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Effect of Heating Temperature on Corn Seeds Drying Efficiency in Tray Type Dryer

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Abstract
Post-harvest handling, namely drying, is an important stage to maintain the quality of corn seeds during storage. However, the problems faced by farmers are the high initial water content of corn seeds and unfavorable weather conditions are obstacles faced in the drying process. One alternative tool that can be used for the corn drying process is a tray dryer. This study aims to determine the efficiency of drying corn seeds using a rack dryer against time. This study uses an experimental method. The drying process uses a heating temperature of 65ºC, 70ºC and 75ºC with a drying air speed of 2 m/s repeated 3 times until it reaches a water content of 14 - 15%. The results of this study are that the higher the temperature used to dry corn seeds, the greater the drying efficiency. The average drying efficiency of corn seeds is 11.91% for a heating temperature of 75ºC, 8.66% for a heating temperature of 70ºC and 6.99% for a heating temperature of 65ºC.

Keywords: *Dryer, corn seeds, heating temperature, drying efficiency*

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I. INTRODUCTION

Drying is an important stage to maintain the quality of corn during storage, currently corn drying is carried out in two ways, namely with direct sunlight and artificial heating. Drying in the first model is constrained by dependence on the season, where drying can only be carried out if the intensity of sunlight is sufficient and it is not rainy, in addition the results of the drying process have non-uniform water content depending on the relative humidity of the surrounding air during the drying process, while artificial drying is constrained by low efficiency which is still below 60%, and degradation of protein content in corn, especially if the air temperature for the drying process is more than 60°C. [1]. Corn has a high selling price if the water content in the corn kernels meets the desired standards on the market, the Indonesian national standard determines the water content in corn, namely 13-14%. [2].

Artificial drying is needed as an alternative to overcome these problems, various forms of drying machines are circulating in society today, rack-type drying machines are one type of dryer that is often used in the drying process, drying using a Tray Drayer drying machine is one of the effective drying methods, the drying process with Tray Drayer can be done anytime or not depending on the weather and space. In addition, drying with a rack type does not require a lot of manpower used, based on the problems that have been raised, it provides ideas for studying the drying method using a Tray Drayer drying machine, which is thought to be very helpful for farmers to dry their corn harvest, at this stage the characteristics of corn drying are studied with various drying operating conditions, namely at various temperatures and air speeds that have been determined and temperature distribution analysis is carried out and testing the performance of the dryer using a rack-type drying machine. [1].

The efficiency of the tray dryer type cocoa dryer is multilevel by flowing hot air into the drying chamber. The inlet air temperature is varied, namely 60ºC, 65ºC, and 70ºC with the air flow rate kept constant at 6.37 m/s. The results of the study showed that the time required to reduce the cocoa water content from 72.9% to 7.5% is 1.75-3.25 hours. The drying efficiency obtained was 23.34% at an inlet air temperature of 60ºC, 26.56% at an inlet air temperature of 65ºC, and 29.21% at an inlet air temperature of 70ºC. [3].

The corn drying process using a vertical cylinder dryer type is based on a water content of 29% bb, 27.5% bb and 26% bb. The results of the study showed that the time used to dry the corn to reach a water content of 12-14% in each test was different. Performance test 1 takes 8 hours, performance test 2 takes 7 hours and performance test 3 takes 6 hours. But the drying rate for each performance test almost has the same value of about 5 kg H_2O/Hour. So the total drying efficiency in performance test 1 is 23.56%, performance test 2 is 26.90% and performance test 3 is 23.57%. [4].

Fast drying time is obtained at high air temperatures, conversely long drying time is obtained at low air temperatures. In the study, variations in air temperature of 55°C, 60°C and 65°C were used, the results showed that at an air temperature of 65°C the drying time was the fastest compared to drying at temperatures of 55°C and 60°C. While the longest drying time was obtained at an air temperature of 55°C. [5].

Drying is one of the most important factors in determining the quality of corn seeds, in addition to the harvesting process. The quality of corn seeds is determined by their water content. Drying aims to reduce the water content in corn seeds to a condition where the water content in corn seeds cannot reduce the quality of corn seeds and corn seeds are not overgrown with mold. Based on the energy source, drying in corn can be divided into natural drying and artificial drying. [6].

