Performance Test of Disc Mill Type Ffc-23 Production of BBPP Batangkaluku

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Abstract. Rice is a commodity that has a strategic role in food security to meet the basic needs of the community. In Indonesia, rice is not only consumed as a staple food, but we often get rice processed into other food ingredients such as cakes. However, before becoming a cake, the rice is first processed into flour, which is usually called rice flour. Rice flour is flour that is widely used in Indonesia because it is low in protein and does not contain gluten. This study aims to determine the working capacity of the disc mill-type flour mill FFC-23. The research method used is to perform flouring by operating a disc mill-type FFC-23 flour machine and calculating the percentage of rice flour soaking. The results of this study indicate that the working capacity of the machine, where the working capacity of the 60 mesh sieve is higher than that of the 100 mesh sieve. This shows that the mesh size with the smallest value can optimize the performance of the FFC-23 disc mill-type flouring machine.

1 Introduction

Rice is a commodity that has a strategic role in food security to meet the basic needs of the community. This commodity is much sought after to be substituted with other commodities. This causes the rice commodity to have a very important value. In addition to being a basic need, it can also be used as a parameter for the economic and social stability of the country. If there is a scarcity or unmet need for rice in the community, it will have an impact on inflation and social turmoil.

In Indonesia, rice is not only consumed as a staple food, but also often we get rice processed into other food ingredients such as processed cake ingredients that become snacks. But before becoming a cake, rice is first processed into flour, which is usually called rice flour. Rice flour is widely used in Indonesia because it is low in protein and does not contain gluten.
Rice is a processed product obtained from an agricultural product called rice (*Oryza sativa*). Rice is a food community that is the staple food for most Asian nations. Especially Indonesia, Thailand, Malaysia, Japan and Myanmar [1]. Rice includes cereal grains derived from the family of grasses (*Gramine*) has a high carbohydrate content so that it becomes a staple food for humans, animal feed and industries that use carbohydrates as raw materials [2]. Rice flour is widely used in Indonesia as a raw material for making various types of market snacks. This is because rice flour is a low-protein flour that does not contain gluten. The process of making rice flour is quite simple, namely by milling method using a special grinder or flour milling to produce the desired rice flour [3].

Processing rice into rice flour is done through the process of flouring. Flouring is a process that is most widely practised. The mechanism is the breaking of the material caused by pressure on the material at a critical point. The material will absorb the pressure exerted as pressing energy, causing the material to break. The rupture of the material will follow the cleavage plane according to the nature of the material [4]. Currently, there are several pressing machines used with different technologies or specifications, including hammer mills, roller mills and disc mills. A hammer mill is a type of impact mill that is used to break down materials. The working principle is that a blow between the hammer and the wall reduces the material. Then, the material is pushed through the perforated plate until heat is generated. This causes the product to become hot and then lose water content. Unlike the hammer mill, the working principle of the roller mill is to apply the roller's compressive force to the material so that the material deforms and reduces in size. At a certain size reduction, the material will be broken into smaller fragments than the original size.

The use of a disc mill provides smaller and more economical crushing results when compared to other mill machines so it was chosen as the object of research.

The flouring machine used in this research is the FFC-23 type disc mill flouring machine found at the Batangkaluku Agricultural Training Center. This research was conducted to determine the working capacity and efficiency of the FFC-23 disc mill flouring machine against the rice flour produced.

The FFC-23 disc mill type flour machine is a machine used to produce flour by using a 2 hp electric motor as a driving motor. The main components include the frame as the foundation for several components in the flour machine, an electric motor as the main engine, a pulley (pulley) to transmit power and rotation of one shaft to another with the help of a belt, a flouring room, bearings, an intake and output funnel, and a sieve [5].

The purpose of this research is to determine the working capacity of the FFC-23 type disc mill flouring machine.
2 Research methods

2.1 Tools and Materials

The tools used in this research include a Disc Mill type FFC -23 flouring machine, basin, sack, scales, label paper, stopwatch, stationery, laptop and cellphone for documentation. The material used in this research is mekongga variety head rice.

2.2 Research procedure

The research procedure includes the preparation of tools and materials and then conducting engine performance tests through measurement and calculation of various parameters, including the following:

1. Crushing capacity
   a. The flouring machine is operated.
   b. Rice is fed into the hopper continuously.
   c. The results of pressing are collected, the pressing time is calculated, and
   d. The resulting flour was weighed.

2. Percentage yield of rice flour
   a. The weight of the floured rice is weighed before it is put into the hopper.
   b. The weight of the flour was weighed.

2.3 Observation parameters

The parameters observed in this study are as follows:

1. Crushing capacity
   The capacity of the flouring machine can be calculated using the formula:
   \[ K_{pt} = \frac{W_{pk}}{T} \]  
   Description Kpt crushing machine capacity (kg/hour), Wpk material Weight (kg), T crushing time (hour).

2. Milling machine yield
   The yield of the flouring machine can be calculated using the formula:
   \[ H_t = \frac{W_t}{W_{pk}} \times 100\% \]  
   Description Ht milling machine yield (%), Wt eight of flour from flouring (kg), Wpk weight of the pressed material (kg).

