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Application of rotary dryer modification technology to increase animal feed production efficiency

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ABSTRACT

Lorong Ujung Tanjung Dua, Lingk 15, Bagan Deli Village, Belawan, North Sumatra became the location of this community research and service with Mr. Deddy Suryono as the owner of the business as the partner. His business activity is processing seafood shell waste into animal feed products. This business partner had problems whereas manual drying prolong the time due to the natural causes. Furthermore, the market of the product was in lower level due to the absence of explanation of the content of the product and also the brand name. One of the solution to propose is a high quality functional drying oven with eligible size and fixed temperature. Secondly, to increase the marketing of the product it need to be standardize by laboratory and make the brand name. This program follow 3 steps of method, namely train, socialization and assistance. The results, Rotary Dryer Modification Technology was used as the dryer which increased the product 4 times in quantity. The product was analysed in laboratory with three type of products whereas Shrimp Skin, Crab Skin and Fish Skin. The lab result showed that fish skin has the highest protein more than 50%. The brand name then named as EBYPRO.

KEYWORDS
Seafood waste
Animal feed
Rotary dryer

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1. Introduction

Fish, shrimp and crabs are seafood that are most often consumed by people all over the world. The Ministry of Maritime Affairs and Fisheries (KKP) issued a 2018 Reflection & Outlook 2019 report regarding the main commodities of fishery products in Indonesia. The commodities were seaweed, shrimp, squid-octopus, tuna, skipjack tuna, and crabs [1], [2]. The increasing number of seafood causes an increase in fish, shrimp and crab shell waste which results in environmental pollution. Because the smell is very strong, it requires a closed place to accommodate it. This seafood waste then becomes waste that throw into the sea which is then it will have a bad impact on the marine ecosystem [3]–[5]. On the other hand, this seafood waste has beneficial nutrients. Shrimp shell waste has advantages as an energy source where one of the nutrients contained in this is axtaxanthin. This nutrient also changes the color of the shrimp skin to reddish when fried that functions as provitamin A which is needed as poultry nutrition [6]–[8]. Each poultry requires a different nutritional content. For example adult birds need more energy rather than broilers. Furthermore, different type and age of bird also different in terms of energy values to consume. Therefore the content of the animal feed produced have to be different for each case [9]–[11]. These issues was related with residents business in Lorong Ujung Tanjung Dua, Lingk 15, Bagan Deli, Medan Belawan. Since 2019 this residents initiated the idea of overcoming the problem of seafood waste by establish the business on making animal feed named UD Berkah Alam. This step also became one of a big step to improve the residents' economy by making community business units.

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The animal feed products made by these residents experienced several problems, not only in the processing but also in marketing their animal feed products. The problems faced by partners in developing the business of processing shrimp and crab shell waste into animal feed include:

- The drying process. Seafood waste need to be dried before processing the product. Partners drying this seafood waste manually by using sunlight. This seafood waste were spread out by the sea and on the roofs of residents' houses. This drying process met some problems. First, it was not perfectly dry. The lack of space caused the drying process was not equally perfect. Furthermore, with this result, the drilling process further impact with the bad product. Second, natural causes. The temperature of sunlight was unstable. It made hard to predict the exact time of drying process. Residents should always checked whether the seafood waste was already dry. Furthermore, the availability of sunlight was also unpredictable. In addition, the drying process will be disrupted if the air temperature is not too hot, or when it rains. Another conditions, such winds will also affect the drying process, especially the position of this village which is right on the seafront. If it is slow it might help the process faster, but if it is strong it might even cause the product spread in to the air. Another causes might came from small things such as insects, dust or air pollution. These causes might also affect to the basic ingredient of the seafood waste itself. All of these problems not also disturbing the length of drying process but also the quality of the product.
- The drilling process. Previously, partner used a small machine. This small machine could not handle a lot of job therefore they had to prolong their time when it was the time to drill. This small machine also can not filtered ash from seafood waste. This ash also cause a further effect. This condition produce air pollution which was then felt by the workers. The workers complained that it was easier for them to get cough and sick after using the machine. If this continue, the workers might get serious illness in the future.
- Product content. The result of product content is necessary for consumen. It will ensure consumen to buy the product and use it as animal feed. The animal feed produced has never been analyzed for its content in the laboratory, so it becomes a major obstacle for partners when marketing to consumers. Large-scale consumers will usually ask about the protein content in the animal feed. By conducting animal feed lab tests. If the feed is contaminated and does not match the nutritional needs of the livestock, it is not impossible that the livestock will get sick and even die. Animal feed laboratory tests cannot be ignored, because this is related to the health of livestock. If the feed is contaminated and does not match the nutritional needs of the livestock, it is not impossible that the livestock will get sick and even die. Therefore, it is necessary to conduct periodic animal feed laboratory tests. The test result also use to support the brand name.
- The marketing. Partners market their products used ordinary sacks without the name of the product or the name of the manufacturer. This caused the marketing of this animal feed product to be limited . The market of the product was in lower level. On the other hand, the brand itself without the explanation of its ingredients can not make consumer believe to buy their product, therefore brand name with product content is a necessary.

