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## Implementation of Rotary Dryer for Cassava Drying as a Raw Material for Mocaf Flour Production

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### Abstract

Modified cassava flour (mocaf) is one of the innovative cassava processed products with high market value and promising business prospects as a substitute for imported wheat flour. The women's farming group (KWT) Ngudi Sari, located in the village of Tanjungsari, Gunungkidul, has processed cassava into mocaf flour and various cassava-based products, including cassava chips, tiwul, gatot, mocaf sticks, and various cookies. During the production process of mocaf flour, one of the common challenges faced is the drying of cassava chips, which has traditionally relied on sunlight and home-based drying methods. With the increasing demand for mocaf flour, large-scale drying of cassava chips becomes necessary. To address this challenge, a technology of rotary dryer is implemented to KWT Ngudi Sari to enhance the efficiency and effectiveness of the cassava raw material drying process. This outreach project aims to empower KWT Ngudi Sari and boost the production capacity of the resulting mocaf flour. The application of this appropriate technology is expected to improve the quality of cassava as a raw material for mocaf production and enhance its energy efficiency, thus contributing to the economic development of KWT Ngudi Sari. Throughout the project, mentoring, monitoring, and evaluation are also conducted to measure the progress in knowledge and skills of the partners involved.

**Keywords:** cassava, farmer women group, mocaf, production, rotary dryer

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### INTRODUCTION

The global food crisis that has occurred in the past decade has highlighted the need for accelerated efforts to enhance and strengthen food self-sufficiency. Food self-sufficiency, as expressed in the Undang-undang Republik Indonesia No. 18 Year 2012 concerning Food, which emphasizes the utilization of natural, human, social, economic, and local wisdom resources to achieve food self-sufficiency. Gunungkidul is one of the districts in DIY Yogyakarta with a population of approximately 758,168 people in the year 2022.

The topography of the Gunungkidul region is characterized by undulating terrain, with all areas situated on the limestone mountains of the Thousand Mountains region, stretching from the Indonesian Ocean to the northern tip, with elevations ranging from 0 to 800 meters above sea level. This region has a barren and chalky landscape. Almost the entire agricultural land, covering an area of 100,303 hectares, is dry land, with only 2,065 hectares being irrigated (BPS Gunungkidul, 2020). The sub optimal condition of irrigation has led the people of Gunungkidul to cultivate crops, primarily maize and cassava. Over the last two years, cassava cultivation has shown encouraging growth, with a harvested area reaching 50,701 hectares. The cassava-producing centers are located in the sub-districts of Saptosari, Tepus, Tanjungsari, Rongkop, Girisubo, and Semanu.

Cassava produced in Gunungkidul is typically sold in its wet condition or processed into dried cassava slices known as "gaplek." The selling price for cassava in its wet condition is relatively low, ranging from Rp500.00 to Rp650.00 per kilogram, while processed gaplek is sold for Rp1,500.00 per kilogram. Another cassava product with high market value is Modified Cassava Flour (mocaf). Mocaf is a type of flour made from cassava through a fermentation

process. Mocaf is a gluten-free product that is considered healthier than other types of flour (Asmoro, 2021). The potential for using mocaf flour as a substitute for wheat flour is substantial (Lovett et al., 2019). The business development prospects for mocaf flour are promising, considering the market potential and the availability of cassava as a raw material. Indonesia has abundant cassava resources at a relatively low cost, which positions it as a competitive alternative to imported wheat flour, with the potential to replace up to 50% of wheat flour imports (Dina et al., 2023). With lower production costs, mocaf flour can be sold at a more competitive price compared to wheat flour and rice flour. This cost advantage makes mocaf flour an attractive option for food industries that rely on flour as a raw material (Firdaus et al., 2014; Ratnawati et al., 2020). Therefore, mocaf flour has a promising business outlook.

KWT Ngudi Sari in Gunungkidul is a women's farming group that processes cassava into various products, including mocaf flour, cassava chips, and other cassava-based products. KWT Ngudi Sari was established in 2014 and has made cassava its primary commodity for cultivation and processing. The group cultivates various cassava varieties such as Gatotkaca, Dwarawati, UJ 5, and Telo Ketan. From these cultivation efforts, KWT Ngudi Sari is able to harvest 20 tons of fresh cassava, which is then processed into mocaf flour. To date, mocaf flour can be further processed by KWT Ngudi Sari into various derivative products. mocaf flour itself is sold at a price ranging from Rp13,000.00 to Rp15,000.00 per kilogram. Currently, KWT Ngudi Sari has 20 members, and the organizational structure is shown in Figure 1.

