p–ISSN: 2723 - 6609 e-ISSN: 2745-5254
Vol. 5, No. 7 July 2024 http://jist.publikasiindonesia.id/

Design of Horizontal Type Mangosteen Peel Flour Machine for Mangosteen Peel Processing

Rosyid Ridho
Universitas Mataram, Indonesia
Email: Rosyidridho@unram.ac.id
*Correspondence

Keywords: flour machine, mangosteen, fruit skin.

ABSTRACT

The Mangosteen fruit (garcinia mangostana L.) nicknamed the queen of fruit is one of Indonesia's superior fruits. Mangosteen fruit consists of components in the form of seeds, fruit, pulp, and fruit skin. This research aims to design a horizontal-type mangosteen peel-blowing machine. This mangosteen rind flouring machine is designed in a horizontal shape which aims to flour the dried mangosteen rind. The design process uses the Solid Work application and then the manufacturing process. Machines that have been manufactured are subjected to testing. The flouring process uses a separating cylinder and a crushing knife. Dried mangosteen skin that is put into the hopper will enter the cylinder and be crushed by a rotating blade and produce flour. The flour will come out through the output door. This machine floured the skin of the mangosteen fruit according to the initial design objectives. This research succeeded in removing the dried mangosteen peel.

Introduction

Mangosteen fruit is the fruit that has become the prima donna of Indonesian exports. West Nusa Tenggara is one of the provinces that produces mangosteen with a total production in 2023 of 18,081 tons (BPS, 2024). The pattern of direct consumption of mangosteen fruit in Indonesia and the export of mangosteen fruit only in the form of fresh fruit poses problems. Mangosteen fruit that is used as a table dish by the community produces more waste, one of which is in the form of fruit peels that are not consumed thoroughly (Ibrahim & Ridha, 2024). Mangosteen peel must be reprocessed into a valuable product. Thus, mangosteen fruit is no longer consumed in the form of fresh fruit that produces waste and is exported in the form of raw materials but can be processed into processed products with high economic value. (Ridho, Hermawan, & Ahmad, 2018).

Although the handling of mangosteen cultivation and post-harvest is still modest. It turns out that mangosteen fruits originating from Indonesia can penetrate the world export market in large quantities, and can even compete with mangosteen from other countries. The quality of mangosteen fruit originating from Indonesia is very preferred by consumers from China (Hariastuti, 2017). Although Indonesia produces mangosteen, mangosteen has not been widely processed, both flesh and skin. Recently, there have been

several mangosteen fruit processing companies (Junaidin, Abdullah, & Ridho, 2021). The number of mangosteen that is not suitable for export reaches 90% of total production. So, the processing needs to be encouraged to increase the added value of mangosteen. Currently, mangosteen processed in Indonesia is generally in the form of syrup, juice, and puree derived from the pulp, while the peel is processed into syrup or canton powder (Yatman, 2012).

The peel of mangosteen fruit is known to be composed of quite a lot of polyphenol compounds, including anthocyanins, xanthones, tannins, saponins, and phenolic acid compounds. Xanthone, which is abundant in the peel of mangosteen fruit, functions as an antioxidant. (Handayani, Suryanto, Siregar, & Efendi, 2015). The largest component of all mangosteen fruits is the skin, which is 70-75%, while the pulp is only 10-15% and the seeds are 15-20%. The highest xanthone content is found in the peel of mangosteen, which is 107.76 mg per 100 grams of fruit peel. (Aminudin, Sa'diyah, Prihastuti, & Kurniasari, 2019).

In addition to xantone compounds, mangosteen peel also contains anthocyanins. Anthocyanins are an important type of flavonoid and have several positive responses for the body. (Priska, Peni, Carvallo, & Ngapa, 2018). Anthocyanins and several flavonoids are useful in the health world as anticarcinogens, anti-inflammatory, antihepatotoxic, antibacterial, antiviral, antiallergic, antithrombotic, and as protection due to damage caused by UV radiation and antioxidants.

One of the things that has not yet been developed is the mangosteen fruit processing machine, especially the peeling of mangosteen fruit. Efforts to increase yields to be efficient and can increase the capacity of the flour machine, a plan to make a mangosteen peel flour machine is needed to help the utilization of mangosteen peel waste. (Mangesa, Riwu, & Julfikar, 2020). So an idea was created for the design and manufacture of machines, especially the design and construction of horizontal-type mangosteen fruit flour machines and electric motor driving power. There is already a Vertical Type Mangosteen Fruit Peel Flour Machine that is made and researched. However, this is still not significant. (Ningsih, 2021). More research is needed related to the shelling of mangosteen fruits. Therefore, this study designed a horizontal-type mangosteen peel flour machine.

