Performance Analysis of Rice Drying Equipment Using Rice Husk Waste as Fuel

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Abstract- ***Petroleum is the energy source with the largest consumption today when compared to other energy sources. In fact, our petroleum reserves are running low and will only last until 2025 (ESDM, 2006). This condition provides an impetus to find other alternative energy sources, and can be renewed compared to petroleum, natural gas or coal. One interesting option is biomass. Where biomass itself is very suitable to be developed in Indonesia, especially in areas that produce rice. Where after the milling process, the outer rice will produce rice husks which have so far been thrown away as rice husk waste. This rice husk waste is one of the biomass sources that is quite interesting to use as fuel. Drying of paddy (rice) can use biomass energy, a combination of solar and biomass energy and can use a drying tool. This research is a continuation of previous research, namely a 1000 kg/hour Rice Dryer has been created using Rice Husk heaters, so that it is possible to continue the research. The purpose of this study is to analyze the performance of a rice dryer using rice husk waste as fuel. The method used in this study is an experimental and descriptive method. And the targeted output is a reputable international journal. In addition, the Technology Readiness Level (TKT) level 3 with achievement indicators can increase the production of farmers' rice harvests.***

Indexed Terms- ***Drying tool, Rice, waste. rice husk***

I. INTRODUCTION

Fuel oil is the energy source with the largest consumption today when compared to other energy sources. In fact, our oil reserves are running low and will only last until 2025 (ESDM, 2006). This condition provides an impetus to find alternative energy sources that are abundant and renewable compared to oil, natural gas or coal. One interesting option is biomass. Where biomass itself is very suitable to be developed in Indonesia, especially in the Bolaang Mongondow Regency area because of its abundant amount. One of the biomass sources that is quite interesting to use is rice husks.

In Indonesia, this is a country where the weather often changes erratically. The rainy season makes it difficult for farmers to dry their crops. Therefore, it is necessary to make a drying tool to secure their crops.

Drying is a process of reducing the water content of harvested products, if it still contains water content, the product may rot. The water content of agricultural products is usually expressed in percentage of wet basis and percentage of dry basis.

Drying is usually divided into two parts, namely sun drying and artificial drying. Sun drying requires sunlight as an energy source, a heat source and ultraviolet light. This drying is done openly, sometimes there is a large gust of wind from the air so that drying is slow and also prone to contamination from the air, and dust from the surrounding environment. In addition, this drying is only done if the weather permits. If not, artificial drying can also be used. Artificial drying uses fuel. The working principle is heating by conduction (heat transfer) or convection (heat flow) which aims to reduce the water content of food. [1]

With abundanceRice husk waste after rice milling, which has so far been disposed of in a wasteful manner and requires a large disposal site, based on the description above, research was conducted on the performance analysis of a rice dryer using rice husk waste as fuel.

II. LITERATURE REVIEW

2.1. State Of The Art

Previous research serves to analyze and enrich the discussion of the research, and differentiate it from the

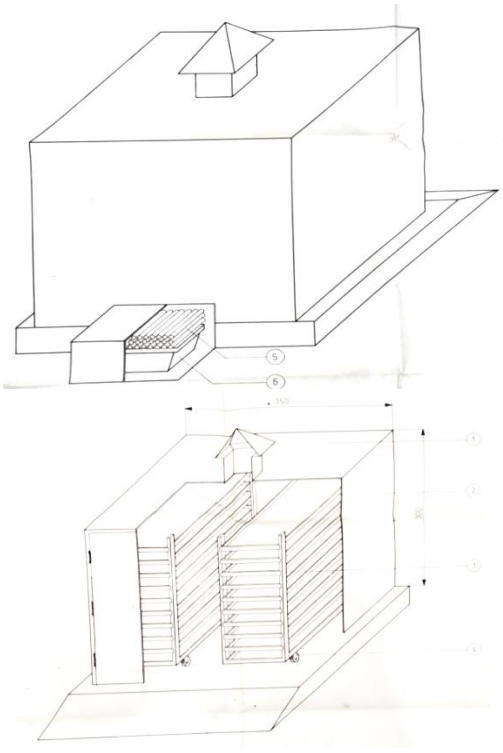
research being conducted. This research includes several previous research concepts related to the concept of this research, including:

1. Spin Dry-pad Automatic System-Based Rice Dryer Spin Machine to Improve the Quality and Productivity of UD Sumber Rejeki Rice by M. Marcus Adhim, ITS Surabaya department. The process of drying rice with an electrical drying method based on an automation system, which includes an automatic rotation system to turn the rice over so that the drying process is even and a temperature control system that can be adjusted according to needs
2. Planning of a Rice Dryer with a Capacity of 1000 kg/hour Using Rice Husk Heater. The research results show that the manufacturing process begins with the identification of working drawings and identification of its components. [3]
3. Planning a rice drying tool using a hot water well for the Hihwan village community, Dumoga Barat District. PKM Rudy Poeng. From the results of this planning, a model will be obtained, in the form of a technical drawing of a simple rice drying tool using a hot water well. [4]
4. Making a Rice Dryer with a Capacity of 1000 kg/hour Using Rice Husk Heater. In this study, a rice dryer was obtained with a heater using Rice Husk waste. [6]