In this community service activity, we then look for solutions to these four problems faced by partners so that partners can handle the problems and increase the quantity and also sales of their products.

2. Method

The solutions that can be done to solve this partner problem are as follows; (1) Problem number 1 and 2 solve with provide seafood waste drying oven machine as well as drilling machine with large capacity. The result of the solution to the problems is the availability of an effective and highly productive seafood waste drying oven. This dryer and driller is called a Rotary Dryer, as described below; (2) Problem number 3 and 4 solve by test the products to certified laboratories recognized by the Department of Animal Husbandry for animal feed analysis. The output of the solution to these problems is in the form of a

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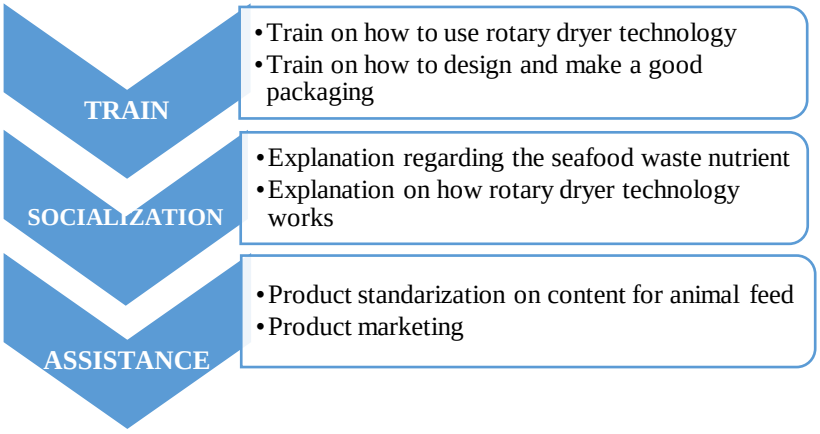
certificate of analysis on the content of animal feed from seafood waste from partners which can be used as the main requirement when marketing the product. The analysis to be carried out are; Protein content, Fat level; Water content, Ash content, Calcium Level, Phosphorus level, Fiber Content, Calories. The content is needed to be analyzed so then it will be able to determine the sales target of the animal feed produced. This is because each animal requires a different nutritional content. The approach used to achieve the objectives of this activity is the training method, socialization and assistance on product standardization with appropriate technology applications (detail of this method can be seen in Fig 1). The success rate of this community service activity is measured from the seafood waste drying and



drilling machine, knowledge of good animal feed processing from seafood waste and content analysis from the laboratory as well as good and safe animal feed packaging methods.