Research Methods

The design of a horizontal-type mangosteen peel-blowing machine was made using Solidworks software and then realized by making a model of the mechanism and prototype of the machine with several types of construction materials (stainless steel plates, etc.). The material used in this study is dried mangosteen peel. The method used in this study is experimental. The trial of the horizontal-type mangosteen peel flour machine was carried out at the Workshop Laboratory, Faculty of Food Technology and Agroindustry, University of Mataram.

1. Design Analysis

Design analysis is carried out based on the concept that best meets the expected design criteria. Design analysis consists of functional design analysis and structural design. Functional design is the breakdown of engine functions and the selection of alternative components or mechanisms to perform primary and auxiliary functions. The main function of the developed machine is to carry out the process of crushing the peel of dried mangosteen. In addition to functional analysis, structural analysis is carried out in the form of technical analysis. The goal is to consider the shape, size and material of each component to ensure it meets the function and strength standards.

The research was carried out through the stages of problem identification, development of the concept of the mangosteen peel harvesting mechanism, making a mechanism model, testing and evaluating the mechanism model, making a machine prototype and testing it. The stages of the research design that have been carried out are presented in Figure 1.

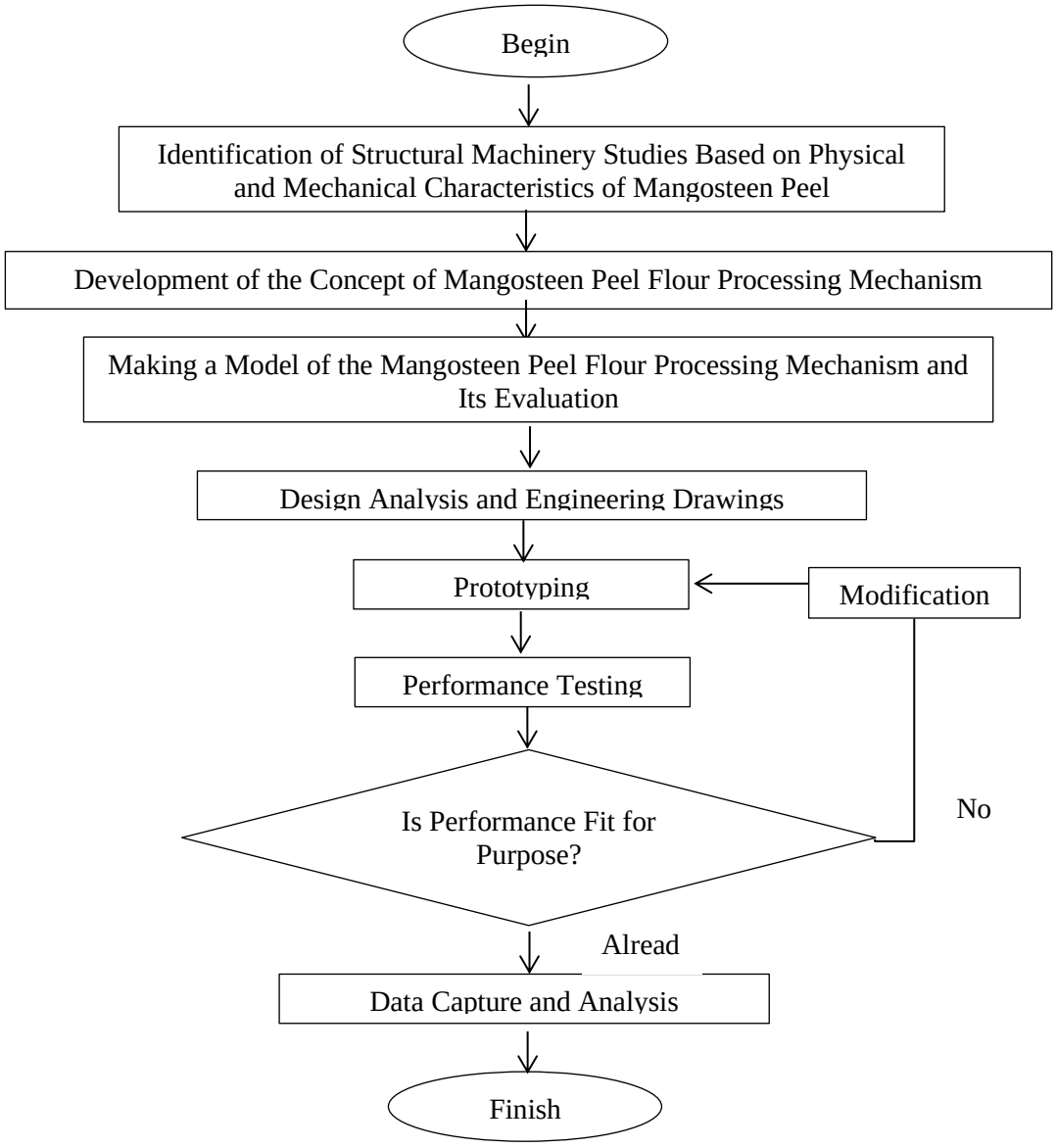

Figure 1
Stages of design research

2. Technical Drawing Creation

The creation of engineering drawings is carried out using Solid Work software. The process of making engineering drawings is carried out to facilitate visualization and the process of making machines. Technical drawings are made based on design analysis. The technical drawings produced include front view, inner view, top view, left side view, right side view, and isogonal view. Here are some of the images that have been created using Solid Work software.

