Analysis of The Effect of Hot Fluid Flow Speed Variations On Potato Chips Drying Capacity Using LPG Gas

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Abstract

Some of the potato chips circulating in the community contain carbohydrates and have high oil absorption capacity. This slicing or slicing stage affects the level of uniformity of the potatoes during the oven, because during the oven the potato slices that are not uniform will cause case hardening and if they are too thin they will easily burn. Then cool, slice and dry until the water reaches 10%. To find out what percentage of water content is in potatoes so that these potatoes can be consumed properly, this research was carried out. The aim of the research was to see the effect of hot fluid velocity on potato drying. In this research, the following research variations were carried out by experimental; the speed of the incoming air flow is 3.8 m/s, 4.2 m/s, and 4.5 m/s. The results of this research are that the greater the speed of hot air, the greater the resulting temperature. After testing for 30 minutes and with variations in air speed of 4.5 m/second, the potato weight was 505 grams with good potato yields. . LPG fuel is more efficient than other fuels.
***Keywords*:** *drying, potato chips, variation of air speed energy.*

Abstrak

Keripik kentang yang beredar di masyarakat sebagian mengandung karbohidrat dan daya serap minyak yang tinggi. Tahapan pengirisan atau slicer ini mempengaruhi tingkat keseragaman kentang pada saat pengovenan, karena pada saat pengovenan irisan kentang yang tidak seragam akan menyebabkan case hardening dan bila terlalu tipis pula mudah gosong kemudian di dinginkan, di iris dan di keringkan sampai air mencapai 10%. Untuk mengetahui berapa persen kadar air dalam kentang supaya kentang ini dapat di konsumsi dengan baik maka dilakukanlah penelitian ini. Tujuan penelitian adalah melihat pengaruh kecepatan fluida panas terhadap pengeringan kentang. Pada penelitian ini dilakukanlah secara eksperimen dengan variasi penelitian sebagai berikut; kecepatan aliran udara yang masuk yakni 3,8 m/s, 4,2 m/s, dan 4,5 m/s. Hasil penelitian ini adalah semakin besar kecepatan udara panas maka temperatur yang dihasilkan semakin besar. Setelah dilakukan pengujian selama 30 menit dan dengan variasi kecepatan udara 4,5 m/detik maka diperoleh bobot kentang 505 gram dengan hasil kentang yg baik. Bahan bakar LPG lebih hemat dari bahan bakar yg lain.
Kata kunci: pengeringan, keripik kentang, variasi kecepatan udara.

1. Introduction

Potatoes are plants from the Solanaceae family that have edible tubers and are also called "potatoes". Potato tubers have now become one of the important staple foods in Europe even though they were originally imported from South America. This plant is an herb (short, non-woody plant) that likes a cool climate. In tropical areas, it is suitable for planting in the highlands. Potato chips that are circulating in the community contain carbohydrates and high oil absorption. The slicing or slicer stage affects the level of uniformity of potatoes during baking because when baking, potato slices that are not uniform will cause case hardening, and if they are too thin they will easily burn. Then, it cooled, sliced , and dried until the water content reached 10%. The slices of the dried chips are then oven, usually served as snacks or with rice as side dishes. During the baking process, the chips expand and have low pores which is called development, this is one of the important quality parameters in chips. One of the processes in the production of chips is the drying process.

The drying process carried out by most people is still conventional, namely, drying is done in an open place that depends on sunlight, The crispiness of the chips is also influenced by the expansion power, the greater the expansion power of the potato

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chips, the greater the crispiness will be. In this case, drying is one of the important aspects of processing potatoes into chips that require hot weather to be able to dry the chips, so these chip makers rely on the weather, even if the weather is hot it will be beneficial for these chip makers. On the other hand, when the weather is bad, they definitely can't dry their chips, especially during the rainy season, they can't produce chips because they are afraid of rotting because they can't be dried without heat. So here we thought of making a solution to help chip makers because the most important aspect of making savory chips is that this is closely related to drying or drying the chips. The weather is very difficult to predict or determine so it is necessary to have a chip dryer that can be used in various weather conditions.

