ABDIMAS TALENTA
Jurnal Pengabdian Kepada Masyarakat
Journal homepage: https://talenta.usu.ac.id/abdimas

Production of Black Garlic Assyifa made by the Utsman Bin Affan Islamic Boarding School, Pantai Labu District use Thermolysis Equipment

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ARTICLE INFO

Article history:
Received : 09 September 2024
Revised : 12 September 2024
Accepted : 15 November 2024
Available online: 27 December 2024

E-ISSN: 2549-418X
P-ISSN: 2549-4341

How to cite:
Sebayang, N. U. W., Hidayat, B., Raju., Rahma, K. A., Pratiwi, S., Tanwie, C. N., and Zidan, M. S. (2024). Production of Black Garlic Assyifa made by the Utsman Bin Affan Islamic Boarding School, Pantai Labu District use Thermolysis Equipment. ABDIMAS TALENTA: Jurnal Pengabdian Kepada Masyrakat, 9(2), 161-169.

http://doi.org/10.32734/abdimastalenta.v9i2.18126

ABSTRACT

Black Garlic is a product resulting from the thermolysis of garlic which is highly nutritious and has many benefits for the health of the human body. The problem that occurs is that black onion products are very rare and the price is very expensive. Limitations regarding equipment and from marketing and social aspects of the community include knowledge in producing black garlic, as well as marketing it to be able to increase partners' income sources. So far, partners have only used a simple method, namely an electronic rice cooker (Rice Cooker). The solution is to increase public understanding about the properties of black garlic and increase awareness of production so that it can get added value in the form of income if sold to the Utsman Bin Affan Islamic Boarding School. By using a thermolysis device with a capacity of 30 kg, it is possible to increase the quality and production of black garlic. The aim of the PkM implementation activities for the DRTPM Community Based Empowerment scheme in 2024 is to improve the quality of Black Garlic made by Pondok Tahfizh Utsman Bin Affan Pantai Labu by utilizing a thermolysis tool so that it can increase the level of income for partners. This service activity resulted in the production of 30 kg of black garlic on the 12th day of thermolysis with visualization results such as a slightly chewy texture, an even black color throughout, and a distinctive black garlic smell. The organoleptic results of black garlic have a taste that is dominated by sweetness and is slightly sour. The next plan in this service is to help partners in the packaging and marketing process using social media technology.

Keyword: Black Garlic, Production, Thermolysis

1. Introduction

Black garlic is a fermented food ingredient made from garlic at a certain temperature and humidity. This fermentation process results in changes in the nutritional content of garlic so that black garlic will have different and more diverse benefits. Black garlic has strong antioxidant activity both in vivo and in vitro. The antioxidant activity of black garlic is greatly influenced by appropriate processing methods, especially temperature conditions, and water content during fermentation. Black onion products have high polysaccharide content, low sugar content, various proteins, phenolic compounds, and sulfur. The number of polyphenols in black garlic is also six times higher than regular garlic [1].

The process of blackening garlic into black garlic is caused by the Maillard reaction. The Maillard reaction occurs in three stages. In the initial stages of heating, condensation of sugar groups and amine groups occurs, but the resulting color is not yet very brown. The two-color stage of the onion begins to turn brown and the final stage of the reaction produces a black color in the range of 5–45 days [2].

The potential for black garlic in Indonesia is very large, both as a health and culinary product. Black garlic is known to have high health benefits, such as improving the immune system, reducing the risk of heart disease, and having strong antioxidant properties. Black onion production in Indonesia is also supported by the high availability of garlic as the main raw material. Economically, black onion production offers significant advantages. For example, Intan Anastasia Amsyah from Bogor managed to achieve an income of 1-2 billion rupiah per year from this business, with an export market that includes several countries in Asia and Europe. This success shows that black garlic has a potential market not only domestically but also abroad, supported by increasing demand and government facilitation through international exhibitions [3].

