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The Effectiveness of OSTO-3P Machine in The Process of Making Hygienic Tempe

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ABSTRACT

Tempe is a native Indonesian food, made from soybeans and widely consumed by the majority of Indonesian people. However, the tempe production process still uses conventional methods with makeshift tools, so the quality and cleanliness (hygiene) of the product is not maximized. The tempe production process, especially in the process of peeling, breaking and separating the soybean epidermis takes a long time and tiring and it is difficult for tempe producers to find employees to assist the production process. In dealing with this problem, the researchers found an innovative solution, namely the OSTO-3P Machine which features soybean cleaning, soybean splitting, and soybean separator with its epidermis. The method of implementing this activity is making detailed drawings, carrying out assembly manufacturing processes and machine trials, handover and machine implementation. Through the application of the OSTO-3P machine, it has a positive impact on the process of making tempe including: 1) increasing the production capacity of tempe to be doubled from before, 2) being able to speed up the process of splitting and separating soybeans which was originally 50kg/hour to 150kg/hour, 3) quality Tempe is more hygienic because it does not come into direct contact with hands and uses components made from foodgrade.

INTRODUCTION

Tempe is one of the original Indonesian foods, made from soybeans. Currently, tempe is promoted so that it can become international quality food, it must be improved both in terms of the production process, management of tempe and preserving it as part of Indonesian culture. According to the statement from the Chairman of The Indonesia Tempe Forum (ITF), namely Prof. Made Astawan, that "although there are many tempe producers in Indonesia, not all of them have good and correct techniques in making tempe. So, one of the things that need to be considered in producing tempeh is quality improvement both in terms of technique and cleanliness. Therefore, it is necessary to improve the quality of tempeh by using better and more hygienic technology during the production process (Jumiono dkk, 2019).

Background of the Problem

The background of the problems of this study include: (1) the tempeh production process still uses conventional methods with makeshift tools, so the quality and cleanliness (hygiene) of the product is not maximized (Fevria dkk, 2021); (2) the process of producing tempeh, especially in the process of peeling, breaking and separating the soybean epidermis, takes a long time and is tiring (Sari dkk, 2022); and (3) it is difficult for tempe producers to find employees to help with the production process. In dealing with this problem, the researchers found an innovative solution, namely the OSTO-3P Machine which features soybean cleaning, soybean splitting, and soybean separator with its epidermis (Mujiyanti dkk, 2023).

Objectives of Research

The objectives of this research include: (1) creating and developing a 3in1 tempe processing machine (OSTO –3P) to maintain tempe hygiene and speed up the production process (Budijono dkk, 2023); (2) registering product certification and quality management so that it is ready for commercialization (Umar dkk, 2018); (3) can improve the quality of production so that the turnover of tempe entrepreneurs increases; and (4) there are no more difficulties in finding human resources for the production process (Ridlwan dkk, 2022).

Factors of the Problems

The majority of tempe production in Indonesia uses traditional methods. This means that tempe producers come from home industries that still use traditional equipment and production processes. The tempe production process which still uses conventional methods with makeshift tools can cause several problems related to the quality and cleanliness of tempe products. Several factors can cause this problem, including (1) quality of raw materials, the use of raw materials for soybeans that are not fresh or of low quality can affect the quality of the tempeh produced. Poor soybeans can reduce the nutrition and taste of tempeh ; (2) unhygienic processing, using improvised tools may be difficult to keep clean. This can cause contamination of bacteria and other microorganisms that can cause tempeh to spoil quickly or even have the potential to cause health problems for consumers ; (3) limited production process control, the conventional tempe production process with makeshift tools may have problems controlling temperature, humidity, and other factors that can affect the quality of tempe (Ma'ruf dkk, 2023).

Making tempeh with split seeds will produce tempeh with a higher protein content than tempeh with whole seeds. This is related to a more complete fermentation because the soybean seed chips, the breakdown of the seeds, results in tempeh with a higher water content than tempeh with whole seeds and more protein broken down by mold. The tempeh production process involves the time-consuming and tiring stages of peeling, breaking, and separating the soybean epidermis. Some of the factors that cause this problem are: (1) process manuality, the process of stripping and breaking soybean epidermis is often done manually with simple tools, so it requires a lot of energy and time (Lubis dkk, 2019) ; (2) low productivity, this manual process can lead to low productivity levels, meaning the production of large quantities of tempeh becomes more difficult and requires a lot of manpower (Widi dkk, 2017); (3) product inhomogeneity, the manual process often causes non-uniformity in the size and shape of the soybeans which will affect the final product of tempeh (Lengkey dkk, 2021).