Fig. 1. Method steps

3. Results and Discussion

3.1. Rotary Dryer Performance

The advantages of this rotary dryer are as follows; (1) The drilling tool uses a spiral cutting tool that allows to avoid the air pollution generated from the shells of shrimp, crabs and fish. With this tool can protect the health of residents who carry out drilling activities; (2) This driller also uses a rotary dryer system, thus allowing even distribution of the drying process so that it will also facilitate the drying process later; (3) The modification of the rotary driyer made is that it has two other functions, namely, the process steps can be carried out in 2 ways, namely drying first and then drilling and vice versa, drilling first and then drying. This can be used by partners by adjusting the stages of the process with the conditions of shrimp shells, crab shells and shrimp shells before the process of making animal feed. The design of rotary dryer machine can be seen in Fig 2.

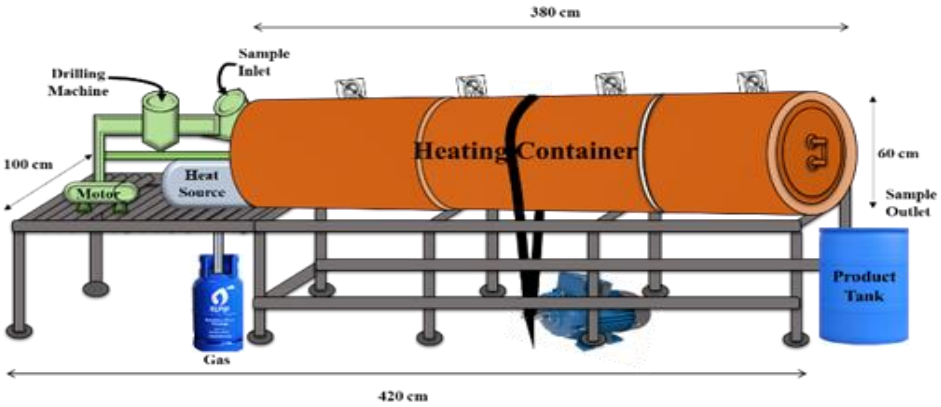


Fig. 2. Rotary dryer design

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This overall program was held in June-Desember 2021 with 15 person from partner and 3 university student involved. The rotary dryer training was held in August 2021. All of the participants was enthusiast on learning and practicing this new machine as can be seen on Fig 3.

Fig. 3. Rotary Dryer Training

After this activity is carried out, the results of this activity have a big impact on partners and local residents who carry out animal feed manufacturing activities as shown in Fig 4. The economic and social impacts obtained are as follows; (1) By having the knowledge and skills to process animal feed from seafood waste professionally leads to produce quality and competitive animal feed products so that they have high selling power. With the provision of appropriate knowledge and technology, this Partner's business can continue its expertise and skills, so that it has a greater opportunity to get consumers and produce more products; (2) This technology also help to safe the workers health. It was minimize the air pollution in form of ash. The workers or residents were healthier than before; (3) The rotary dryer made in this activity is very helpful for partners to be able to process animal feed faster and safer. If previously the drying and drilling process of shrimp, crab and fish shells to be used as animal feed took 3 to 6 days in total, then with the availability of this rotary dryer, the processing time for animal feed processing can be completed in just 1 day and the results of animal feed obtained also increased 4 times. Before using this rotary dryer partners were only able to produce 250 kg per day, but after using this rotary dryer partners could produce animal feed up to 1000 kg per day.