### SUSUNAN PENGURUS KWT NGUDI SARI

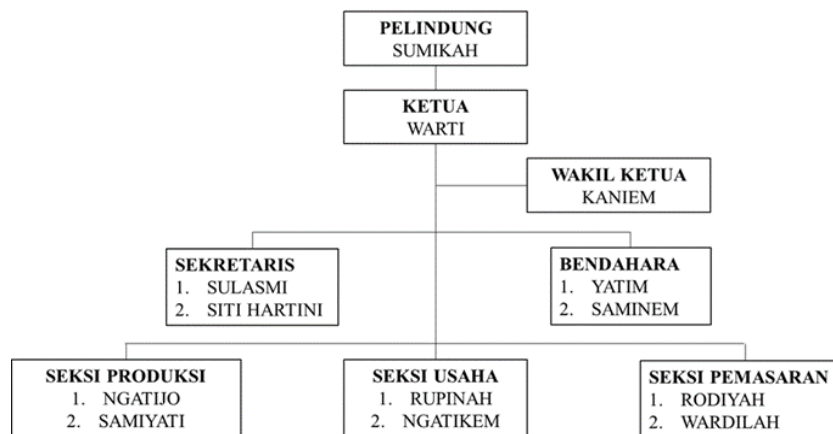


Figure 1. Organizational structure of KWT Ngudi Sari Gunungkidul

In the process of producing mocaf flour, KWT Ngudi Sari has established standard operating procedures (SOP) as illustrated in Figure 2. Generally, the business process of making mocaf flour consists of the following stages: (a) raw material preparation (selection and washing), (b) cutting cassava into chips, (c) soaking the chips in a starter solution for approximately 72 hours, (d) drying the chips, (e) milling, (f) sifting mocaf flour, and (g) storing mocaf flour.

One of the production challenges faced by KWT Ngudi Sari in mocaf flour production is related to the drying technique of cassava chips. The drying of chips has traditionally relied on sunlight using drying houses. Manual drying methods that depend on weather conditions like this can become a production obstacle, especially during the rainy season. During the rainy season, KWT Ngudi Sari can only produce mocaf flour on a small scale. While the presence of drying houses can address drying issues during the rainy season, this method also faces limitations. In humid conditions, dew droplets can form on the roof and walls of the drying house. This condition hinders the optimal drying of chips (Helmi et al., 2020).