Another problem faced by tempe producers is the difficulty in finding employees who are willing to help in the production process. some of the factors that cause this problem are: (1) lack of interest in agricultural jobs, the tempe production sector is often less attractive to the younger generation because of the impression that this job is less profitable and less prestigious (Bintari dkk, 2014); (2) low wages, tempe producers may find it difficult to provide workers with attractive wages, especially if they still use conventional production methods with makeshift tools (Abdullah dkk, 2022); (3) lack of labor skills, the tempe production process may require special skills in processing soybeans into quality tempe. However, the difficulty of finding workers with these skills can be an obstacle (RIANTO, 2015).

This is in line with that despite being superior in terms of sanitation, many tempe industries with modern equipment can support the lives of tempe processors and have the advantage of good hygiene compared to traditional methods. As for conventionally the industrial production process of tempeh is a crucial and laborious process with a limited workforce. Traditionally, the production time for tempeh is long enough to overwhelm producers and is unable to keep up with the increasing public demand for tempeh consumption.

As for the conventional process of breaking soybeans causes 10% of the soybeans to remain unbroken and requires a relatively long time (1 hour). The process of breaking soybeans in the traditional way has unsatisfactory results, because apart from the relatively small results, it still uses human power to crack soybeans. In addition, the length of processing of soybeans into tempeh is the main problem for tempe entrepreneurs, so they are less able to get promising profits.

Some technologies that implement machines to maximize tempe production are soybean epidermis breaking and separating machines with a capacity of 300 kg/, soybean crushing machines as tempe ingredients with a capacity of 154 kg/hour, skin peeling machines soybean extract with a capacity of 20 kg/hour, a soybean grinding machine with an electric motor driving 1 HP and a soybean crusher machine with a 5.5 gasoline motor, PK with a production capacity of 300 kg/hour, a machine sieve type MPT001 soybean thresher, an environmentally friendly and hygienic automated soybean processing machine.

METHODS

The methods used for this research include developing detailed tool designs, implementing the assembly manufacturing process and machine testing, as well as machine handover and implementation. The research flow is depicted in Figure 1 below.

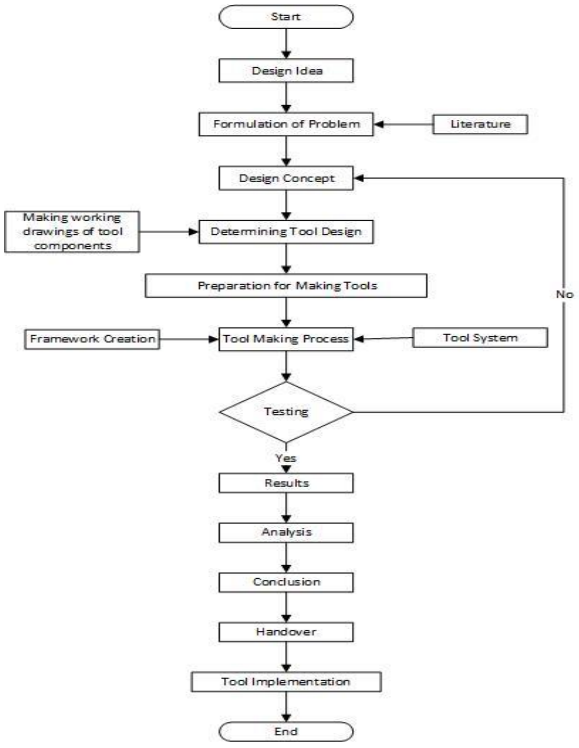

Figure 1. Research Flow of OSTO-3P Machine

The trials on the OSTO-3P tool were carried out in two Small and Medium Enterprises (UKM) locations. The purpose of this research is to find out whether the machine is working effectively or not using.

