Solar Fish Dryers as a Solution for Improving the Quality of Fisheries Products to Support Green Technology during the Pandemic Covid-19

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Keywords: Green Technology, Fish Dryers, Fisheries.

Abstract: The fishing communities in "Sungai Rasau" village, South Kalimantan, Indonesia, have several joint business groups that mostly process their fish catch into salted fish products and shrimp paste for sale in the market. The fish drying technique still uses traditional methods that rely on sunny weather, this is not effective because the weather is difficult to predict due to climate change globally. This means that high rainfall affects fish drying production activities. If left unchecked, this certainly results in a decrease in the quantity and quality of salted fish production and affects their income and welfare. To maintain and improve the quality of raw materials for fisheries production, the solution is the use of appropriate technology, namely making salted fish processing equipment or dryers that are energy efficient and not influenced by weather factors such as rain. Using this tool can improve the quality and quantity of production. The form of activity methods carried out include (1) coordination with related parties to foster local fishing groups; (2) identify problems and determine solutions; (3) solar fish dryer design; (4) making efficient technology fish dryers that effectively and efficiently utilize solar energy.

1 INTRODUCTION

As the largest archipelagic country in the world with 2/3 of its territory is the sea, Indonesia has a large area of sea, coast, and small islands that are strategically significant as pillars of national economic development. Specifically for fish catches, Indonesia's potential is very abundant so that it can be expected to be a leading sector of the national economy. The potential of captured fish can be consumed by Indonesian citizens and can even be exported abroad. To get a good level of sales, of course, must be balanced with quality processed products.

Sungai Rasau Village is one of the coastal and densely populated villages in the prosperous sub-district of Tanah Laut regency with a population of 2,044 inhabitants. About 70% of the population earns a living as fishing and fishing laborers. Rasau river village has the potential to develop fisheries and maritime businesses because it is in the Java seafront position.

Figure 1: Location Map.

The headman of Sungai Rasau Village as shown in figure 1 has a plan to solve the problems faced by fish processing groups in tidying up:

Risa, M., Irawan, A., Pratomo, A., Khalid, A. and Fauzi, Y.
Solar Fish Dryers as a Solution for Improving the Quality of Fisheries Products to Support Green Technology during the Pandemic Covid-19.
DOI: 10.5220/0010965500003260
In *Proceedings of the 4th International Conference on Applied Science and Technology on Engineering Science (iCAST-ES 2021)*, pages 1365-1369
ISBN: 978-989-758-615-6; ISSN: 2975-8246

- Improving the quality of salted fish and other sea products (quality) that have fallen due to fungal attacks when raw materials have not been dried up.
- Increase salted fish production (quantity) which decreases when rainfall is high.
- Utilization of cheap new renewable energy sources

Figure 2: Traditional Drying Locations.

As shown in figure 2, the fish processing group in Sungai Rasau village still uses traditional methods in which the process of drying salted fish and other sea products is highly dependent on the weather. If the weather is uncertain, the drying process will be disrupted, because the results of dried fish and other marine products are very dependent on the sun's heat. Besides the problem of dependency on the weather, another thing that is a problem in the storage process of the product which is less than the maximum so that sometimes the product becomes damaged. The problems faced by the Fish Processing Joint Business Group (KUB) in Sungai Rasau Village, Tanah Laut South Kalimantan Regency are the inability in mastering the energy-saving salted fish processing technology sector and minimal funding problems.

Fish meat contains a good source of protein (15-20%), vitamins, carbohydrates, and other substances that are soluble in water (Sobukola and Olatunde, 2011). Fish is one type of food that contains water, where the water content in fish must be discarded. If fresh fish is not used directly or not processed into finished products, the fish will undergo a decay process (Sidhi et al., 2018). Proper handling of fish is needed so that the quality can be maintained. There are various methods of preserving fish such as fumigation, drying, salting, and freezing. The drying of food products is an important thing to increase resistance on degradation due to water activity reduction (Bellagha et al., 2002). Fish drying can be done by using traditional methods, namely open sun drying or solar drying using hot air. The open sun drying process has many disadvantages including long drying times, requires a large area, the quality of fish decreases due to dust, prone to animal disturbances such as flies, chickens, cats, and dogs and requires considerable labor (Setyoko and Darmanto, 2012). Comparing to open sun drying, the use of greenhouse dryers leads to reducing drying time up to 50% and a significant increase in product quality in terms of color, texture, and taste (Das and Tiwari, 2008). Solar dryer for fish products has been developed in several studies. Sengar, Khandetod, and Mohod (2009) examined solar dryers with the cost of dry shrimp (Kolambi) (Das and Tiwari, 2008). Bintang, Pongoh and Onibala (2013) made a solar fish dryer with a loading and unloading system (Bintang et al., 2013). Sidhi, Pujianto, Prasetyo, and Muhfizar (2018) conducted an experimental study of yellowtail fish drying under an active greenhouse dryer (Sidhi et al., 2018).