Apart from that, black onion production also provides opportunities for Micro, Small, and Medium Enterprises (MSMEs) to develop. Therefore, increasing knowledge and technology in the production process can further improve the quality and competitiveness of Indonesian black onion products in the global market. One of the Islamic boarding schools in North Sumatra that is pioneering in producing Black Garlic is Pondok Tahfizh Utsman Bin Affan, Pantai Labu Branch, located on Kamboja Street, Denai Lama Village, Pantai Labu District, Deli Serdang Regency, North Sumatra Province, which is here in after referred to as PkM's partner with the economy. non-productive. There are 40 students and 6 administrators. However, only 15 students can pay tuition fees. Considering the many benefits of black garlic for human health, and that it has been known for thousands of years as a traditional medicine, several other activities carried out by PkM partners apart from carrying out learning activities to memorize the Al-Qur'an and hadith, students are also taught to start producing Black Garlic.

The problems experienced by PkM partners are from the production aspect, namely limited equipment, and the marketing and social aspects of the community, namely also knowledge in producing black garlic, as well as marketing it to increase partners' income sources. So far, partners have only used a simple method, namely an electronic rice cooker (Rice Cooker). This limited equipment and knowledge has become an urgent barrier factor faced by partners for several years. In the process of making black onions, stable conditions are needed in terms of temperature, water content, and humidity. Antioxidants in black garlic are greatly influenced by appropriate processing methods, temperature and humidity conditions, or water content during the fermentation process.

During the process of making black onions using a five-liters capacity rice cooker, the partner was only able to make 1 kg of black onions. Meanwhile, the process of making black garlic takes approximately 2 weeks. So it is very difficult for PkM partners to produce large quantities within that time. PkM partners want to make black garlic a superior product that can later be produced in large quantities to improve the economy of PkM partners to help orphaned/underprivileged students who want to study the Koran and hadith so they can study for free. Based on these problems, optimization and technological innovation of tools are very necessary to increase black onion production.

The innovation offered by the PkM DRTPM service team in 2024 to PkM partners is the use of a thermolysis tool that can accommodate 30 kg of garlic to be fermented into black onions. Apart from that, the quality of the black garlic produced is also better compared to using the previous tool (rice cooker). In this thermolysis tool, the temperature and water content can be adjusted so that the enzyme and nutritional composition are better and optimal. The aim of the PkM implementation activities for the DRTPM Community Based Empowerment scheme in 2024 is to improve the quality of Black Garlic made by Pondok Tahfizh Utsman Bin Affan Pantai Labu by utilizing a thermolysis tool so that it can increase the level of income for partners. The aim of the PkM implementation activities for the DRTPM Community Based Empowerment scheme in 2024 is to improve the quality of Black Garlic made by Pondok Tahfizh Utsman Bin Affan Pantai Labu by utilizing a thermolysis tool so that it can increase the level of income for partners.

2. Materia and Methods

This activity was carried out at the Utsman Bin Affan Islamic Boarding School which is located on Kamboja Street, Denai Lama Village, Pantai Labu District, Deli Serdang Regency, North Sumatra Province. The materials used in this service activity are a single garlic, baking paper, cloth, masking tape, aluminium foil, jars, banners, and service signs. The tools used in this service activity are a thermolysis tool with a capacity of 30 kg, a camera, and other necessary tools. The approach used to overcome the problems of PkM partners is by creating alternative problem solving, namely educating the administrators and students at Pondok Tahfizh Utsman Bin Affan Pantai Labu about the science of applying thermolysis to single garlic which will be used

as black garlic as medicine. traditional, teaches equipment operating techniques, teach the importance of measuring temperature and water content correctly so that the black garlic produced is of high quality so that the selling value will be high. Next, hand over the equipment needs to the PkM partner administrators. Learning activities are carried out by providing theories that are easy to understand and understood by PkM partners, both administrators and female students.