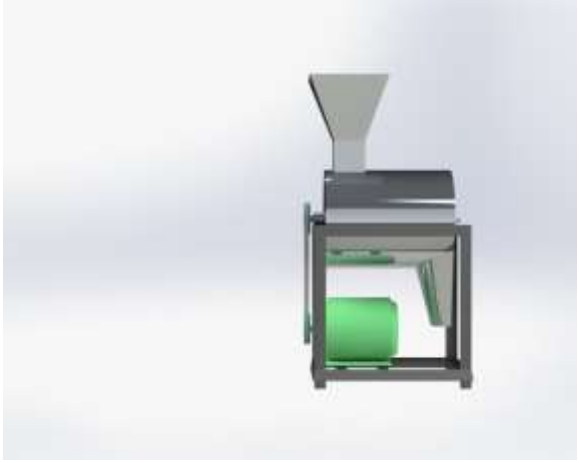

Figure 1
The design of the mangosteen peel flour machine front view

Figure 2
The design of the mangosteen peel battering machine looks deep.

Figure 3
The design of the mangosteen peel battering machine is seen on the left side.

Figure 4
The design of the mangosteen peel battering machine is seen on the right side.

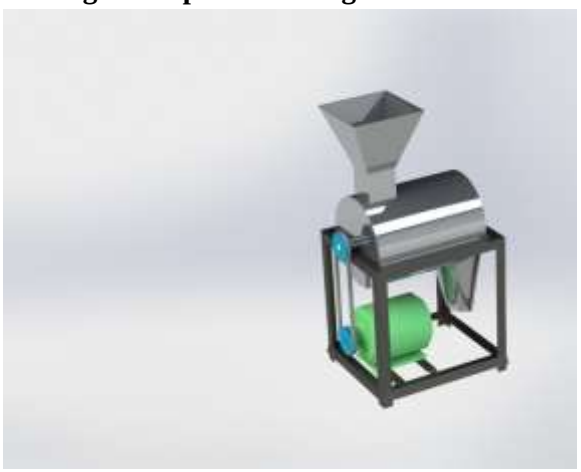

Figure 5
The design of the mangosteen peel-blowing machine looks isogonal.

1. Preparation of Test Materials

The mangosteen peel used is small and medium in size. Mangosteen fruit is obtained from the traditional market of Mataram City. The test material is mangosteen

peel which was previously separated between the pulp and the skin. Mangosteen peel is immediately dried in the sun for 2 to 3 days. This varies depending on the weather conditions in the field.

2. Batter engine test methods

The test is carried out by operating a mangosteen fruit flour machine and seeing and analyzing the output results released from the frying process. Also, pay attention to whether during the flocking process, the engine operates properly without any obstacles.

Results and Discussion

Manufacturing of horizontal-type mangosteen fruit flour machine

This horizontal-type mangosteen peel flour machine has a rotating blade mechanism with a static separating cylinder. In the manufacturing process, stainless steel material is used. The motor used as the driving force has a specification of 1.5 Hp with a rotation of 1420 PPM and a voltage of 220 Volts to move the rotating shredding blades. The rotating shredding knife will crush the peel of the mangosteen fruit that is fed from the hopper to the separator Slider. The scavenging process occurs by crushing the mangosteen peel in a separator cylinder using a crushing knife. The peel of the mangosteen fruit that has turned into flour will come out of the separator cylinder heading to the exit. The manufacturing results of the Horizontal type mangosteen flour machine can be observed in Figure 6, Figure 7, Figure 8, and Figure 9.

Figure 6 Mangosteen peel flour machine front view

Figure 7 Mangosteen peel flour machine top view

Figure 8
Mangosteen peel flour machine is seen on the right side.

Figure 9
The Mangosteen peel-blowing machine is seen on the left side.

Performance of Mangosteen Peel Peeling using Horizontal Type Mangosteen Flour Machine

Mangosteen is a fruit product that has a high selling value in the domestic and international markets. Mangosteen has a sweet taste and unique texture so it is liked by many consumers. Mangosteen has many benefits because the vitamins and nutrients contained in mangosteen are very beneficial for the body. (Purwanti, Rakhmawati, & Yuliati, 2016). Mangosteen peel has many properties. In the medical world, it is usually used for facial care from the inside, by making beauty products in the form of medicines that can maintain the health and stability of the body.