2 METHOD

To achieve its objectives, technology implementation activities in Sungai Rasau village will be carried out through several approaches including:

a. Participatory Rural Appraisal (PRA) model that emphasizes community involvement in all activities starting from planning, implementing, and evaluating program activities.
b. Participatory Technology Development Model that utilizes appropriate technology based on local cultural knowledge and wisdom.
c. A community development model is an approach that involves the community directly as the subject and object of the implementation of community service activities.

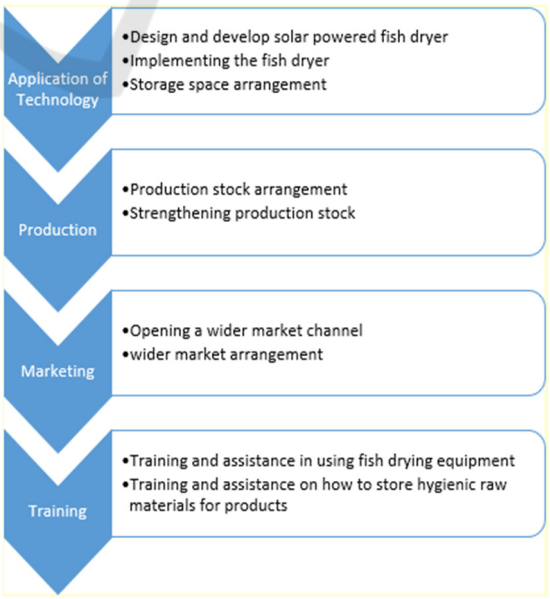

Figure 3: Activity Steps.

d. Persuasive is an approach that is appeal and support without coercion for the community to play an active role in this activity.
e. Educative namely the approach of socialization, training, and assistance as a means of transfer of knowledge and education for community empowerment.

3 RESULT AND DISCUSSION

3.1 Design

The solar fish dryer uses the main material of the Solar Collector which functions to absorb solar radiation energy that falls on the surface of the absorbent plate so that the plate temperature becomes high. Solar cell construction as follows:

Table 1: Tool specification.

	Tools	Function
1	Solar panel board	Functioning to convert solar energy into electrical energy is used to supply electrical energy in fish drying equipment. The module used is 300 wp, so the power produced is 300 watts/hour.
2	Solar charge controller	Serves as a voltage regulator from the supply of photovoltaic modules to battery charging and inverter supply.
3	Inverter	Serves as a modifier of the input voltage from the solar regulator in the form of a DC voltage which is then converted to an AC voltage to supply the voltage to the control thermometer, heater, and fan.
4	Battery	Serves to store energy from photovoltaic modules used as a backup supply for the night so that the device continues to operate
5	Heater plate	Function as a medium fish dryer
6	Cables	As a power supply

The design of the sea fish dryer into salted fish uses a rack system with the main components in the form of solar panels, solar charge controller, batteries (batteries), intervers, temperature control, RTD temperature sensors, incandescent lamps, as seen in figure 4, 5, 6 and 7:

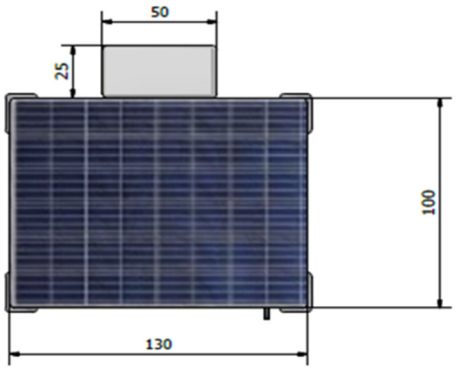

Figure 4: Design top view.