Research on chip dryers has been widely conducted by previous researchers, including Muhammad Evit Kurniawan (2019) has conducted a prototype study of photovoltaic solar cell dryers (the effect of airflow rate on thermal efficiency in the cracker drying process). Fixed variables include the type of kemplang crackers used, the mass of kemplang entering the oven, and the drying time conditions in the oven. The control variables are the flow rate and temperature conditions, and the results obtained are efficiencies of 57.16%, 68.98%, 73.27%, 78.12%, and 80.4% where the lowest efficiency is at a flow rate of 6 m / s and the highest efficiency is at a flow rate of 10 m / s. From the results of the calculations and analysis, it can be concluded that the flow rate affects the thermal efficiency in the drying process, kemplang. The weakness of this study is that weather conditions greatly affect the drying results because they use solar power.

An oven-type dryer was also made by Ade Octavia et al. (2019) through a business management assistance program and the use of cracker drying machines at UKM Pelayangan, Jambi City. The drying machine used is an electric oven type using an electric heater. The weakness of this tool is that the electricity costs are quite high.

Imron Rozikin et al (2020) has conducted research on an Arduino-based cracker dryer using the fuzzy method. The method used to process data is the Fuzzy Sugeno method with two main parameters, namely temperature and humidity. This system has succeeded in monitoring and controlling the IoT-based cracker dryer prototype which can monitor remotely and automatically manage the temperature on the cracker dryer prototype to remain stable, making it easier for cracker producers to monitor the condition of the cracker dryer even though they are far from the cracker drying place as long as the tool and cracker producers are connected to the internet network. Halogen lamps were chosen by researchers as a heat source because they have heat equivalent to the heat of the sun. The disadvantage is the high cost because it uses electrical energy.

Rita Khathir et al (2020) have also conducted research on the performance of a solar-powered Hohenheim-type tunnel dryer for drying oyster crackers. The Hohenheim-type tunnel dryer is suitable for drying oyster crackers with a layer thickness of 6 mm in a short time, but further research for modifying the dryer is still needed. The weakness of this tool is that because it uses solar power, its effectiveness is highly dependent on weather changes.

Unung Lesmanah et al (2021) have made a cracker dryer with an oven shape and type using electric heater power which was donated to "UKM" in a community service event. The cracker dryer was made in order to improve small home industry businesses in Mulyoagung Village, Dau District, Malang Regency.

From the literature study on the cracker dryer above, a question arises about the fact that there is still no one who discusses in detail the use of LPG fuel and the use of burners with the regulation of variations in the speed of hot fluid flow that flows to the drying capacity of potato chips.

and comparing the use of wood fuel, electricity and LPG gas.

Therefore, the purpose of this study is to determine the effect of hot fluid flow rate on the drying capacity of potato chips using LPG gas. Conversion of electricity, firewood, and LPG gas fuel usage.

2. Methode

The main equipment that will be used in this study are as follows:

1. Mechanical chip dryer
2. Anemometer
3. Analog scales
4. Stopwatch
5. Thermometer
6. Potato cutter

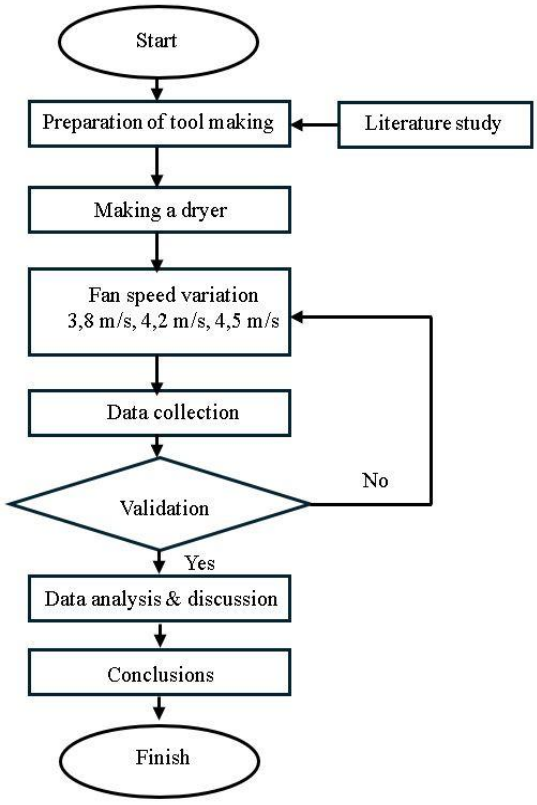

Figure 1. Research flow diagram

Data Collection Procedure:

a. Check the condition of the tool and clean the tool from dust that sticks.
b. Check the hose and regulator to make sure they are in good condition.
c. Arrange the pieces of chips on the tray.
d. Attach the hose and regulator to the prepared LPG cylinder.
e. Turn on the fire.
f. Wait until the temperature reaches 60°C.
g. Set the specified fan speed (3.8 m/s, 4.2 m/s, 4.5 m/s).
h. Insert the tray into the dryer (tunnel dryer).
i. Close the door for the tray entry.
j. Turn on the stopwatch.
k. Take data on Temperature, RH, Water Vapor and Potato Mass every 10 minutes.

For the research flow diagram, please see Figure 1 above.

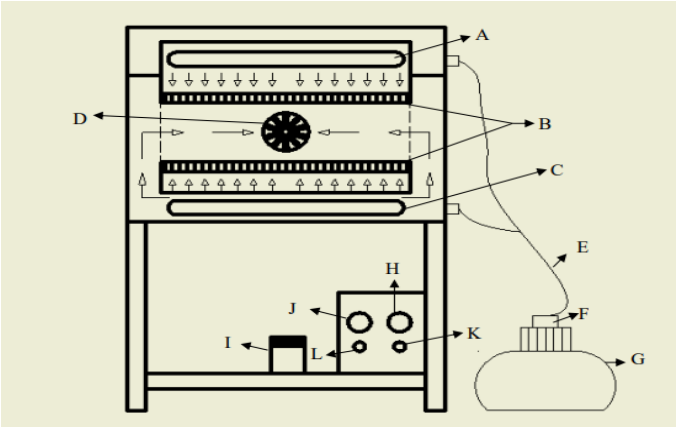

Figure 2. Components of a potato chip dryer
Description:
A. Upper burner, B, Tray J. Timer, C. Lower burner, D. Exhaust
E. Gas hose, F. Regulator, G. LPG cylinder, H. Exhaust speed regulator, I. Accu, J. Timer,
K. Indicator lamp, L. Exhaust cable connector.

3. Results & Discussion

3.1. Validation

Validation was conducted first to prove that the steps taken in this study were correct and can be seen in Table 1 below.

Based on Table 1 below, it can be seen that during the 60-minute research process, the potato drying process in the oven using LPG gas had an average value of 628.57 grams. While the stove using a heater by Pilster (2015) researchers had an average potato weight of 630.43 grams. The

difference in research results is around 0.29%.

Table 1. Validation of this research with previous research by Pilster (2015)

Time	Water mass in the present study (%)	Water mass (Pilster, 2015) (%)
0 min	700	700
10 min	680	698
20 min	670	670
30 min	640	650
40 min	600	590
50 min	580	560
60 min	530	545
Average	628,57	630,43

3.2. Relationship between time and temperature variation of flow velocity

The relationship between time and temperature can be seen in Figure 3 below based on the results of heating in the oven when drying potatoes.