RESULT AND DISCUSSION

The OSTO-3P machine has been created based on analysis and working drawings. Based on the working drawings, a prototype is then created. The OSTO-3P engine specifications are in Table 1 below.

Table 1. OSTO-3P engine specifications

Aspect	Information
Ingredients	Stainless Steel 304 standard Foodgrade
Dimension	60 x 60 x 120 cm
Driver motor	Electric motor 0,5 Hp
Capacity	150 kg/h
Feature	- Soybean cleaner - Soybean crusher - Separating soybeans from their epidermis

On the OSTO-3P machine, there are several important components, namely the upper roll borders, lower roll borders and rolling rubber. The way this machine works is that the soybeans are put into the top hopper, then the soybeans will be crushed between the roll borders and the rubber roller so that they break and separate from the epidermis. The soybeans are rolled over twice by the top and bottom rolls, so that the breaking and separation of the soybeans is maximized. The way this works can be seen in the following image.

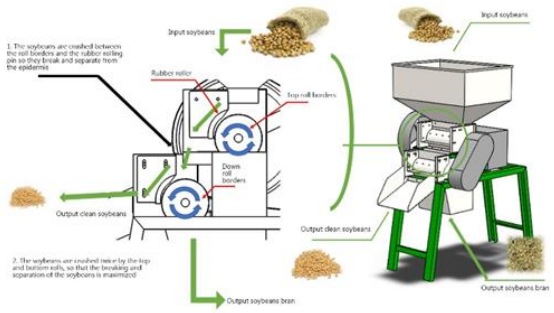

Figure 2. Design concept OSTO-3P Machine

The results of testing this tool can be seen in Tables 2, 3. From Table 2, testing the soybean peeling machine in UKM I with a load of 50 kg in test I obtained 50 kg of peeled soybeans, 0 kg of whole soybeans, 5 kg of separated epidermis and 750 grams of skin are not separated within 60 minutes. In test II, 50 kg of peeled soybeans were obtained, 0 kg of whole soybeans, 5.8 kg of separated epidermis, 575 grams of unseparated epidermis in 60 minutes. In trial III, 50 kg of peeled soybeans were obtained, 0 kg of whole soybeans, 6 kg of separated epidermis, 400 grams of unseparated epidermis within 60 minutes.

Meanwhile in table 3, testing the OSTO-3P machine in UKM 2 with a load of 150 kg in trial I obtained 150 kg of peeled soybeans, 0 kg of whole soybeans, 9 kg of separated epidermis, 1500 grams of unseparated epidermis in 60 minutes. In trial II, 150 kg of peeled soybeans were obtained, 0 kg of whole soybeans, 9.8 kg of separated epidermis, 1175 grams of unseparated epidermis within 60 minutes. In trial III, 150 kg of peeled soybeans were obtained, 0 kg of whole soybeans, 10.6 kg of separated epidermis, 900 grams of unseparated epidermis within 60 minutes.

Table 2. Testing of soybean epidermis breaking machine in UKM I

Information	Test I	Test II	Test III
Flaked soybeans (kg)	50	50	50
Whole soybeans (kg)	0	0	0
Epidermis separates (kg)	5	5,8	6
Epidermis not separated (gr)	750	575	400
Tool operating time (minutes)	60	60	60

Table 3. Testing of OSTO-3P machine in UKM II

Information	Test I	Test II	Test III
Flaked soybeans (kg)	150	150	150
Whole soybeans (kg)	0	0	0
Epidermis separates (kg)	9	9,8	10,6
Epidermis not separated (gr)	1500	1175	900
Tool operating time (minutes)	60	60	60

From the results of these trials, an increase in epidermis separation was obtained after using the OSTO-3P machine and the separation results tripled. The quality of tempeh is more hygienic because it is not touched much by hands and the machine components are made from food grade materials.

CONCLUSION

Through the application of the OSTO-3P machine, it has a positive impact on the process of making tempe including: 1) increasing the production capacity of tempe to be doubled from before, 2) being able to speed up the process of splitting and separating soybeans which was originally 50kg/hour to 150kg/hour, 3) quality Tempe is more hygienic because it does not come into direct contact with hands and uses components made from foodgrade.

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