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# Operational Testing and Performance Analysis of a Pineapple Jam Mixing Machine

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**Abstract.** This study aims to evaluate the performance of a pineapple jam mixing machine designed to enhance production efficiency and product quality. The testing was conducted at a stirring speed of 28.5 rpm with three repetitions, each lasting 2.05 minutes, 2.25 minutes, and 2.10 minutes, respectively. The results indicate that the mixing machine can improve mixing efficiency by up to 30% compared to manual methods, while also producing jam with consistent and good quality. Statistical analysis reveals that mixing time has a significant effect on the quality of the final product. Overall, the pineapple jam mixing machine has proven to be effective in improving the performance of the production process.

**Keywords:** Machine, Pinepple, Jam.

## 1. INTRODUCTION

Jambi Polytechnic's partnerships with micro, small, and medium enterprises (MSMEs) have attracted significant attention from various groups, including government agencies and the general public. In Jambi City, there is an MSME renowned for its diverse culinary offerings, one of which is Lapis Angso Duo. Lapis Angso Duo is a sponge cake business with a signature dish, pineapple sponge cake made with delicious pineapple jam. This MSME previously used a pineapple jam mixer, but it was not fully functional.

The pineapple jam mixing machine is used to mix the raw materials evenly to achieve the desired jam quality. Uneven or prolonged mixing can damage the raw materials, such as breaking the pineapple fibers or causing undesirable changes in texture. Therefore, the mixing machine's performance needs to be carefully analyzed to ensure efficient production and high-quality pineapple jam [1].

The UMKM lapis angso duo in making pineapple jam using the previous machine was very disturbed because the motor of the mixer made noise, and also did not have a machine cover, which could cause dirt from the machine

to enter the pineapple jam processing, therefore the pineapple jam mixing machine was made with a machine cover to prevent dirt or oil from entering the processing, and also added speed control to the machine as an innovation.

Based on sources from existing literature and the results of the final project on pineapple jam mixers, we will optimize the tool in terms of the raw material capacity of the tool of 25 pieces/hour, therefore the author is interested in making a final project with the title "Testing and Analysis of Pineapple Jam Mixer Machine Performance".

## 2. LITERATURE REVIEW

Previous research aims to provide comparative and reference material. Otherwise, avoid assuming similarities with this research. Therefore, in this literature review, the researcher includes the findings of his previous research. The content is as follows:

(1) Cracker Dough Mixer Machine

The process of mixing 25 kg of cracker dough with this mixer machine only takes ± 3 minutes, while with manual mixing by hand and foot, it takes at least 30 minutes. This means it is 10 times faster than the manual method used by cracker MSMEs so far. The results of observations on the time needed for the manual mixing process of 25 kg of cracker dough are, if mixing 25 kg manually takes time (29.53 minutes), while if mixing 25 kg using a dough mixer machine takes time (2.56 minutes) [2].

This electric motor and reducer mechanical cracker dough mixing machine can work effectively and efficiently with hygienic cracker product results with a production capacity of 500 kg / hour, has a processing speed 10 times faster than the manual method of 50 kg / hour. The quality of the resulting cracker dough mixture is also better, smoother and more elastic, so that the quality of the resulting cracker product is better, tastes better and has a brighter physical appearance.

(2) Dodol Mixing Machine

This test was conducted to determine the duration of the first stage of dodol cooking which was still light brown in color for a long time, the dodol cooking process in the second stage saw the dodol change color slightly to brown and bubbles appeared on the dodol due to the longer cooking duration, in the third stage the dodol increasingly looks thicker and changes color to pitch black due to the longer cooking time and the dodol is ready to be lifted. Data collection was carried out through 3 tests, where for all tests there was 1 trial, so that 3 tests were carried out there were 3 trials. In each test carried out in Making dodol using an automatic stirring machine, it takes faster time than manual stirring manual. Mixing dodol using a machine takes 101 minutes, while mixing manually takes 139 minutes. Making dodol using an automatic mixer produces chewy, browner dodol, and has a more intense aroma and flavor [3].

(3) Green Peanut Butter Mixing Machine

The trial of this machine will be carried out by collecting data used as a basis for determining the level of effectiveness, efficiency, and capacity of this green peanut butter making machine. This machine will be subjected to two trials, namely the homogeneity trial and, the test is carried out by entering ingredients consisting of 8 kg of green beans and 6 kg of sugar. The ratio between green beans and sugar is 1: 0.75. So every 1 kg of green beans is mixed with 750 grams of sugar. The results of the trial of the green peanut butter making machine for 15 minutes, showed that the green peanut butter was still not ripe, marked by a color that was still pale, not mixed evenly, and the texture of the jam was still rough. The second trial was the result of a 30-minute trial, showing that the green peanut butter was quite ripe and the color turned slightly yellowish. Then the third trial was the result of a 45-minute trial, producing green peanut butter that was ripe, yellowish in color, and had a soft texture. Based on the results of the design of the tube and mixer of the green peanut butter making machine with a capacity of 15 kg/45 minutes, it can be concluded that the tube has dimensions of 550 mm high, 740 mm long, and 570 mm wide. These dimensions yield a volume of 150,242 $cm^3$, or 150.2 liters. The mixer has a height of 215 mm per blade and a length of 640 mm. The mixer has a rotation speed of 29 rpm. The test results were consistent with the requirements for making green bean jam [4].

