# Design and Study of Spinner Machine Performance through Simulation and Proximate Analysis of Sepakung Village-Speciality Pegagan Leaf (Centella asiatica) Chips

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# Design and Study of *Spinner* Machine Performance through Simulation and Proximate Analysis of Sepakung Village-Speciality Pegagan Leaf (*Centella asiatica*) Chips

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***Abstract*— Sepakung Village is a tourism village in the rural area of Semarang Regency which provides various farm products such as rice, coffee, brown sugar, vegetables and processed product, Sepakung Village-specialty pegagan leaf (*Centella asiatica*) chips. In the production chain of pegagan leaf chips, one of the influencing factors towards the storability or shelf-life is the cooking oil content within the packaged product, in which the excess cooking oil content should be minimalized. A design of 3-kg capacity onefold *spinner* machine is introduced as 2D and 3D model and simulated using Solidworks software to determine the individual parts' strength and recommended material through creative and weighted objective method. After utilization of the *spinner*, the cooking oil and final nutrient contents are analyzed before and after the process by the duration of spinning time from 0 to 60 minutes. The cooking oil drained or removed from the chips were analyzed descriptively, while the data is analyzed using ANOVA to determine the effective spinning time. The result shows that the spinning duration had an effect toward the removed cooking oil content in which the graphical approach shows an exponential curve between the spinning duration and cooking oil content. The effective spinning duration is achieved at 30 minutes in which the product cooking oil content is at its lowest and highest difference compared to the previous results.**

***Keywords*— design, spinner machine, oil content**

## I. Introduction

The development of small industrial centers in several parts of Indonesia is increasingly becoming a special attraction for the community. One of them is in the Sepakung Village industry center which produces various kinds of agricultural products such as rice, coffee, palm sugar, vegetables, as well as home-based industrial products, one of which is a speciality product of Desa Sepakung, pegagan leaf chips. The ever-increasing food market growth demands high quality and quantity from the industrial production of pegagan leaf chips [1].

The production process that uses traditional method still has problems in reducing the level of cooking oil in products that are ready to be packed. Excessive cooking oil content causes a rancid smell and the shelf life of the product becomes shorter [2]. Some respondents also want the product to have a minimum oil content so that an effort is needed to reduce the content of cooking oil from this pegagan leaf chips product.

Based on this background, a simple spinner machine is designed to be suitable for home industries [3]. The function of this spinner machine is to reduce the cooking oil content in fried foods using centrifugal force. Snacks supplied in the oil spinner tube is pushed so the oil will be drained out through the tube hole and held on the outside part of the drain tube. To test the effectiveness of the spinner machine, the content of cooking oil in the product was analyzed before and after the use of a slicing machine in several time ranges to determine the optimum time of the oil draining process.

## II. Research Methodology

This research was conducted in three stages, the first stage was survey and problem identification aimed to find out the obstacles in the Pegagan chips industry through interviews with business owner. The second stage is the process of designing and manufacturing simple spinner machine using Solidworks application in 2D and 3D. The next stage is product analysis before and after the use of a spinner machine to determine the effectiveness of the machine itself. The results of the research data were processed using ANOVA (Analysis of Variance) method to determine the optimum time for the process of draining cooking oil.

The survey and identification of problems were carried out in July 2018 in the Srikandi Micro Small Medium Enterprises (UMKM) as producers of the Sepakung Village speciality pegagan leaf chips. Data problems and production capacity requirements from the business owner are then realized in the design of a spinner machine.

The oil slicing machine is designed using Solidworks applications in 2D and 3D and strength analysis with Solidworks simulation which is then adjusted to the material needs and tool capacity of the survey and identification results [3]. The tool was designed and produced in August 2018 which was then applied to the production of pegagan leaf chips.

Product analysis before and after the draining process was carried out at 0, 10, 20, 30, 40, 50, 60 minutes and a spinner speed of 500 rpm using oil extraction method with n-hexane [4]. The data was processed by ANOVA method with and without the use of spinner machine which were displayed in graphical form. The optimum time is obtained when the oil content has reached the stationary point or when there is no significant change compared to the cooking oil content from the previous analysis.

## III. RESULT AND DISCUSSION

From the interview results of business owner, the problem experienced is the excessive cooking oil content in pegagan leaf chips which causes a shorter shelf life of products. Pegagan leaf chips production process reaches approximately 10 kilograms per day which requires a tool capacity of around 3 kg with a maximum power of home industry energy consumption of 900 watts. With this research method, the design concept is obtained as shown in Figure 1.

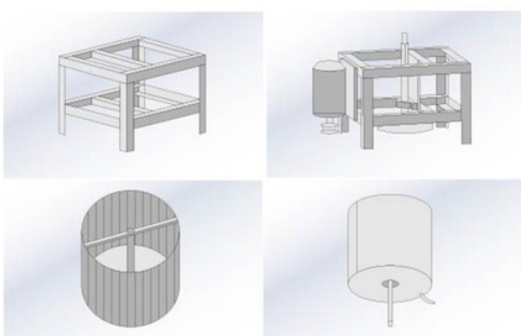

Fig. 1. Design of spinner machine parts

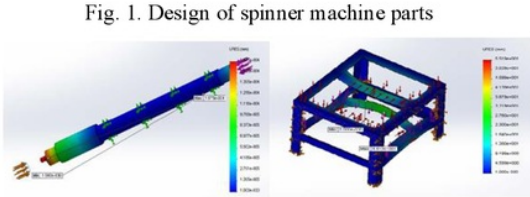

Fig. 2. Strength simulation of spinner machine's main parts

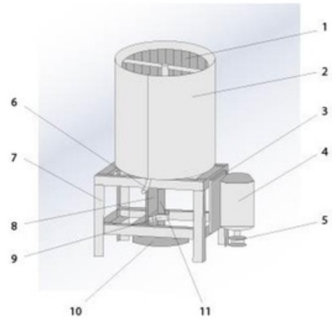


Fig. 3. Spinner machine parts

Fig. 4. The result of spinner machine assembly

The parts and functions of the spinner machine are listed in Table 1.