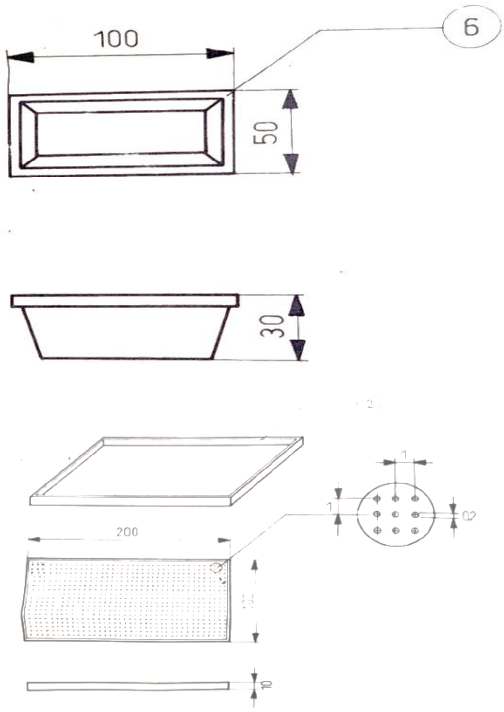
2.3. Proposer's Research Roadmap

Research that has been conducted by the proposer of machine tool development related to the roadmap of this research:

1. In 2020, the proposer conducted a study on the Planning of a 1000 kg/hour Rice Dryer Using Rice Husk Heater. The results obtained a design for a rice dryer product using rice husk fuel.



Dryer and Combustion Chamber



Drying Rack

Furnace Tray

Figure 2.1 Design of a rice dryer using rice husk as fuel. [4]

2. In 2022-2023 the proposer has carried outresearch on the manufacture of a 1000 kg/hour capacity rice dryer using rice husk heaters. The results show that the manufacturing process starts from identifying work drawings and identifying components, making orders and procuring from the market and for other components. Thus, a cooling system can be produced to reduce the manufacture of a rice dryer using rice husk fuel [6]

From the research that has been conducted, the proposer submitted a research proposal with the title "Analysis of the Performance of a Rice Dryer Using Rice Husk Waste as Fuel", where the research road map is as explained in Figure 2.5 below.

From 2020 to 2023, the author has conducted several studies, both independently and funded by DIPA UNSRAT.

Figure 2.2 Research roadmap

III. RESEARCH METHODS

This research procedure was conducted in several interrelated cycle stages as shown in Figure 3.1. The stages of this research procedure are as follows:

1. Literature Study

This stage involves studying literature related to the research topic.

2. Tool Preparation

All drying equipment is checked, whether it is still in good condition/damaged. If it is still good, then it is continued with further research testing, if there is any damage, it is repaired/replaced.

3. Measurement.

Combustion chamber testing (whether the combustion chamber can function as expected, if not repaired, if yes, continue testing).

Measurement of the temperature of the drying room, where drying can only be carried out if the temperature is between 50 - 60°C (if the temperature is outside the specified limit, the combustion process of the Rice Husk fuel must be checked again until the drying room temperature is as specified).

4. Drying

Where in this process, the rice that is still wet after harvest is filled in a tray with a thickness of 5 cm.±
Measurement of the moisture content of rice before the drying process.
Trays filled with rice are placed on shelves in the drying room.
Drying process, where in this process water content measurements are carried out every 1/2 hour during the testing process.

5. Data processing

This stage involves processing the results of the rice drying process test which are tabulated in the form of a time table against the mass of rice.

6. Discussion

This stage involves making a graph of the relationship between drying time and rice mass, as well as the percentage of reduction in water content to analyze the performance of the rice dryer.

7. Conclusion.

This is a brief statement regarding the results of the analysis and discussion of this research.
The research steps are explained in the form of a flow diagram as shown in Figure 3.1 below.

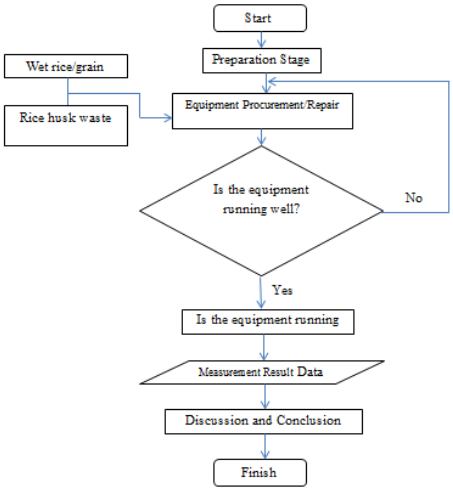


Figure 3.1 Research Procedure

The observation results of this study are in the form of data from the results of testing the rice drying process with a capacity of 1000 kg (1 Ton). The tests carried out in this study are:

1. Carrying out the process of drying rice with a thickness of 5 cm per tray of rice as many as 20 trays±
2. Measuring the decrease in water content of rice every ½ hour using a measuring instrument: Digital Grain Moisture Meter

The data resulting from the rice drying process test in question can be seen in Table 3.1.

