The analysis of wasted grease amount towards filtering machine’s spinning rate

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Abstract. Grease amount inside a food can influence human’s health. Grease amount in a food has correlation with cholesterol amount which could lead to various diseases, such like hypertension, stroke, diabetes, and cardiac arrest risk. This research purposed to characterize wasted grease amount of food towards various spinning cycle of grease filtering machine. Various methods could be implemented to decrease the grease amount in a food, potato chips. Using the influence of centripetal force by applying motors spinning rate became the method which was implemented in this research. Determining volume of wasted grease amount was done by scaling food before grease filtering process then re-scale after filtering process was done. In order to find out the volume of wasted grease was through a division between the mass of wasted grease with the density of grease which is 0.8 g/cm³. Examination result shows potato chips grease amount decreased up to 10%. Wasted grease amount towards linear spinning rate with 0.99 determination coefficient graph also found based on experiments implementation. The result of research determines for each 1 rpm increase from spinning cycle, the numbers of wasted grease amount is 10.9 grams.

1. Introduction
The process of frying is usually chosen to process most of kind of foods [1]. Foods which is fried could absorb high amount of grease. Grease as heat transfer medium which enter foods could contain nutrition and taste [2]. Yet, the grease amount in certain food has a correlation to high amount of cholesterol. The process of cholesterol oxidation in food may produce high toxicity [3]. The condition may lead to many kind of serious disease. If anyone consume grease total more than 67 grams each day, the person may suffer from hypertension, stroke, and heart attack [4]. Moreover, consuming fried foods may increase diabetes risk [5]. Fried food as an example may be in form of potato chips.

The process of grease amount alleviation towards potato chips was done by several ways. Those ways are: keeping the drainage time which is controlled by dehydration process [6], wiping food with tissue or paper, or else using grease filtering machine [7]. In this research, the way to alleviate the grease amount was done by machine. Work principle of grease filtering machine is through the use of high spinning technique centrifugal in order to release out the grease [8]. The grease filtering machine in this research was used AC motor as the activator. AC motor uses alternating current as the source. AC motor will be able to change electrical power to mechanical motion. This case relates with a physic concept, where electric current positioned as a base measurement variable in instrumentation system [9]. The grease will be taken out from the food when the filtering machine is spinning. It is caused by the effect
from grease heating process which makes the distance between molecules is gapping [10], the grease texture will become slicker so that it is easier to be taken out while machine is spinning.

The grease filtering machines are already been sold publicly in varied model. Yet, there was not any research which came up on how much wasted grease amount in a food after the drainage process. Hence, in this research, we focused on wasted grease amount towards different spinning rate of the grease filtering machine.

2. Methods

In this research, AC motor was used as an activator. AC Motor was built by two primary component, stator and rotor [11]. In order to detect motor spinning rate, researcher used opto-coupler sensor type WYC H2010. Opto-coupler sensor is kind of devices which is divided into two parts, transmitter and receiver [12]. The number of maximum output voltage from sensor is 3.4 V. Dimmer is used to control spinning rate of the motor. The dimmer shift of angle is determined to change motor spinning rate.

The motor current and voltage was calculated by Multimeter. The voltage which was given to the motor was 220 V. Block diagram for this research showed on Figure 1.

![Block diagram](image1)

**Figure 1.** Research Blok Diagram

The grease filtering machine which was made by ourselves is shown by Figure 2 and the food sample is shown by Figure 3.

![Grease Filtering Machine](image2)

**Figure 2.** Grease Filtering Machine

![Potato Chips Sample](image3)

**Figure 3.** Potato Chips Sample
We started the research in February to June 2018 in Laboratory of Instrumentation, Department of Physics Education, Faculty of Mathematics and Science Education, Universitas Pendidikan Indonesia.

3. Results and Discussion

Before the researchers did the examination to analyse wasted grease amount towards various grease filtering machine spinning rate, we characterized the current and voltage of AC motor which is being used. The result is shown in Figure 4.

![Characterization between current and voltage of AC motor.](image)

According to the Figure 4, researchers were able to see the correlation between \( I \) (mA) and \( \nu \) (volt) of the AC motor is linear. Figure 4 shows the number of current comparable with the input voltage. AC motor started spinning when the input voltage reached more than 50 V, with the maximum voltage of 220 V. It caused by the time when the current flowing was low then the motor could not resist the friction force between rotor and magnet in stator, it means that the hindrance is very large. Hence, motor will start spinning when the current to activate the motor is enough, then the current will decrease and increase comparable to the input voltage which is being given.