Applicative activities in the field are carried out by PkM partners, students, and service teams together in accordance with their respective field competencies. Socialization or counseling activities are planned to be carried out in the Tahfizh Utsman Bin Affan Pondok Hall. Several steps taken in the PBM scheme PBM activities at Pondok Tahfizh Utsman Bin Affan Pantai Labu are based on EDIPTI Design Thinking principles (Empathize, Define, Ideate, Prototype, Test, and Implement). This is outlined in Figure 1.

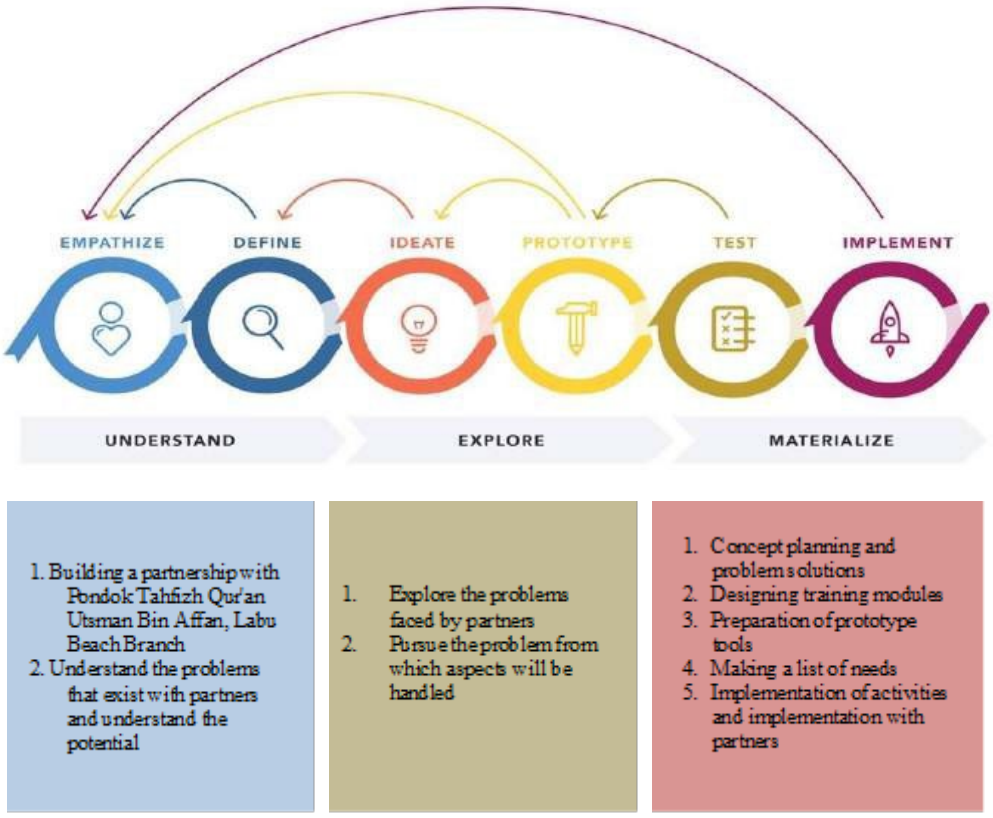

Figure 1. Application of the EDIPTI method in PkM activities for the PBM scheme in 2024

The stages of implementing community service at Pondok Tahfizh Utsman Bin Affan include:

1. Socialization
   Socialization was carried out about Black Garlic which included:
   a. Introduction
   b. Benefits of black garlic on health
   c. Process of making Black garlic (temperature and water content)
   d. Use of thermolysis equipment
   e. Black garlic production
   This socialization will be guided by students as MC, and by the Chief Executive of PkM as a resource person.
2. Training
   a. Training activities were carried out in the process of making black garlic using a thermolysis tool. This activity will be carried out by the service team, PkM partners, and students. This training will be guided by PkM implementing members.
   b. The application of technology is carried out in conjunction with the training process for making Black Garlic which will be guided by PkM implementing members.

c. Assistance and evaluation of the process of making black garlic will be accompanied and monitored by the PkM team for PkM partners by visiting partners every month and or can be done online via call/video call conference using a gadget. The evaluation carried out includes:
   i. Monitor the temperature and water content once a week in the process of making black garlic
   ii. Production process carried out in the second week
   iii. The post-production process includes quality control of color, taste, and smell (organoleptic).