Table 3.1 Data results from testing the rice drying process

Tem °c	Jam Penelitian	Penurunan Kadar Air %	Persentase penurudan kadar air%	Waktu Pengeringan Jam	Massa Padi kg
50-60	06.30	30	0	0	1.000
	07.00	28,6	1.40	0.5	986
	07.30	27,3	1.30	1.0	973
	08.00	26,4	0.90	1,5	964
	08.30	24,4	2.00	2,0	945
	09.00	22,9	1.50	2,5	931
	09.30	22,0	0.90	3,0	923
	10.00	21,1	0.90	3,5	914
	10.30	20,5	0.60	4,0	909
	11.00	19,8	0.70	4,5	902
	11.30	19,1	0.70	5,0	896
	12.00	18,5	0.60	5,5	891
	12.30	17,8	0.70	6,0	885
	13.00	17,2	0.60	6,5	879
	13.30	16,7	0.50	7,0	880
	14.00	16,1	0.60	7,5	875
	14.30	15,7	0.40	8,0	871
	15.00	15,1	0.60	8,5	866
	15.30	14,5	0.60	9,0	861
	16.00	13,1	1.40	9,5	849
	16.30	12,8	0.30	10,0	846

The data from observations and calculations of the rice drying time can be graphed as shown in Figure 3.2. The horizontal axis is the rice drying time and the vertical axis is the rice mass. These results show that the higher the rice drying time, the lower the rice mass will be.

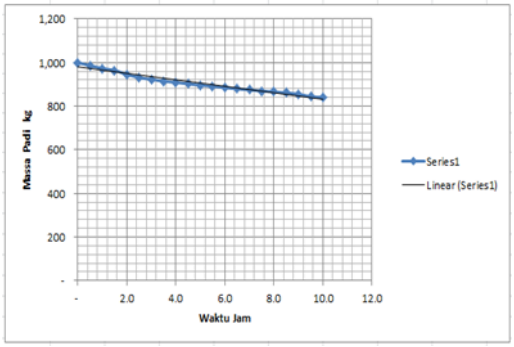


Figure 3.2 Graph of rice drying time against rice mass.

The data from observations and calculations of rice drying percentage can be made into a graph of the relationship, as in Figure 3.3. The horizontal axis is the percentage decrease in rice water content and the vertical axis is the mass of rice. These results show that the higher the percentage decrease in rice water content, the lower the rice mass will be.

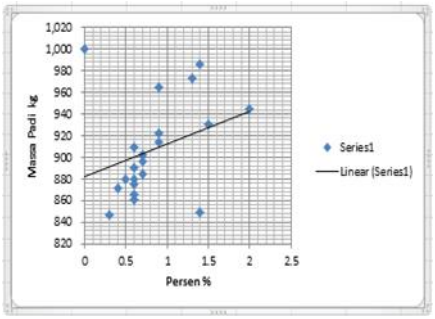


Figure 3.3 Graph of the percentage decrease in rice water content against rice mass.

The data from the observation and calculation of the rice drying potential can be made into a graph of the relationship, as in Figure 3.4. The horizontal axis is the water content of the rice and the vertical axis is the mass of the rice. These results show that the lower the water content of the rice, the lower the mass of the rice will be.

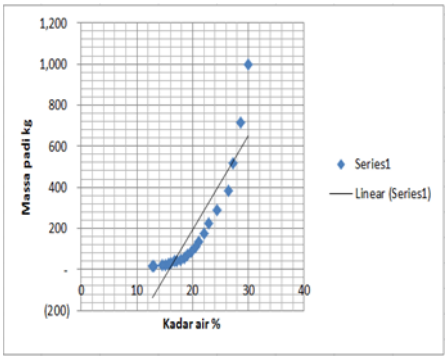


Figure 3.4 Percentage graph of decrease in rice water content against rice mass

IV. CONCLUSION AND SUGGESTIONS

4.1. Conclusion

From the results of the research that has been carried out, the following conclusions can be drawn:

1. The drying temperature must be maintained at 50 oc – 60 oc
2. The drying time for 1000 kg (1 ton) of rice is 10 hours until the moisture content of the grain reaches 13% ready to be milled. So this tool can be said to be effective.

4.2. Suggestions

1. It is hoped that this research can be further developed into other products.
2. Analysis can be carried out using other fuels.

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