TABLE 1.

| No | **Spinner Machine Parts** | |
|---|---|---|
| | ***Part*** | ***Function*** |
| 1 | Spinner tube | Serves as a place for oily products to be placed and rotated |
| 2 | Spinner cover | Closing the spinner tube part that rotates and holds the filtered oil |
| 3 | Motor base | Electric motor seat holder |
| 4 | Electric motor | Spinner tube drive motors are connected with pulleys and belts |
| 5 | Motor pulley | The part that is rotated directly by an electric motor |
| 6 | Outlet pipe | The oil exit pipe is filtered and collected on the cover of the spinner |
| 7 | Machine frame | Base of the machine parts |
| 8 | Pillow block base | Pillow block seat holder |
| 9 | Pillow block | Shaft bearing from the spinner machine |
| 10 | Spinner tube pulley | The part connected with an electric motor pulley to drive the spinner tube |
| 11 | Main shaft | The shaft that rotates the spinner tube directly connected to the pulley circuit and the electric motor |

Based on the strength analysis carried out by Solidworks simulation in Figure 2., the shaft and frame parts of the machine are the main parts with a fairly high pressure. However, the shaft section experiences the highest pressure at the base compared to the pressure on the frame which tends to be fairly even. The whole spinner machine design was obtained as shown in Figure 3. It was designed with Aluminum metal as a machine frame material and Stainless Steel as shaft material and rotating components to maintain product quality and prevent rust on the machine as shown in Figure 4 [3]. The electric motor used is the Single Phase Electric Dynamo Type B with the power consumption of 200 watts of maximum speed of 2800 rpm which is then set to 500 rpm to prevent damage to the chips.

Analysis of cooking oil content on pegagan leaf chips product is done by oil extraction method with n-hexane solvent by weighing the mass of the sample after extraction and the mass of the sample before extracting at a certain time. The results of the analysis obtained are processed in graphical form as Figure 5.

The product cooking oil content before treatment was in the range of 53.5%. After the use of spinner machine, a significant decrease in cooking oil content between 0 and 60 minutes reached 19.3%. In pegagan leaf chips products without the use of a slicing machine, the product is left in a closed container with the same capacity. Obtained cooking oil content without the use of a spinner machine which tended to decrease but linearly with the content in the 60$^{th}$ minute was 42.7%. Statistical data to compare changes in cooking oil content can be seen in Table 2.

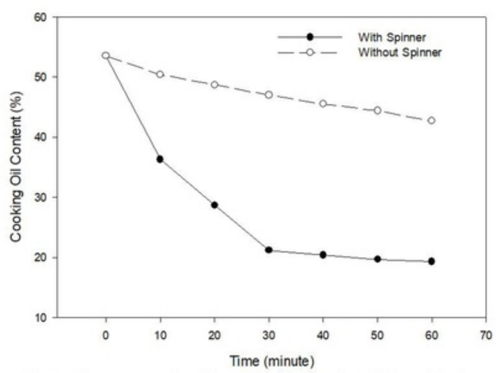


Fig. 5. The content of cooking oil in pegagan leaf chips with time variations with and without the use of a spinner machine

TABLE 2.

| Time (minute) | With Spinner (%) | Without Spinner (%) | Comparison |
|---|---|---|---|
| 0 | 53.5 | 53.5 | - |
| 10 | 36.3 | 50.4 | 5.5 |
| 20 | 28.7 | 48.7 | 6.2 |
| 30 | 21.2 | 47.0 | 7.4 |
| 40 | 20.4 | 45.5 | 1.1 |
| 50 | 19.7 | 44.4 | 1.4 |
| 60 | 19.3 | 42.7 | 0.5 |

Based on the comparison obtained at each time of draining, the comparison of the difference in oil content with oil content without the use of the machine showed the highest value in the use of oil draining machines for 30 minutes reaching 7.4 times with cooking oil content of 21.2%. This comparison shows the effectiveness of using a slicing machine. The use of a slicing machine gives a change in the oil content which when compared to changes in oil content without the use of the engine, the optimum time is determined by the highest ratio, in which the study was 30 minutes.

In the use of a spinner machine exceeding the optimum time, the ratio of cooking oil content to pegagan leaf chips was smaller than the comparison in the previous minute. This shows that the decrease in cooking oil content with the use of the machine over the optimum time is smaller than the decrease in cooking oil content without the use of a spinner machine

## IV. CONCLUSION

Based on the research and discussion that has been carried out, there is a problem identification data that is sufficient to be used to design and assemble a onefold oil cutting machine with a capacity of 3 kg with a 200 watt energy requirement and a 500 rpm rotation speed. The use of a spinner machine in the oil draining of Sepakung Village speciality pegagan leaf chips requires an optimum time of 30 minutes with a cooking oil content of 21.2%. The use of a slicing machine at the time before and beyond the optimum time gives less optimal results.

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