Research on drying corn seeds (zea mays. Sp) using a rack-type grain dryer found that drying corn seeds affects the drying rate and changes in water content in corn seeds or causes water content to decrease. The higher the temperature and the longer the drying process will cause the drying rate to be faster and the decrease in water content will be smaller or slower [1]. Drying corn on a fluidized bed tool found that the higher the air speed, the faster the corn drying time, in the study, using a drying air speed of 7 m/s produced the fastest drying time while an air speed of 5 m/s got the longest drying time. [5].

II. RESEARCH METHODS

This research is an experimental research with a scheme as shown in the following figure.

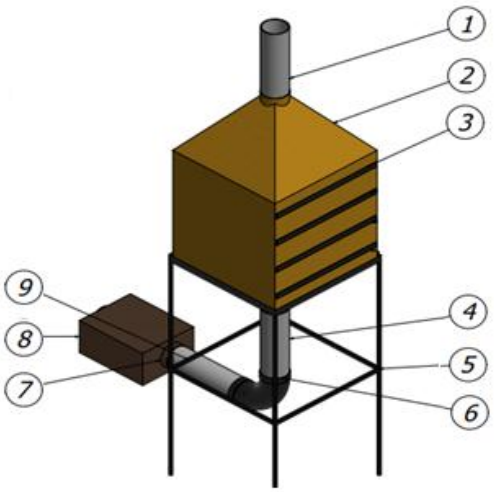

Figure 1. Installation of the dryer. 1. Output pipe, 2. Dryer box, 3. Rack, 4. Input pipe, 5. Frame, 6. Keni, 7. Controller sensor, 8. Heater box, 9. Blower pipe

In this study, two types of variables were used, namely dependent variables and independent variables. The dependent variable is a variable that is influenced by other variables such as the power used, by analyzing the dependent variable, it is expected to find answers or explanations regarding the problems being tested. The dependent variable in this study is to obtain drying efficiency. The independent variable is a variable that can be adjusted and determined according to testing needs. The independent variables used in this study are variations in the temperature of the heating drying chamber 65ºC, 70 ºC, and 75 ºC with an air speed of 2 m/s.

The research procedure is as follows,

Drying stage

1. Turn on the dryer's power.
2. Set the dryer temperature using the specified temperature.
3. Set the air flow rate by the fan according to the testing needs.
4. Put the corn kernels into the dryer weighing 2 kg with each rack 0.5 kg.
5. Weigh every 30 minutes the material and record the mass of corn and air speed until the maximum corn water content is 14%.
6. Repeat steps 2 to 5 with temperature variations in point 2 with temperature variations of 65ºC, 70ºC and 75ºC. and air speed of 2 m/s.

III. RESULT AND DISCUSSION

In the implementation of the research, data collection was taken every half hour after the corn was put into the dryer for 3.5 hours. Based on Fig 2, the graph of the relationship between drying time and drying room temperature is directly proportional to the temperature used to dry the corn kernels themselves. The longer the time used for the drying process of corn kernels, the higher the temperature of the drying room. This happens because the longer the drying time, the less water content in the corn and as a result the heat used to evaporate the water content contained in the corn kernels is less. This condition has an effect on the temperature of the drying room which is getting higher along with the length of the drying time.