3. Application of Technology
   Application of technology in the form of using a thermolysis tool to produce high-quality black onions. The use of thermolysis technology in the production of black garlic can significantly improve product quality compared to conventional methods using a rice cooker. The thermolysis tool works by utilizing precisely controlled temperature and humidity, so that the garlic fermentation process becomes more stable and even. In a rice cooker, fluctuations in temperature and humidity are often unavoidable, which can lead to a less consistent result in terms of both texture and taste. With a thermolysis device, process parameters such as temperature, humidity, and fermentation duration can be adjusted optimally, producing black onions with a richer taste, smoother texture, and higher nutritional content. Apart from that, using this tool also reduces the risk of contamination and damage to materials, so that the quality and hygiene of the final product can be guaranteed.
4. Mentoring and Evaluation
   Assistance and evaluation of community service in using thermolysis technology to produce black garlic at Pondok Tahfizh Utsman Bin Affan aims to improve the quality of production and welfare of the surrounding community. The mentoring process begins with intensive training on the use of thermolysis equipment, including setting optimal temperature, humidity, and fermentation duration. Participants from the Islamic boarding school will be taught how to operate the equipment properly, including care and maintenance steps to ensure the equipment remains functioning properly. Furthermore, evaluation programs are carried out periodically to monitor the progress and success of implementing this technology. Evaluation includes assessing the quality of the black onion produced, such as taste, texture, and nutritional content, compared to conventional methods.

3. Result and Discussion

In implementing activities, the stages carried out by the DRTPM 2024 community service team are:

1. Preparation of Tools and Materials
   All tools and materials used have been prepared and taken to the partner location by means of a pick-up vehicle.

Figure 2. Tools and materials used in PKM DRTPM 2024 activities

The selection of single garlic is done by sorting based on physical shape (size, perfectly round shape and even white skin color). The garlic used measures 2.5 cm (height) and 2.5 cm (diameter). The garlic used must be perfectly oval in shape as in Figure 3.

Figure 3. Physical characteristics of single garlic that can be used in black garlic production (top left) and those that are abnormal, damaged or deformed (top right, bottom left and bottom right)

2. Socialization which includes:
   The introduction is the opening of the event by the MC played by Suranti Pratiwi (student of the Faculty of Agriculture), remarks by the head of the service team, namely Nur Ulina Warnisyah Sebayar, SP., M.Agr, and remarks by the Chair of the Utsman Bin Affan Islamic Boarding School Foundation or representing Ummi Nursiti Pasaribu, SE.

Figure 4. Opening by MC Suranti Pratiwi (left) and remarks by the head of the PKM DRTPM 2024 team (right)

3. Delivery of material
   It delivered to all female student participants about the benefits of black garlic for the health of the human body, delivered by the chairman of PkM DRTPM 2024, namely Nur Ulina Warnisyah Sebayar, SP., M.Agr. In this case, the material was delivered using the lecture method using printed power point (PPT) teaching materials, as well as a guidebook for using the tools which was distributed to all participants.

Figure 5. Delivery of material by the PKM DRTPM 2024 team leader

4. Introduction and use of thermolysis equipment
   When using a thermolysis device, the limiting factor is electric current. This thermolysis tool with a capacity of 30 kg has an electric power of 1000 Watts so the Utsman Bin Affan Islamic Boarding School needs to increase the electric current to 3000 Watts if there are 2 tools that will produce at the same time. The service team also made a manual for using the thermolysis machine which was distributed to all service activity participants so they could study it (Figure 6).