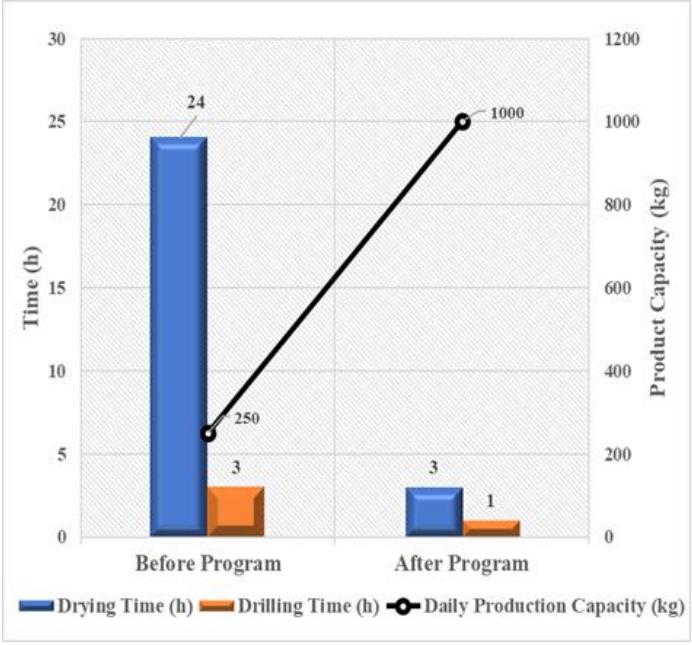

Fig. 4. Profile of changes in partner work efficiency in animal feed processing.

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3.2. Results of Analysis of Animal Feed Content

As mentioned previously that each animal requires a different nutritional content. Therefore the content of seafood waste based needed to be analyzed so then it will be able to determine the sales target of the animal feed produced. This sharing knowledge has discussed in socialization phase as can be seen in Fig 5.

Fig. 5. Socialization

Certificate of Analysis on behalf of the Partner from a Certified Laboratory, namely Sucofindo laboratory for the three types of animal feed, namely; (1) Animal Feed from Shrimp Skin; (2) Animal feed from Crab Shells; (3) Livestock Feed from Fish Skin. Animal feed samples obtained from drying and drilling consist of 3 types of samples, namely: Shrimp Skin, Crab Skin and Fish Skin, taken to the Testing Laboratory (Sucofindo) to be analyzed for their chemical content. From the results obtained, animal feed from fish skin has the highest protein and calorie content, 55.20% and 349.23 kcal/100g. Meanwhile, animal feed from shrimp shells contains protein and calories of 25.57% and 178.78 kcal/100 g, slightly higher than internal feed derived from crab shells, which are 22.78% and 143.37 kcal/100 g, respectively. Reinforcement feed or also called concentrate is animal feed that has a low crude fiber content, below 18%. The main nutrients from concentrated feed are energy and protein. There are two different concentrates, namely concentrate as a source of energy and as a source of protein. Concentrated energy sources are concentrates that have a protein content of less than 20%. In contrast, protein source concentrates are concentrates that have protein levels above 20%. Concentrate is an animal feed ingredient that is given together with other animal feed ingredients to increase the nutritional content of animal feed mixed as complementary feed [8]. However, animal feed made from shrimp shells and crab shells has a higher carbohydrate content and calcium content than animal feed made from fish skin. This high calcium content can also be used as animal feed for certain types of livestock. In detail, the results of the laboratory analysis for these three animal feeds can be seen in Fig 6.

Minerals or salt substances are needed for dairy cattle. Inorganic substances such as: Calcium, Potassium, Iron, Phosphate, Sodium, Magnesium, and others are all kinds of substances needed by the body of livestock. Additional minerals are needed as additions to some animal feeds, but not all, because most of these minerals can be obtained from the feed ingredients provided. Therefore, it is very important to know the content of the animal feed provided, whether it is sufficient for the mineral needs of livestock or not [12], [13]. Vitamins are very important for optimizing growth, and maintaining the natural function of the body system of farm animals. There are two groups of vitamins needed by the body of livestock, namely water-soluble vitamins including vitamin B complex, B6, B12, C, biotin, kholin, inondol, niacin. And fat-soluble vitamins such as vitamins A, D, E, and K. Indeed, only a small amount of vitamins are needed, but this cannot be ignored at all because not all animal feed ingredients contain complete vitamins, considering the risks of livestock, which if lack of vitamins can cause the animal's body to become weak, sick, and even die.