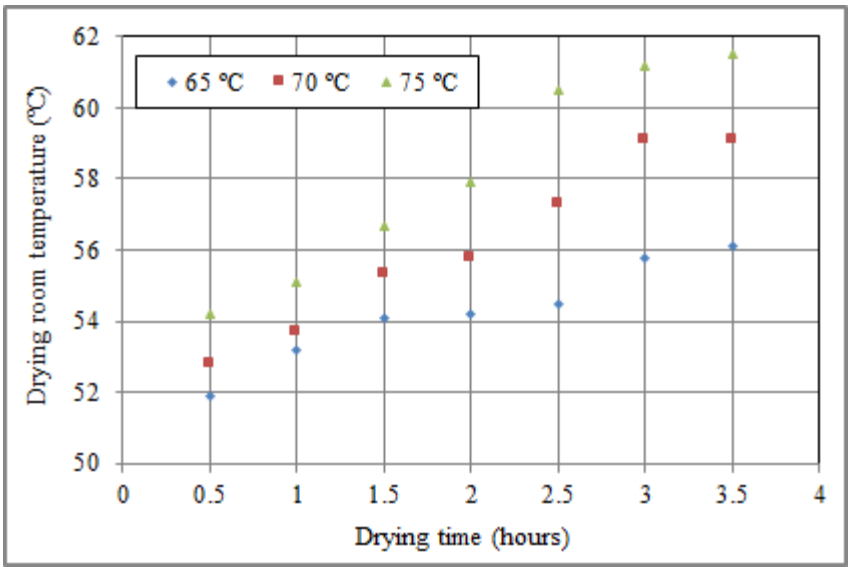

Figure 2. Graph of the relationship between drying time and drying room temperature.

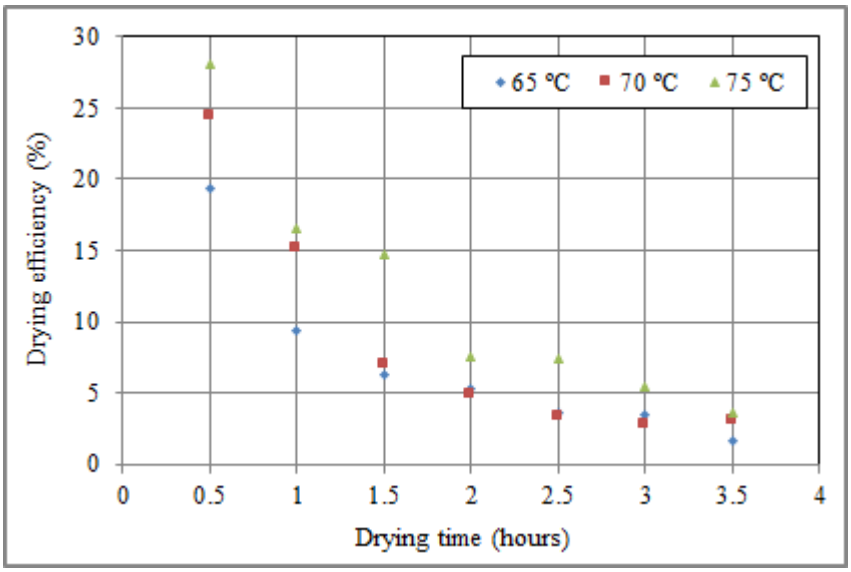

Figure 3. Graph of the relationship between the mass of test material and drying efficiency.

Drying efficiency was analyzed by comparing the amount of heat used to dry the coffee beans to the heat supplied to the drying chamber. Fig 3 shows that the drying efficiency of corn seeds increases with the increasing heating temperature, but is inversely proportional to the length of drying time, showing a decrease in efficiency. This shows that the drying mechanism and heat generated by the heating furnace can be absorbed well by the material during the drying process. However, the results of the study showed that providing high heat does not guarantee that the existing drying mechanism will cause the material to absorb maximum drying heat. Fig 3 shows that the highest drying efficiency of 28.14% was obtained in the drying process with a heating temperature of 75ºC and in the first 30 minutes. While the lowest drying efficiency of 1.58% was obtained in the drying process with a heating temperature of 65ºC and a drying time of 210 minutes. The higher the temperature

used to dry the corn seeds, the greater the drying efficiency. The average drying efficiency of corn seeds was 11.91% for a heating temperature of 75ºC, 8.66% for a heating temperature of 70ºC and 6.99% for a heating temperature of 65ºC.

IV. CONCLUSION

Based on the analysis of drying process data with air velocity of 2 m/s and temperature of 65ºC 70ºC 75ºC, it can be concluded that the higher the temperature used to dry corn seeds, the higher the drying efficiency. The average drying efficiency of corn seeds is 11.91% for a heating temperature of 75ºC, 8.66% for a heating temperature of 70ºC and 6.99% for a heating temperature of 65ºC. Meanwhile, the longer the drying time, the lower the drying efficiency.

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