Figure 6. Booklet instructions for using the black garlic thermolysis machine

Figure 7. Explanation of the use of thermolysis equipment by the PKM DRTPM 2024 Team Leader

5. The process of making Black garlic
   Next, the process of making black garlic was carried out, guided by the leader of the PKM DRTPM 2024 team, namely Nur Ulina Warnisyah Sebayar, SP., M.Agr. This activity was also assisted by all the students who took part in this activity, namely Kirana Aulia Rahma, Suranti Pratiwi and Corrady Noveindo Tanwie. In the process of making black garlic, an education method is carried out by explaining the use of tools while carrying out the production process.
   The procedure for making black garlic is as follows.
   1) The baking sheet/pan must be lined with baking paper measuring 60cm x 40cm
   2) Pour 3 kg of garlic into the baking dish/pan
   3) Evenly distribute the garlic in the baking dish
   4) Cover the garlic with a cloth (you can use an old cloth)
   5) Cover the baking pan and tape it using paper tape
   6) After everything is completely closed, put the baking sheet into the thermolysis machine
   7) After all the pans are filled with single garlic, arrange the pans in the machine rack
   8) To make the process of making black garlic easier, rotate the pan so that the resulting black garlic cooks evenly and perfectly
   9) Write the code on the baking sheet with codes for example 1A, 2A, 3A, etc

10) Likewise on the opposite side of the pan, write with code 1B, 2B, 3B, etc.
11) Close the thermolysis machine, make sure the lid is tight and perfect
12) Turn on the machine with electricity until the indicator light turns on and turns red
13) Set the temperature to 70o
14) Leave the onions in the machine for 9 days
15) After 9 days, the condition of the onions will be checked
16) It is recommended to manage the pan by rotating the pan every day so that the results are perfectly even
17) To maintain even onion production, we must rotate the pan every day
18) Turn the pan on the top shelf to the middle shelf and turn the pan from front to back
19) For example, pan 1A is moved to 3A while rotating it from front to back
20) Likewise, transfer pan 2A to pan 4A while rotating it from front to back
21) So, you can see the codes 1B, 2B, 3B etc. on the front
22) After 9 days in the machine, remove the baking sheet to sample the onions
23) After removing the tape, lift the baking sheet and remove the cloth that was in the baking pan
24) You can see that the garlic has turned dark brown black
25) Take 1 or 2 cloves of onion, do an organoleptic test by tasting the taste, if you still feel the dominant sour taste, then cover the baking dish again with duct tape
26) Put the onions back into the machine for approximately 2-3 days so that the onions are completely cooked and of good quality
27) To make it black, put the baking sheet in the machine without covering the onions with a cloth
28) After 2 days, sample the onion again to see it visually and carry out the organoleptic test again
29) If the onions are black and have a predominantly sweet taste, then they are ready to be harvested
30) If you want to harvest the black garlic in drier conditions, you can put it back into the machine without using duct tape
31) The characteristics of quality black onions are that the onion skin does not stick to the hand when held, is evenly black in colour and has a distinctive black onion smell and has a sweet and chewy taste (Figure 8).

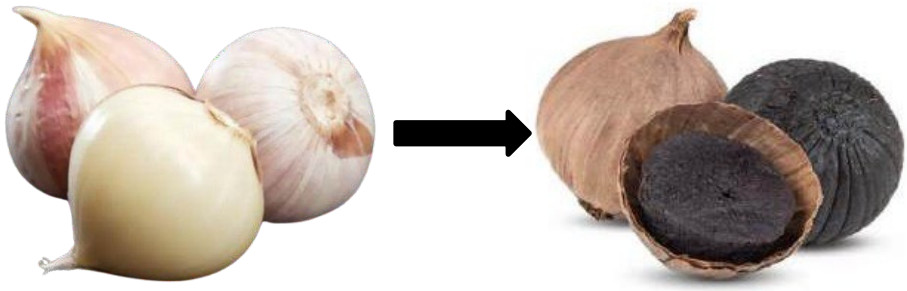

Figure 8. Change of single garlic into black garlic

The participation of students and staff at Pondok Tahfizh Utsman Bin Affan in a community service program regarding the use of thermolysis technology to produce black onions is the key to the success of this program. This active participation not only improves their technical skills but also strengthens their sense of community and social responsibility. The following are several forms of participation that can be done:

1. Training and Education:
    - Santri: Santri undergo intensive training which includes theory and practice of using thermolysis equipment. They learn about the importance of temperature and humidity control as well as optimal fermentation processes.
    - Staff: Lodge staff act as facilitators and mentors during training. They are also responsible for maintaining and monitoring the routine operation of thermolysis equipment.
2. Production and Supervision:
    - Santri: Directly involved in the black onion production process. They are tasked with preparing raw materials, operating equipment, and monitoring the fermentation process. This gives them practical experience and a deep understanding of the technology used.

- Staff: Responsible for supervising and ensuring all procedures are followed correctly. They also evaluate production results and provide feedback for improvement.

3. Research and Innovation:
    - Santri: Encouraged to participate in simple research activities that can improve production quality and efficiency. They can test various production parameters and propose innovative ideas.
    - Staff: Help direct research and record the results to be used as material for evaluation and further program development.
4. Entrepreneurship Skills Development:
    - Santri: Learn aspects of entrepreneurship such as marketing, financial management, and sales strategies. They are involved in designing product packaging, promoting black garlic, and interacting with potential buyers.
    - Staff: Provide guidance in business management and help connect students with potential markets. They also play a role in looking for collaboration opportunities with external parties.
5. Evaluation and Feedback:
    - Santri: Actively participate in evaluation sessions to provide feedback on the production process and results. This helps improve the quality of the program and ensures that their needs and aspirations are met.
    - Staff: Collect data and feedback from students and use this information to prepare evaluation reports. They also design follow-up plans based on the evaluation results.

The inhibiting factor that occurs in the field during the black garlic production process is that if there is a power outage, the black garlic production process will be hampered. Because there will be a significant drop in temperature, which will make the quality of black garlic poor in terms of maturity and taste. The taste of black garlic will turn bitter if the temperature is not maintained. The supporting factor in implementing the PKM DRTPM 2024 activity which helped the realization of this activity was the positive response from participants at partner locations, starting from surveying the service location, making proposals, and sending materials and equipment during the service, to socialization activities and guidance assistance. technical progress. A positive response was shown by a good and warm welcome when the service team arrived at the location and when the activities were carried out. In this activity, it was seen that all participants had a high level of enthusiasm in participating in this activity to open their horizons and increase their partners knowledge.

Figure 9. Documentation all team PKM DRTPM 2024 with Santri Pondok Pesantren tahfizh Al Quran Ustman Bin Affan

4. Conclusion

The Based on all DRTPM 2024 Community Service activities that have been carried out, it can be concluded that black garlic production using thermolysis equipment has had a positive impact and great benefits for partners. Apart from that, the female students and administrators of the Utsman Bin Affan Islamic Boarding School are very grateful because they have been allowed to be given a new source of income by utilizing thermolysis equipment. In this activity, it was seen that all participants had a high level of enthusiasm in participating in this activity to open their horizons and increase their partners' knowledge.

5. Acknowledgment

The author would like to thank the Directorate General of Higher Education, Research and Technology, Ministry of Education, Culture, Research and Technology and LPPM USU for providing the opportunity for the 2024 DRTPM Community-Based Empowerment Scheme PKM with contract number 401/UN5.4.11.K/Contract/DRTPM/2024. The author also thanks the Ustman Bin Affan Islamic Boarding School, Pantai Labu District, which has become a partner in this activity.

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