autonomous fish pellet production using locally abundant palm kernel waste. Despite this, many community members lacked understanding of the production process and raw material processing. Through a community service program at the University of Riau, targeted technology transfer efforts aimed to empower residents to produce fish pellets independently. The program focused on enhancing knowledge through comprehensive guidance on pellet production. The implementation of this program was expected to enable Merangin Village residents to manufacture their own fish pellets, potentially enhancing income and fostering a sustainable fish farming venture. The implications of the program included optimized palm waste utilization, reduced production costs, increased income, and effective waste management. A locally designed fish pellet machine, boosting a production capacity of up to 50 kg/hour, facilitated community to control over production and reduced dependence on costly commercial options. The pellet formula integrated locally available ingredients such as bran, palm kernel cake, tofu dregs, fish waste, and kiambang. Educational campaigns and practical training sessions equipped fish farmers with the skills to operate the pellet machine, formulate recipes, and manage production effectively, thereby contributing to the socio-economic development of Merangin Village and other communities.

1. INTRODUCTION

Merangin Village is strategically located along the Pekanbaru-West Sumatra and Rokan Hulu Crossroads, providing connectivity to North Sumatra. Situated within Kampar Regency, Merangin Village is traversed by the Kampar River, endowing it with diverse potential and a rich array of natural resources. Additionally, the village is encompassed by the Bukit Barisan hills and encompasses the expansive reservoir of the Koto Panjang Hydroelectric Dam, presenting substantial prospects for floating net cage

farming (Yuliani, 2013).

The community occupations in Merangin Village, Kampar, predominantly revolve around agriculture, animal husbandry, and pisciculture. The piscicultural sector encounters recurring challenges, notably the elevated costs associated with commercial fish feed. A significant proportion of fish farmers heavily depend on commercially produced feed, resulting in an economic imbalance between total revenue and production costs. Notably, over 60% of

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the overall production costs are attributed to feed expenses (Astuti et al., 2020; Sari et al., 2017). Addressing this concern necessitates the exploration of alternative, high-quality, cost-effective, and locally accessible feed sources (Nikhilani et al., 2022). The high feed expenses can be mitigated by harnessing local environmental resources within Merangin Village, Kampar. One potential alternative is the utilization of waste derived from palm kernels as raw materials in the production of fish pellets. Adopting this alternative has the potential to reduce the costs associated with procuring traditional fish feed. This approach not only addresses the economic aspect but also demonstrates sustainable practices by repurposing waste materials for beneficial use in aquaculture.

The protein content of palm kernel waste ranges from 13.6% to 17.45%, and its fat content is approximately 17.1% to 21.55% (Pratama et al., 2023). Feed ingredients derived from plants are known to contain several indigestible components for fish, such as non-starch polysaccharides (NPs) and anti-nutritional factors (ANFs). One method to enhance the utility of protein and reduce indigestible components in palm kernel waste is through the fermentation process, which provides added value as a fish feed ingredient (Samsuar & Chairunisa, 2021; Yustina et al., 2019).

The utilization of palm kernel waste fermentation technology as fish feed is expected to offer a solution to the challenges faced by fish farmers in Merangin Village. This community engagement aims to improve the understanding and skills of the community regarding the application of fermented feed technology for environmentally friendly fish farming, increase revenue for partners involved in economic activities, and enhance the quantity and quality of cultured fish products.

2. METHOD

The community service activities were carried out by the community service team and students from the Chemical Engineering Program of the University of Riau. They began with a situational analysis at the activity location involving fish farmers to identify the most crucial health issues and the most influential factors.

The team then developed a problem-solving plan in collaboration with the community in Merangin Village, Kampar. The community service activities were implemented after completing the licensing and administrative processes. The following are the specific activities conducted:

1. Identification of the needs of fish farmers in Merangin Village, Kampar with in-depth interviews
2. Identification of potential raw materials available in Merangin Village and formulation of fish pellet recipes
3. Education on fish pellet production for the residents of Merangin Village, Kampar.

Protein and fat levels were analyzed at the Agricultural Product Analysis Laboratory, Faculty of Agriculture,

University of Riau to assess the nutritional content of the fish pellet formula. The team also evaluated the participants' level of knowledge after the education on fish pellet production.

3. RESULT AND DISCUSSION

The community empowerment program, implemented in Merangin Village, Kuok District, Kampar Regency, embraced a two-stage approach between June and November 2023. Stage one focused on development solutions and community empowerment. In contrast, stage two encompassed the implementation of activities such as designing a fish pellet machine, developing fish pellet formulas, and knowledge sharing on fish pellet production.

3.1 Development solution (empowerment) for the community

The community service team from the University of Riau, through the 2023 Community Service Program, aims to address unresolved issues in the development of fish farming within the community, specifically in Merangin Village, Kampar. Fish farmers face challenges in maintaining and cultivating fish, particularly the high cost of pellets, which constitute almost 60–70% of the total expenses (Akbar & Adriani, 2023). Farmers have expressed concerns about the increasing prices of commercial pellets (12,600/kg), while the selling price of fish remains constant or may even decrease (19,000/kg). To mitigate pellet costs, the solution proposed by the University of Riau team, in collaboration with community partners in Merangin Village, is to create homemade pellets utilizing palm waste as a raw material.