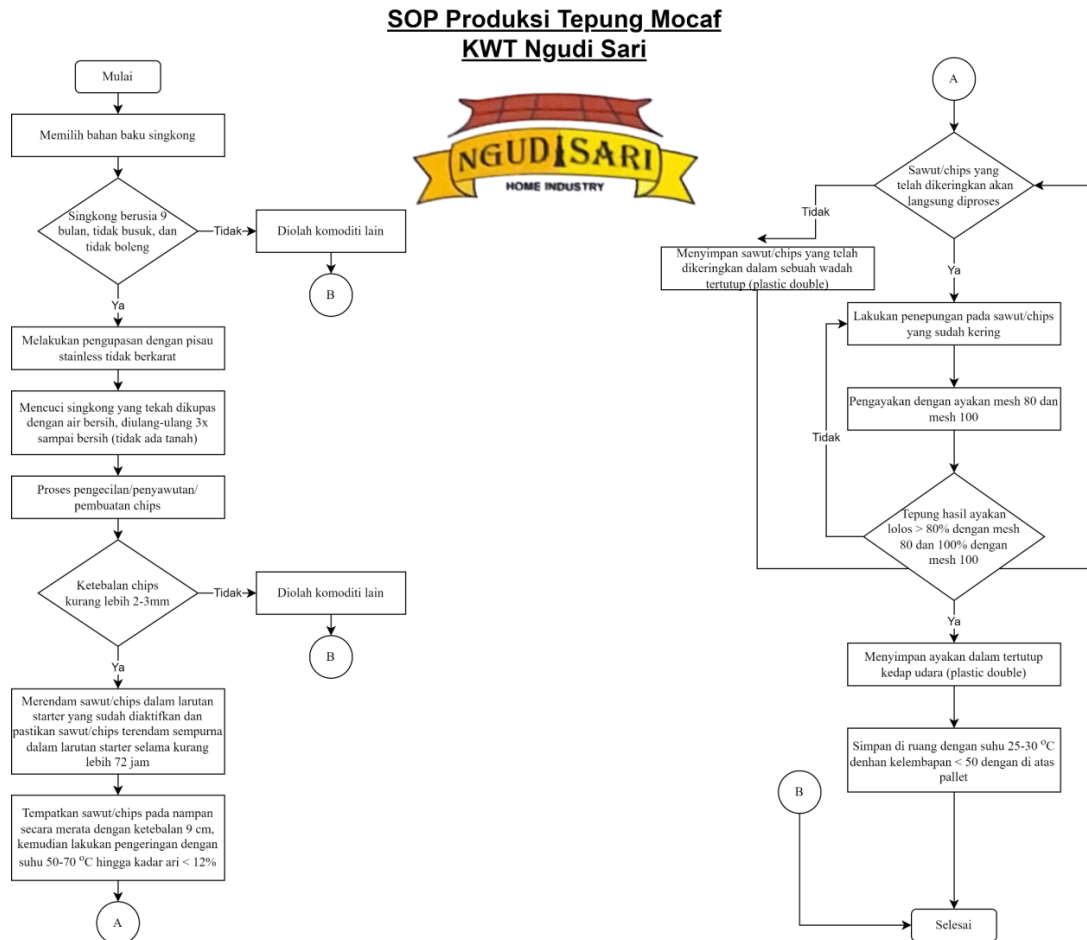


Figure 2. The standard operating procedures (SOP) of producing mocaf flour at KWT Ngudi Sari Gunungkidul

Rotary dryers have increasingly found applications in various home industries for drying various materials, such as the tea leaf processing industry and the spice industry. The use of rotary dryers offers several advantages, including faster drying of materials and the absence of residual discoloration in the materials, which can occur when drying under direct sunlight. The use of rotary dryers for drying various food materials has also shown promising results, characterized by shorter drying times and the absence of mold spots on the dried materials (Delmayuni et al., 2017). The influence of drying parameters on the drying kinetics is designed based on the analysis of parameters related to heat transfer, thermodynamics, and mechanical elements. Air temperature and air velocity are key parameters that have a significant impact on the raw material drying process.

The purpose of this community engagement activity is to enhance the empowerment of KWT Ngudi Sari, the targeted partner of the engagement, to boost the production capacity of mocaf flour. The goals and focus of the community engagement are centered on the application of appropriate technology and the improvement of the knowledge and skills of the partners in using the rotary dryer to promote an increase in mocaf flour production capacity at KWT Ngudi Sari.

## METHODS

This community engagement activity is conducted through direct training and mentoring methods for the target partners, namely the Women Farmers Group (KWT) Ngudi Sari and the Mekar Sari Farming Group, in Kapanewon Tanjungsari, Gunung Kidul Regency. The activity stages include the preparation phase, implementation phase, and evaluation phase. The entire engagement program spans three months, from August to October 2023.

### **Preparation Stage**

The preparation phase began in early August 2023, during which the implementation team conducted initial socialization and communication with KWT Ngudi Sari, the target partner, regarding the planned training program. In the preparation phase, discussions and deliberations were also held to understand the partner's initial situation, providing the implementation team with an initial overview.

### **Implementation Stage**

The implementation phase consists of four (4) sequences, starting with (a) the design and construction of the rotary dryer, (b) experimental use of the rotary dryer, (c) the handover and socialization of the rotary dryer to the partners, and (d) training and mentoring in the use of the rotary dryer. Activities (a) through (c) took place from August 2023 to September 2023. Subsequently, the training activities occurred in October 2023. The design of the implemented rotary dryer is illustrated in Figure 2.



Figure 3. The design of rotary dryer

### **Evaluation Stage**

The final stage, which is the evaluation, is conducted to measure the improvement in the knowledge and skills of the partners. Evaluation is performed by administering pre-tests and post-tests to the training participants. The enhancement of partner empowerment is assessed by comparing the results at the beginning and the end of the training. This stage is carried out collaboratively by the target partners, collaborative partners, and the engagement team. The evaluation also aims to identify solutions in case the partners encounter any challenges during the use of the equipment in the cassava chip drying process.

## **RESULTS AND DISCUSSIONS**

This community engagement activity centers around the implementation of appropriate technology, specifically a rotary dryer, with the target partners being KWT Ngudi Sari and the Mekar Sari Farming Group, both of which process cassava into mocaf flour in Gunungkidul. The training and implementation of the dryer were conducted at KWT Ngudi Sari on October 12, 2023, for participants who are the members of KWT Ngudi Sari and the Mekar Sari Farming Group. During the training activity, the community service team was also assisted by a group of students from the Electrical Engineering and Chemical Engineering Study Programs at UAD.

During the training of rotary dryer implementation, Fathoni Agung Bagus Utama from CV Aneka Technics served as the speaker, providing information about the explanation of the components, uses, and benefits of the rotary dryer in the process of making mocaf flour. Following the theoretical presentation at the beginning, the training continued with hands-on practice and guidance on the cassava chip drying process using the rotary dryer. This session also included discussions and a direct question-and-answer session with the speaker regarding

the proper and effective use of the rotary dryer based on the Standard Operating Procedures (SOP). The training activities are shown in Figure 3 and Figure 4.