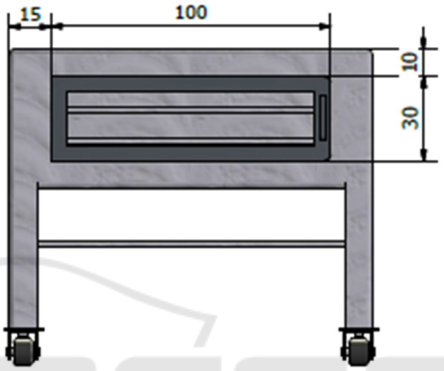

Figure 5: The design of the rear view.

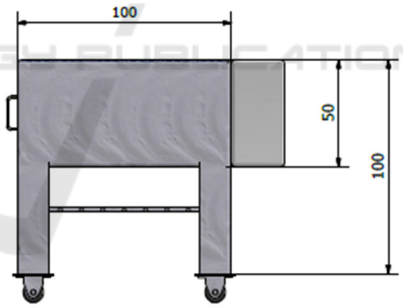

Figure 6: Design side view.

Figure 7: The design of the side view above.

3.2 Implementation

Figure 8: A Fish dryer is a side view.

Figure 9: The inside of a fish dryer.

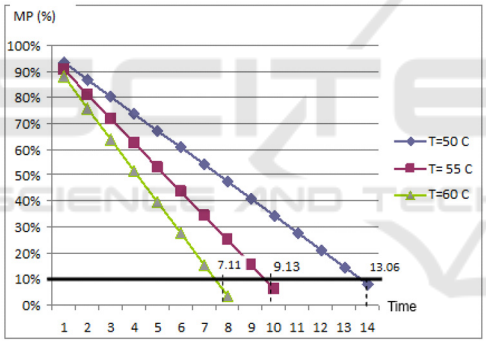

Figure 10: Decreased water content in fish.

Design the size of the Fish drying chamber using data from the calculation of the heat load needed for a fish dryer with a capacity of 5 kg and can be expanded to 7 kg with a tool size of about 1.3 meters, where Qtotal is obtained 35634.96 kJ / the drying cycle and also the collector's need to get heat is 1781.75 kJ / cycle for the needs of the collector used to dry 1 kg of wet fish based on calculations to obtain energy to dry the water fish for 7.11 hours then it is equivalent to the collector of 3.65 m2.

The fish dryer uses a controller that can adjust the temperature automatically, where when the temperature reaches 50o C automatically, the heating machine will turn off. After the temperature drops and reaches 45o C the heater will turn on again. The temperature setting can be adjusted according to the needs of drying raw materials.

The costs incurred for the manufacture of this fish dryer are relatively large, but this is a result of the quality of the durability of the equipment. When compared to a dryer made of wood, of course, the appliance will not last long because it will break quickly. In contrast to tools made of aluminum which have a better level of resistance, termite and fire resistance.

The results of the implementation of the solar powered fish dryer that can be seen are the drying process that is more faster and more production with a better results as seen in the figure 11, figure 12 and table II.

Figure 11: The result of drying the traditional way.

Figure 12: The results of drying using a dryer.

Table 2: Comparison of Drying Results.

	Traditional drying	**Drying using solar dryers**
Production / day	0.5 - 1 ton	0.5 - 1 ton
Drying time during hot weather	1 - 2 days	1 day
Drying time when the weather is not hot	3 - 7 days	1 - 2 days
Production Loss	300 kg	100 kg

Another benefit felt by the community with the solar fish dryer is that more free time can be used to do other jobs such as packing, doing housework, and more time socializing with other parties so that there are more opportunities to expand the market network.

4 CONCLUSION

A conclusion that can be drawn from the implementation of solar fish dryer technology in the Rasau river village is that with the application of solar fish dryer technology, people who are members of the Joint business group can produce better products compared to traditional drying methods, which caused by a more optimal and even drying process. A Solar fish dryer is also a solution to the constraints of the traditional drying process that relies on hot weather, where when the weather is rainy, the resulting product will rotten.

During the pandemic, the process of drying fish using a solar powered fish dryer is very useful because it can reduce time outside the home and the drying process can be done at home.

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