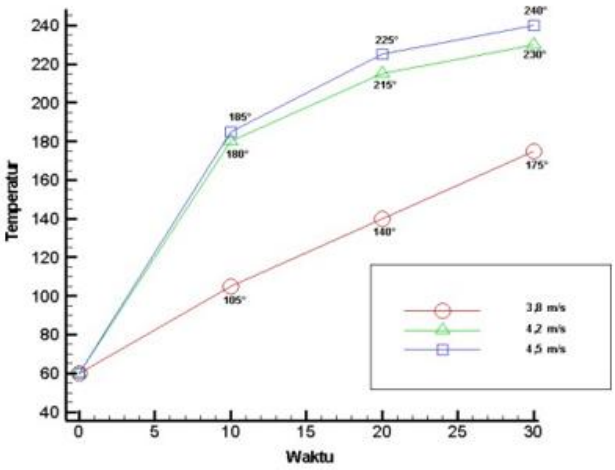

Figure 3. Relationship between time and temperature for various speeds

Figure 3 is a picture of the effect of time on temperature for different speed variations. In general, it can be seen that as time increases, the temperature also increases. Something important here is that the air flow speed of 4.5 m/s obtains a larger temperature distribution than other air speeds, namely 3.8 m/s and 4.2 m/s. This is because the magnitude of the air flow speed affects the convection heat transfer that occurs.

3.3. Potato chips capacity

Based on the calculation results, the potato chips capacity is obtained as shown in Figure 4 below,

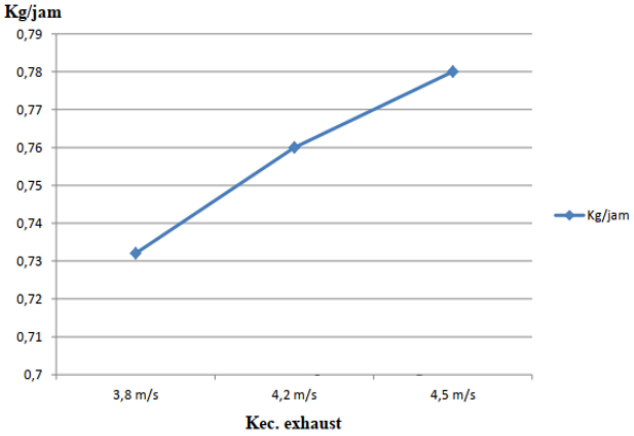

Figure 4. Calculation results for the capacity of potato chips produced with variations in hot fluid flow rate

Figure 4 shows that the capacity rate that occurs in the experiment of the variation rate of the drying air speed increases. This is obtained from the calculation results of the potato chip dryer capacity. At an air speed variation rate of 3.8 meters/second, the potato chip dryer capacity is 0.732 kg/day. At an air speed variation rate of 4.2 m/s, the potato chip dryer capacity is 0.76 kg/day. At an air speed variation rate of 4.5 m/s, the potato chip dryer capacity is 0.78 kg/day. With the higher flow rate and temperature, the water content lost at any given time will be greater, this is in accordance with research by Christopher Willy Benyamin (2018).

3.4. Fuel conversion during 2 weeks of drying

Table 5 is the fuel conversion for use during the 2 weeks of drying crackers. From the table, it can be seen that the fuel that can be used and is economical is LPG gas fuel.

Table 5. Fuel conversion

No.	Fuel	Rupiah	Explanation
1	LPG	Rp. 17.500	3kg tube
2	Electricity	Rp. 56.000	1Kwh = Rp.1.444 38,7 hr
3	Firewood	Rp. 42.000	1 tie/day 1 tie = Rp.3.000 (rambutan firewood)

4. Conclusions

From the data analysis and discussion of this study, a conclusion can be drawn, including: After testing for 30 minutes with convection calculations, it was found that an exhaust speed of 4.5 m/s can increase the heating efficiency in the oven. The greater the speed of the hot air flow in the potato chip drying chamber, the lower the weight of the chips. The use of LPG fuel is more efficient than other fuels.

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