Figure 3. Training on the use and user assistance of a rotary dryer.



Figure 4. The handover of the rotary dryer from the Community Engagement Team to the partner KWT Ngudi Sari.

Before and after the training, participants are given pre-tests and post-tests to measure the effectiveness of material assimilation and as an evaluation phase of the activity. Participants answer questionnaires containing questions given before the material is presented and are provided again after the material presentation. The responses from the questionnaires depict the level of participants' understanding. Table 1 and Figure 5 show the results of the activity evaluation, along with the knowledge components assessed during the training activity.

Table 1. Results of training evaluation

No	Criteria of participant's knowledge and skill	Score Percentage (%)		Rate of increase (%)
		Before Training	After Training	
1.	The benefits and uses of a rotary dryer	29	90	61
2.	The components of rotary dryer	36	82	46
3.	How to operate a rotary dryer	32	77	45

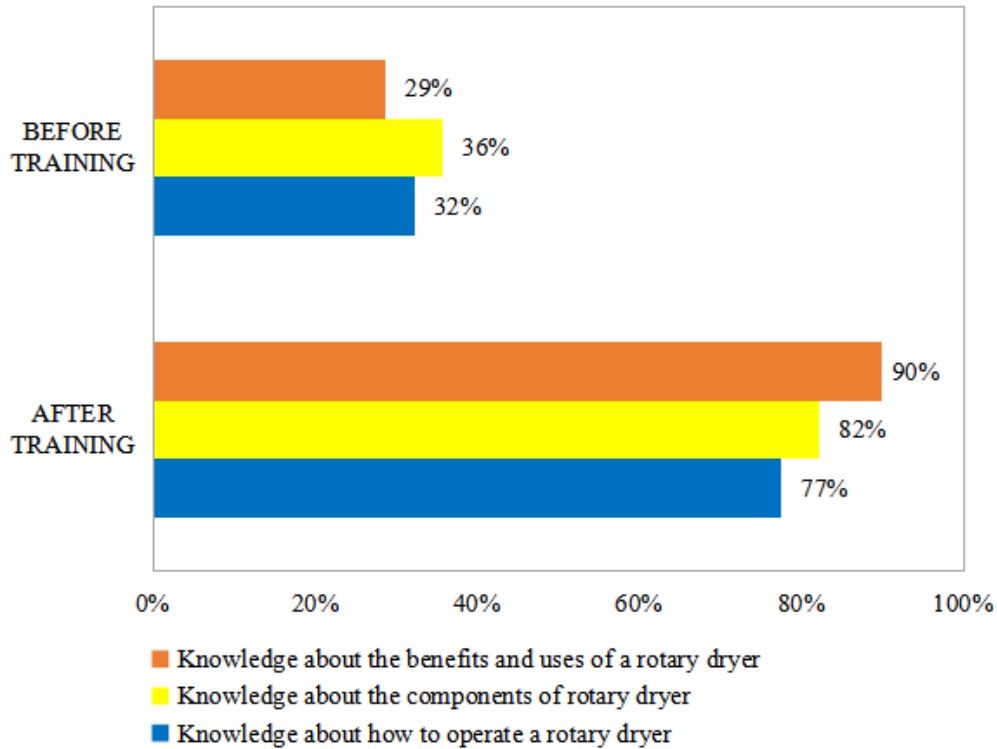


Figure 5. Results of participant’s knowledge and skill before and after training

Based on the description of the activity results, impacts, and evaluations, it is evident that there has been an increase in the empowerment of the partners through this community engagement project. This is demonstrated by the evaluation results, which show that the training activities have successfully enhanced the knowledge and skills of the members of KWT Ngudi Sari and the Mekar Sari Farming Group regarding the use and benefits of the rotary dryer in drying cassava chips in the mocaf flour production process.

**CONCLUSION**

The community engagement project involving the implementation of a rotary dryer for cassava drying to increase the raw material capacity for mocaf flour at KWT Ngudi Sari and the Mekar Sari Farming Group in Kapanewon Tanjungsari, Gunungkidul, has been successfully carried out and is progressing smoothly. The use of the rotary dryer as an appropriate technology has significantly reduced the drying time for cassava chips compared to the traditional method of sun drying using drying houses that depend on sunlight. This activity has received very positive feedback from the partners and is expected to enhance the efficiency and effectiveness of the cassava chip drying process, which serves as a raw material for mocaf flour production. Through the implementation of the rotary dryer, it will also support the increase in mocaf flour production capacity at KWT Ngudi Sari.

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