The current number and the voltage number of motor correlate with the number of motor spinning rate. According to the research, we were able to collect data of motor spinning rate to the input voltage when the motor started spinning with constant spinning rate of the motor. It shows in the Figure 5.
Figure 5. The graph of spinning rate towards voltage correlation.

Figure 5 shows the result of spinning rate towards the voltage is linear and positive. The data collection was done when motor started spinning. It was shown when the voltage reached 50 V. Figure 5 shows when the voltage are getting bigger, the motor spinning rate and the current will also follow. In Figure 5, researcher found the regression formula value by \( \omega = 2.233V + 995.8 \). It shows that every 1 V voltage rise, the spinning rate will also rise to 998 rpm and the coefficient of determination (\( R^2 \)) is 0.9943.

Then, we did a data collection when the machine was ready to be given load as much as 100 grams of potato chips. Data collection was done several times. The result is shown by Figure 6.

Figure 6. The graph of wasted grease amount towards spinning rate correlation.

Figure 6 shows the correlation of spinning rate and wasted grease amount (WGA) is linear. It means if the spinning rate which was given was bigger, the mount of wasted grease amount will also turns bigger. The wasted grease amount in Figure 6 was collected from the measurement of potato chip mass before and after a spin by grease filtering machine.
In Figure 6, the result of regression formula was found \( WGA = 0.0144\omega - 10.974 \). It means every rise of 1 rpm, the amount of leaked grease was 10.9596 grams. The number determination coefficient was 0.9904.

In order to get the volume of wasted grease, researcher divided the mass of wasted grease \((m)\) with grease density \((\rho)\), 0.8g/cm\(^3\). The volume \((V)\) of wasted grease shows by Table 1 below.

**Table 1.** The data of examination result to wasted grease amount towards potato chips.

| No | \( m_1 \) (g) | \( \bar{m}_2 \) (g) | \( \bar{f} \) (Hz) | \( \bar{i} \) (A) | \( \bar{v} \) (V) | \( \bar{\omega} \) (rad/s) | \( \bar{\omega} \) (rpm) | Wasted Grease Towards (gram) | Volume of wasted grease (cm\(^3\)) |
|----|---------------|----------------|----------------|---------------|-------------|-----------------|---------------|--------------------------|-----------------------------|
| 1  | 100           | 95.00          | 18.33          | 0.010         | 69.26       | 115.13          | 1100          | 5.00                     | 6.25                        |
| 2  | 100           | 93.16          | 20.66          | 0.013         | 108.90      | 129.78          | 1240          | 6.83                     | 8.54                        |
| 3  | 100           | 91.96          | 22.33          | 0.017         | 153.15      | 140.25          | 1340          | 8.03                     | 10.04                       |
| 4  | 100           | 90.73          | 23.33          | 0.020         | 184.70      | 146.53          | 1400          | 9.26                     | 11.58                       |
| 5  | 100           | 90.03          | 24.00          | 0.023         | 216.66      | 150.72          | 1440          | 9.97                     | 12.45                       |

In Table 1, the data result was done several times. The change of spinning rate determined by the change of spinning angle in the dimmer by 20°. The spinning rate reached minimum when the motor started spinning at 1100 rpm and for the maximum at 1440 rpm. Researcher gained the number of wasted grease amount maximum for the first mass \((m_1)\) of potato chips (100 grams) was 9.97 with the maximum amount of wasted grease was 12.45 cm\(^3\).

The result regarding potato chips before and after drainage process with grease filtering machine was understood that the potato chip contained a big amount of grease. In the other hand, potato chips lost some amount of grease after drainage process. The grease was successfully thrown out without any damage at the chips texture. The potato chips became healthier, crisper, and there was small amount of grease.

4. **Conclusions**

We have successfully analysed the amount of wasted grease in potato chips. This research was done with the use of grease filtering machine which was built by ourselves and could be used perfectly. The machine took out the grease well done. The result shows that the correlation between the machines’ spinning rate with the amount of wasted grease is comparable.

In conclusion, AC motor need a big current to be activated. After motor is moving, the current will fall down and then rise in liner. In the examination of grease amount in food, it decreased 10% for a sample, potato chip. The graph shows the amount of wasted grease towards spinning rate is liner, with the determination coefficient is 0.99. The result of graph shows that every rise of 1 rpm, the amount of wasted grease is 10.9 gram. This research is wished to be developed to the upcoming research for example use some other variation of food beside potato chip.

5. **References**

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