(4) Pineapple Jam Mixing Machine

The test results showed that the mixing efficiency of 75 rpm rotation speed, 20 minutes stirring time, the highest stirring efficiency (92.5%). Product quality increased along with mixing efficiency and at 75 rpm speed produced the best product quality. The test results showed that rotation speed and mixing time have an effect on the performance of the pineapple jam blender. The rotation speed of 75 rpm and 20 minutes stirring time is the

best combination. This study shows that testing the performance of the pineapple jam blender is important to improve production efficiency and product quality [5].

## 3. RESEARCH METHODOLOGY

### *3.1.Research Design*

This research used an experimental approach with a direct testing method on a pineapple jam mixing machine. The goal was to evaluate the machine's operational performance based on technical parameters, work efficiency, and mixing quality. Testing was conducted in a mechanical engineering laboratory and under simulated conditions of an MSME production process.

### *3.2. Tools and Materials*

The tools and materials used in this research include:

- Pineapple jam mixing machine
- Digital stopwatch and tachometer
- Digital scale
- Infrared thermometer
- Raw materials: pineapple, sugar, and other jam ingredients
- 220 V AC power supply or alternative motor (if available)

### *3.3. Operational Testing Procedure*

Operational testing was carried out using the following steps:

(1) Machine preparation: Initial inspection of the mixing system, drive motor, and completeness of components.
(2) Raw material loading: Pineapple jam raw materials were loaded into the mixing container according to the machine's capacity.
(3) Machine operation: The machine was run for a specified period of time.
(4) Temperature and speed monitoring: During the mixing process, the mixture temperature and rotation speed were recorded periodically.
(5) Mixed sample collection: The mixed jam was taken for analysis of homogeneity, viscosity, and final temperature.

## 4. RESULTS

The pineapple jam mixer machine was tested three times, with data collected three times, each with different results and different time intervals. The complete data can be seen in the table below.

**Table 1.** Test Results of the Pineapple Jam Mixing Machine

| Testing | Documentation | Data Collection of Test Results |
|---|---|---|
| 1 |  | The first test included 25 pineapples with a machine speed of 28.5 rpm, and the test took 123 minutes (2.05 hours). |
| 2 |  | The second test included 25 pineapples with a machine speed of 28.5 rpm and took 135 minutes (2.25 hours) to complete the test. |
| 3 |  | The third test included 25 pineapples with a machine speed of 28.5 rpm and took 126 minutes (2.1 hours) to complete the test. |

From the results of the test table above, there were three tests, and it can be concluded that the average time for stirring pineapple jam took 127 minutes (2.13 hours).

## 5. DISCUSSION

The author's pineapple jam mixer machine testing focused on performance testing and analysis, which served to determine the efficiency and capacity of the test. After optimization, the machine's capacity was able to accommodate 25 pineapples, with a stirring blade rotation of 28.5 rpm. In this process, the tester collected data from three tests, and the calculations were based on the machine's capacity, which could accommodate 25 pineapples.

From the results of testing the pineapple jam mixing machine, the test data was collected through the following process:

Pineapple jam is a type of jam made from pineapple. It has a sweet and slightly sour taste and a distinctive aroma. The final results, based on the mixing time and testing, showed that the pineapple jam was evenly mixed and there were no burnt areas.

**Figure 1.** First Test Results

Based on the fourth picture, the pineapple jam mixture is mixed evenly into the pineapple jam, and the mixing process takes 123 minutes (2.05 hours).

**Figure 2.** Second Test Results

Based on the fifth picture, the pineapple jam mixture is mixed evenly and the mixing process takes 135 minutes (2.25 hours).

**Figure 3.** Results of The Third Test

Based on the sixth image, the results of stirring the pineapple jam, namely 126 minutes (2.1 hours), have met the standards for making pineapple jam. Data from the previous PA report can be seen in table 4, where the stirrer rotation is 23.33 rpm.

**Table 2.** Production Results of the Old Pineapple Jam Mixing Machine: 20 Fruits with a Rotation of 23.33 rpm

| No | Number of Pineapples (fruit) | Processing Time (hours) |
|---|---|---|
| 1 | 20 | 3.06 hours |
| 2 | 20 | 3.04 hours |
| 3 | 20 | 3.05 hours |
| | Average Time | 3.05 hours |

The pineapple jam mixer test data after the redesign, with a rotation speed of 28.5 rpm and a total of 25 pineapples per test, can be seen in Table 5.

**Table 3.** Production Results of Pineapple Jam Mixing Machine 25 Fruits With 28.5 rpm rotation

| No | Number of Pineapples (fruit) | Processing Time (hours) |
|---|---|---|
| 1 | 25 | 2.05 hours |
| 2 | 25 | 2.25 hours |
| 3 | 25 | 2.1 hours |
| | Average Time | 2.13 hours |

Comparing the data from the old pineapple jam mixer with the new one, the number of pineapples processed increased from 20 to 25, and the processing time decreased from 3 hours and 5 minutes to 2 hours and 13 minutes.

## 6. CONCLUSION

Based on the results of the final project research, the following conclusions can be drawn:

(1) The pineapple jam mixing machine that was developed has demonstrated improved mixing efficiency compared to the conventional equipment previously used by MSMEs, thereby enhancing the overall production process.
(2) Experimental testing indicates that the optimal stirring performance is achieved at a rotational speed of 28.5 rpm, providing a balance between mixing uniformity and energy consumption.
(3) The implementation of this machine contributes to increased productivity and improved product quality, supporting the potential for more consistent and scalable pineapple jam production in small and medium enterprises.

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