The material used in the waxing process is the dried mangosteen peel. The peel of the selected mangosteen fruit comes from fresh ripe mangosteen. The dried mangosteen peel is then put into the machine hopper to be made into flour. The image of the dried mangosteen peel and used as a material can be seen in Figure 10.

Figure 10. Dried mangosteen peel

The mangosteen peel that is put into the battering machine is successfully fused with a level of roughness that is not uniform. So that the process for selecting the uniformity of flour size is carried out through a sieving process. The quality of the mangosteen flour produced can be observed in Figure 11.

Figure 11. Mangosteen peel flour

Mangosteen peel flour can be used in the beverage industry, such as juices and instant drinks as well as a wide variety of cosmetic and health products. The use of mangosteen peel in the form of flour will be more advantageous compared to fresh fruit peel. Mangosteen peel flour can be stored for a long time and is easy to distribute. In addition, the continuity of supply and quality of materials will be more guaranteed.

Conclusion

The mechanism and working principle of this horizontal-type mangosteen peel flour machine use an electric motor as its main power. The process of peeling mangosteen fruit using a mangosteen fruit flour machine has been successfully carried out by providing various results. For further research, a way can be found to reduce the noise in the battering machine, to make the battering machine more friendly to the ears of the machine operator.

Bibliography

Aminudin, Muhammad Farid, Sa'diyah, Nayyifatus, Prihastuti, Putri, & Kurniasari, Laeli. (2019). Formulasi Sabun Mandi Padat Dengan Penambahan Ekstrak Kulit Manggis (Garcinia mangostana L.). *Jurnal Inovasi Teknik Kimia*, *4*(2).

Handayani, Madiah, Suryanto, Dwi, Siregar, Tajuddin, & Efendi, Zulhan. (2015). Aktivitas Antimikroba Ekstrak Kulit Buah Manggis (Garcinia mangostana) Terhadap Bakteri Aeromonas hydrophila, Edwardsiella tarda dan Jamur Saprolegnia sp. *Aquacoastmarine*, *8*(3), 11.

Hariastuti, Rahmaniah Mirza. (2017). Permainan tebak-tebak buah manggis: Sebuah inovasi pembelajaran matematika berbasis etnomatematika. *JMPM: Jurnal Matematika Dan Pendidikan Matematika*, *2*(1), 25–35.

Ibrahim, Riyahd, & Ridha, Fabrobi Fazlur. (2024). Perancangan Desain Rangka dan Analisis Kekuatan Rangka Mesin Pengiris Singkong CV Phonna Raya Machinery Menggunakan Software Solidworks. *Prosiding SENASTITAN: Seminar Nasional Teknologi Industri Berkelanjutan*, *4*.

Junaidin, Ahmad, Abdullah, Sirajuddin Haji, & Ridho, Rosyid. (2021). Designing Vertical Type Mangosteen Leather Penepung Machine. *Protech Biosystems Journal*, *1*(2), 33–41.

Mangesa, Daud P., Riwu, Defmit B. N., & Julfikar, Muhammad. (2020). Rancang Bangun Mesin Pemeras Santan Kelapa Dengan Mekanisme Tekan Horizontal. *LONTAR Jurnal Teknik Mesin Undana*, *7*(02), 15–21.

Ningsih, Ningsih. (2021). *Analisis Performansi Mesin Penepung Kulit Manggis Tipe Vertikal*. Universitas_Muhammadiyah_Mataram.

Priska, Melania, Peni, Natalia, Carvallo, Ludovicus, & Ngapa, Yulius Dala. (2018). Antosianin dan pemanfaatannya. *Cakra Kimia (Indonesian E-Journal of Applied Chemistry)*, *6*(2), 79–97.

Purwanti, Eny, Rakhmawati, Anna, & Yuliati, Yuliati. (2016). Pengaruh Variasi Dosis KMnO4 pada Buah Tomat (Lycopersico lycopersicum. L) Varietas Servo Pascapanen terhadap Keberadaan Yeast. *Kingdom (The Journal of Biological Studies)*, *5*(5), 1–8.

Ridho, Rosyid, Hermawan, Wawan, & Ahmad, Usman. (2018). Evaluasi Konsep Tiga Model Pemisah Biji dan Daging Buah Manggis (Garcinia mangostana L.). *Jurnal Keteknikan Pertanian*, *6*(2), 217–224.

Yatman, Eddy. (2012). Kulit buah manggis mengandung xanton yang berkhasiat tinggi. *Jurnal Ilmiah Widya*, 218735.