3 Results and discussion

3.1 Water content

Moisture content is the amount of water contained in an object, such as soil, agricultural materials, and so on. The amount of water content in a food is important to know so that the
processing or distribution process gets the right handling. Errors in handling or determining moisture content will cause damage to food ingredients and can even endanger health if consumed. This is due to the influence of microorganisms that carry out growth. The measurement of water content in this study uses a moisture analyzer. The result of the water content value of rice used in this study before being floured was 13.53%, while the water content of rice after being floured was 11.91%. Based on the data obtained, the amount of rice moisture content is in accordance with SNI, which is a maximum of 14%. This is in accordance with the National Standardization Agency [6], which states that the moisture content of rice, according to SNI, is a maximum of 14%. The same thing is also obtained in the acquisition of rice flour moisture content in accordance with SNI, which is a maximum of 13%. This is in accordance with the National Standardization Agency [7], which states that the moisture content of rice flour, according to SNI, is a maximum of 13%.

3.2 Crushing capacity

Crushing capacity is the ability of the machine to crush a certain amount of flour in one hour. The crushing capacity is obtained until the seeds are completely ground into fine flour. The capacity consists of actual capacity and theoretical capacity. The actual capacity is the amount of flour obtained from the comparison of the mass of rice flour divided by the flouting time. At the same time, the theoretical capacity is the capacity of the machine based on the calculation of variables and dimensions of the flouting machine elements. A comparison of the flour capacity of the FFC-23 Disc mill flouting machine can be seen in Table 1.

<table>
<thead>
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<th>100 mesh</th>
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<tr>
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<td></td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>5</td>
<td></td>
<td>4.55</td>
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<tr>
<td>3</td>
<td>4</td>
<td></td>
<td>3.45</td>
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<tr>
<td>Average (kg/hr)</td>
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<td>4</td>
<td></td>
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</table>

The table above shows that the average value of the flattening capacity of the FFC-23 Disc mill flattening machine decreases as the mesh size increases. The highest flouting capacity is found in flouting using a 60 mesh sieve, which is 4.75 kg/hour, while the lowest flouting capacity is found in flouting using a 100 mesh sieve, which is 4 kg/hour. The smaller the mesh size number on the sieve used in the flouting machine, the greater the flouting capacity. Conversely, the larger the mesh size number on the sieve used in the flouting machine, the smaller the flouting capacity will be. This is due to the difference in hole size on the sieve of the flouting machine. The 60 mesh sieve has a larger hole diameter than the 100 mesh sieve. The larger the diameter of the holes in the sieve, the higher the ability of rice flour to pass the sieve compared to sieves that have a smaller diameter. This is in accordance with [8] which states that the larger the size of the hole diameter on the sieve, the higher the percentage of material that passes the sieve so that the percentage of yield will be greater.

The capacity value of the Disc mill FFC-23 flouting machine with a rotating speed of 1400 rpm drive motor is very low when compared to flouting machines in general. This is in accordance with [9], which states that the optimum capacity in the flouting process is obtained at 5700 rpm-5800 rpm using 80-100 mesh sieves, namely the machine capacity of 15 kg/hour to 20 kg/hour. The low grinding capacity in this study is caused by the rotational speed of the driving motor. This is in accordance with [10] showing that there is a relationship between increasing rpm and grinding capacity. Namely, the higher the Rpm on the driving motor, the higher the grinding capacity.
3.3 Milling machine yield

Milling machine yield is the percentage ratio of the final weight (output) and the initial weight (input) of the flour, or it can be said as the percentage of flour that is successfully floured during the flouring process. A comparison of the yield of the FFC-23 Disc mill flouring machine can be seen in Table 2.

Table 2. Yield testing results (%) of disc mill flouring machine type FFC-23.

<table>
<thead>
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<th>100 mesh</th>
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<tbody>
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<td></td>
</tr>
<tr>
<td>2</td>
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<td>60.7</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>82.2</td>
<td>70</td>
<td></td>
</tr>
<tr>
<td>Average (%)</td>
<td>80.2</td>
<td>63.23</td>
<td></td>
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</tbody>
</table>

The table above shows that the average value of the yield of the FFC-23 Disc mill flouring machine decreases as the mesh size increases. The highest flour machine yield is found in the flour using a 60 mesh sieve, which is 80.20%, while the lowest flour machine yield is found in the flour using a 100 mesh sieve, which is 63.23%. The smaller the mesh size number on the sieve used in the flouring machine, the greater the flouring yield. Conversely, the larger the mesh size number on the sieve used in the flouring machine, the smaller the flouring yield will be. This is due to the difference in hole size on the floursing machine sieve. The 60 mesh sieve has a larger hole diameter than the 100 mesh sieve. The larger the diameter of the holes in the sieve, the higher the ability of rice flour to pass the sieve compared to sieves that have a smaller diameter. This is in accordance with [8] which states that the larger the size of the sieve hole, the higher the yield and vice versa. This is due to the large diameter of the holes contained in each sieve, the larger the size of the hole diameter on the sieve, the higher the percentage of material that passes the sieve so that the percentage of yield will be greater.

4 Conclusion

Based on the research that has been done, the following conclusions can be drawn:
1. The flattening capacity of the FFC-23 Disc mill flattening machine decreases as the mesh size increases.
2. The high working capacity of the FFC-23 Disc mill flouring machine is found at mesh 60 compared to mesh 100.
3. The yield of the FFC-23 Disc mill flouring machine decreases as the mesh size increases.
4. The highest floursing machine yield is found in floursing using a 60 mesh sieve, which is 80.20%, while the lowest floursing machine yield is found in floursing using a 100 mesh sieve, which is 63.23%.

References