The team's solution involves designing a fish pellet-making device, discovering the appropriate pellet formula, and conducting awareness campaigns on how to use the device. This program aims to provide a practical solution for developing and empowering fish farming communities in Merangin Village. The multi-faceted approach addresses both technological and educational aspects to enhance the overall effectiveness of the initiative.

3.2 Activity implementation process

The community service program implemented in Merangin Village aims to provide information and knowledge to the community and business units regarding the production of fish pellets. The community engagement activities consist of three main components: designing a pellet-making machine, formulating fish pellet recipes, and evaluating program achievement on fish pellet production.

3.2.1 The design of fish pellet machine

The first phase is designing the fish pellet machine. In this design phase, we collaborated with a micro, small, and medium enterprise (UMKM) in the Riau Province, namely Mr. Gunawan, who was one of the winners of the appropriate technology innovation competition in the Riau Province. Collaboration with UMKM is also crucial as it can have a positive impact on the community's economy (Muna et al., 2022). Through discussions, we obtained the

design for the pellet machine, which utilizes a diesel engine (6 Hp) with a production capacity of up to 50 kg/hour and a dimension of 1640 x 825 x 1100 mm. The design of the pellet-making device can be seen in Figure 1.



Figure 1 . Fish pellet machine

3.2.2 Fish pellet formula development

The second phase is creating a fish pellet formula following SNI 7548:2009. The formulation of pellet ingredients is adapted based on the available raw materials in the vicinity of Merangin Village, Kampar. Survey results indicate the presence of several raw materials such as bran, palm kernel cake, tofu dregs, fish waste, and kiambang (*Pistia stratiotes*). Research on pellet production collaborates with the Laboratory of Natural Resources and Mineral Technology, Faculty of Engineering, University of Riau.

The pellet formulation utilized in this community service project consisted of 20% bran, 20% palm kernel cake, 20% tofu dregs, 20% fish waste, and 20% kiambang (*Pistia stratiotes*). Pellet production commenced with a 2-day fermentation process of the palm kernel cake using EM4 + sugar. Subsequently, all the raw materials were dried and mixed with sago flour as a binder. Finally, the fish pellets were formed using a pelletizing machine. The resulting pellets are tested for nutritional content at the Agricultural Results Analysis Laboratory, Faculty of Fisheries, University of Riau, as shown in Figure 2 and Table 1



Figure 2 . Fish pellet products

Table 1 . Proximate analysis fish food using palm kernel waste

Content	Fish Food using Palm Kernel	SNI
Protein(%)	34.86	min 30
Fat (%)	6.71	min 5
Fiber (%)	6.48	max 8

Table 1 shows that the experimental feed made with fermented palm kernel cake complies with the Indonesian National Standard (SNI), making it directly applicable to fish ponds. The formulated fish pellet has been tested and proven suitable for both patin (pangas catfish) and lele (catfish) species. The fermentation process aids in improving feed digestibility; the microbes in EM4 can produce enzymes that work on the fermented material. These enzymes make the nutrients more easily absorbed and utilized, resulting in better growth than non-fermented feed (Bibin et al., 2021).

3.2.3 Knowledge sharing on fish pellet production

The third phase involves conducting knowledge sharing on fish pellet production for fish farmers in Merangin Village, Kampar (as shown in Figure 3). In this session, the community service team introduced and explained the process of making fish pellets using natural materials available in the surrounding environment and provides Standard Operating Procedures (SOP) and Work Instructions (WI) to the fish farmers.



Figure 3 . Fish pellet production knowledge sharing

In this phase, a dedicated website for Merangin Village, Kampar, is also created to showcase its potential, as illustrated in Figure 4.

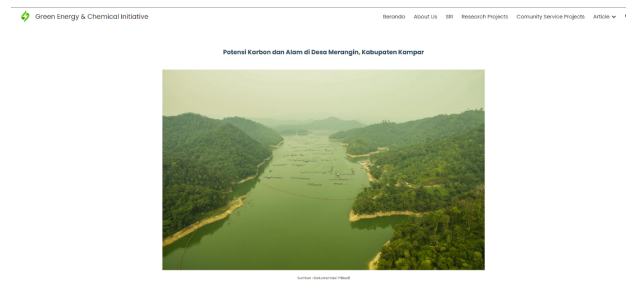


Figure 4 . Merangin Village website

The village website is built to serve as the official public service platform for the village and is constructed and managed by the local village team. Utilizing the website facilitates the provision of public services quickly and easily. In essence, as an information management tool,

the village website serves as a public information medium accessible online. The village government can utilize the website as an informational platform covering the village's profile, village news, village gallery, and village statistics (Anggraeni & Muslihudin, 2020).

4. CONCLUSION

This community service project successfully addressed the challenges fish farmers faced in Merangin Village, Kampar Regency, by empowering them to produce their own fish pellets using readily available and cost-effective resources. A fish pellet machine was designed with a UMKM partner, utilizing a diesel engine and boasting a production capacity of up to 50 kg/hour. This empowered the community with control over pellet production and reduced reliance on expensive commercial options. Locally available ingredients like bran, palm kernel cake, tofu dregs, fish waste, and kiambang were incorporated into the fish pellet formula. This has promoted sustainability and reduced dependence on external resources. Educational campaigns and practical training sessions equipped fish farmers with the skills and knowledge to operate the pellet machine, formulate the recipe, and manage production effectively. This has fostered self-sufficiency and long-term sustainability within the community.

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CONFLICT OF INTERESTS

The authors declare that there is no conflict of interest.

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