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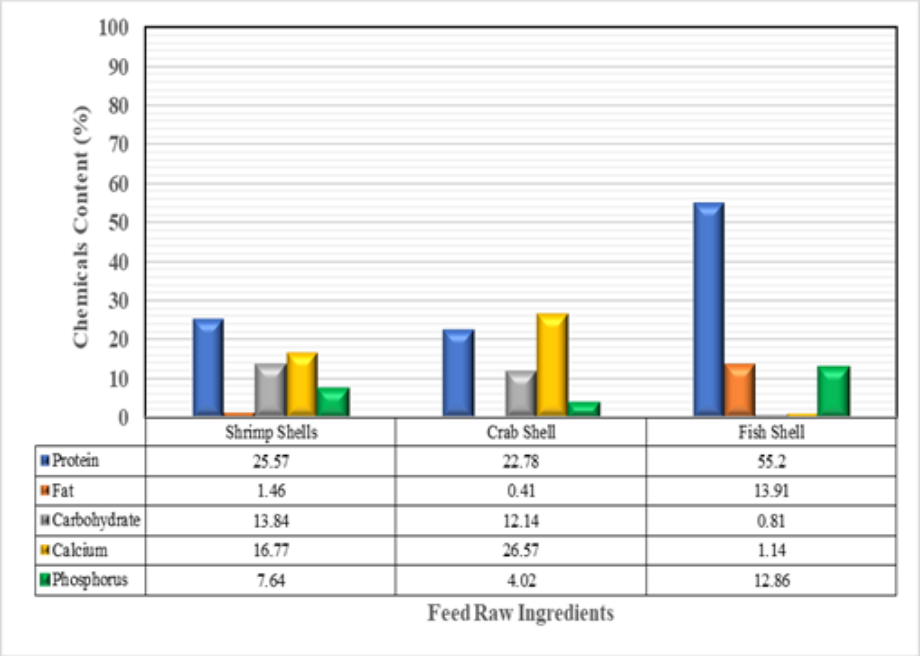

Fig. 6. Laboratory analysis of all types of animal feed

3.3. Packaging for Product Marketing

Foodstuffs produced by livestock are easily damaged by environmental factors and the nature of the product, therefore this food require proper post-mortem treatment. Principles processing needs to be known in order to apply the method and use of packaging materials appropriate for the food product to be packaged. To get results optimally, then in food packaging, it is necessary to know the nature and characteristics of the material to be packaged, so that it can determine the type of packaging which will be used. Many advantages are obtained through packaging of foodstuffs, including reducing damage and providing attractiveness to consumers, which in turn can increase the value sell it. During storage there will be a decrease in the quality of food packaged, so that the estimation of the shelf life of packaged food is something that needs attention. Packaging must be able protects food and is able to block outside influences [14], [15].

To attract consumers' attention, product packaging is also our concern in helping partner businesses. This partner's animal feed product was named EBYPRO. The design of the sacks for animal feed products can be seen in Fig 7. Due to the significant differences in the results of the laboratory analysis for each source of animal feed, the sacks were made to identify the source of the animal feed, whether it is from shrimp shells, crabs or fish. This will certainly help partner consumers in choosing animal feed products that suit their needs. The address and logo are also displayed in the sack design to facilitate the further promotion of this animal feed product.

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Fig. 7. Animal Feed Product Sack Design

By put the brand name, design it in the sack and also put the explanation of its ingredients increase the trust for consumer in high level. Partner was received sacks with brand name in Fig 8.

Fig. 8. Brand Name Print in The Sack

4. Conclusion

The conclusions from this activity include the availability of a Rotary Dryer, drying equipment that is integrated with a drilling machine help encouraged partner activities. The rotary dryer made in this activity is very helpful for partners to process animal feed faster and safer. The lab result showed that fish skin has the highest protein more than 50%. The brand name was design and print in the product sack which also contain the explanation of variety of products ingredients increase the trust for consumer in high level. The brand name named as EBYPRO.

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Declarations

Author contribution. All authors contributed equally to the main contributor to this paper. All authors read and approved the final paper.
Conflict of interest. The authors declare no conflict of interest.
Additional information. No additional information is available for this paper.

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