

Empowerment Program on Natural Soap Production from Used Cooking Oil at Pimpinan Ranting ‘Aisyiyah Tamanan

Author

Oktira Roka Aji^{1*}, Ambar Pratiwi², Nurul Suwartiningsih³

Correspondance

^{1,2,3} Department of Biology, Faculty of Applied Science and Technology, Universitas Ahmad Dahlan

Email: oktira.aji@bio.uad.ac.id

Abstract:

Household waste, particularly used cooking oil, is often improperly disposed of, causing environmental pollution and reducing water and soil quality. This community service program aimed to improve the knowledge and skills of members of Pimpinan Ranting ‘Aisyiyah Tamanan, Bantul, Yogyakarta, in utilizing used cooking oil as an environmentally friendly natural soap. The activity involved 21 participants and was conducted using a participatory approach combining counseling and hands-on training. The program included education on the environmental impact of used cooking oil, purification techniques, and practical training on natural soap production through the saponification method using simple household tools and affordable materials. Evaluation results showed a significant improvement in participants’ knowledge, where understanding of the reuse potential of used cooking oil increased from 33.3% to 100%, knowledge of soap production increased from 19.0% to 100%, and willingness to try making soap increased from 9.5% to 100%. In addition, 100% of participants agreed that the training materials were easy to understand and provided new business ideas. Most participants (81.0%) expressed interest in applying the skills independently at home, primarily for household use, while some participants showed interest in developing small-scale entrepreneurial opportunities. This program demonstrates that appropriate technology-based training can support sustainable household waste management while empowering communities to create environmentally friendly products with economic value.

Keyword: Community empowerment, entrepreneurship, environmental sustainability, household waste management, natural soap, used cooking oil.

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Introduction

Household waste has become an increasingly significant environmental issue along with population growth and rising consumption patterns in society (S. V. Kumar, Salem, Wagner, & Özçağlar-Toulouse, 2025). One common type of household waste is used cooking oil, also known as waste cooking oil (WCO), which is produced from repeated frying processes in daily cooking activities (A. Kumar et al., 2025). In many households, used cooking oil is often disposed of directly into drainage systems or onto soil without prior treatment. Such practices may lead to environmental pollution because waste cooking oil is difficult to degrade naturally, can clog soil pores, reduce soil fertility, and disrupt aquatic ecosystems when it enters waterways. Improper disposal of used cooking oil also contributes to water pollution and may interfere with wastewater treatment systems (Tombolini et al., 2026).

The community partner involved in this program is the Pimpinan Ranting 'Aisyiyah Tamanan, a women's organization located in Tamanan, Bantul, Yogyakarta, which actively engages in social, educational, and community empowerment activities. Most members of PRA Tamanan are housewives who perform daily cooking activities, resulting in the routine production of used cooking oil as household waste. Based on preliminary discussions with the partner, it was identified that waste cooking oil has not been optimally utilized and is generally discarded as waste. This condition indicates the need to improve community knowledge and skills related to household waste management, particularly in converting waste materials into useful and value-added products. Women's empowerment programs based on the utilization of local and environmentally friendly resources have been reported to improve practical skills, creativity, and opportunities for small-scale economic activities among community members (Aji, Pratiwi, & Irsalinda, 2025).

The utilization of waste cooking oil into natural soap represents an application of appropriate technology that can be easily implemented at the household level (Azme et al., 2023). Soap can be produced through a saponification reaction between oil and an alkaline solution, resulting in a cleaning product suitable for daily use (Nova et al., 2025). Transforming waste cooking oil into soap not only helps reduce environmental pollution but also creates added economic value for the community (Suwartiningsih, Pratiwi, & Aji, 2019). This approach promotes environmentally friendly practices while encouraging community creativity and self-reliance in managing household waste.

Based on the situation analysis, several problems faced by the partner were identified. First, the level of public knowledge regarding the environmental impact of improper disposal of waste cooking oil is still relatively low. Second, community members generally do not yet possess the technical skills needed to process waste cooking oil into useful products such as natural soap. Third, the potential of household waste as a simple business opportunity has not been optimally utilized, resulting in limited economic benefits from waste management activities. The objectives of this community service program are to improve the knowledge of PRA Tamanan members regarding the environmental impacts of waste cooking oil disposal and to enhance participants' practical skills in producing natural soap from used cooking oil. This activity also aligns with the Sustainable Development Goals (SDGs), particularly Goal 12 on Responsible Consumption and Production, as it promotes waste utilization, environmentally friendly products, and sustainable household practices.

Method

The community service activity was conducted at the house of one of the PRA Tamanan members as the activity venue, involving 21 participants who are members of PRA Tamanan. The program was designed using a participatory approach combining counseling and hands-on training to improve participants' knowledge and practical skills in utilizing household waste, particularly used cooking oil, into environmentally friendly natural soap. The activity consisted of several stages, including education about environmental impacts of waste cooking oil, training on purification of used cooking oil, and practical soap-making sessions. The materials and procedures used in this activity were adapted from community service training materials on waste cooking oil utilization.

The tools and materials used in the activity included filtered used cooking oil, sodium hydroxide (NaOH) as an alkaline reagent, water, heat-resistant containers, stirrers, digital scales or measuring cups, gloves, and masks as personal protective equipment. The selection of these

tools and materials was based on simple and accessible household equipment to ensure that the method can be easily replicated independently by participants at home. Safety procedures were emphasized during the activity, particularly the proper handling of NaOH solution due to its corrosive properties, as highlighted in the training material.

The purification of used cooking oil was carried out as an initial step to improve the quality of the raw material before the soap-making process. The collected used cooking oil was first filtered using a clean cloth or filter paper to remove food residues and impurities. If necessary, the oil was allowed to stand for several hours to separate solid particles from the liquid oil. The purified oil was then ready to be used as the main ingredient in soap production. This purification step is important to improve the appearance, odor, and quality of the final soap product.

The method used for producing natural soap was based on the saponification reaction, which is a chemical reaction between triglycerides in oil and an alkaline solution to produce soap (Nurfadila, Sumirat, Dwicahyo, & Kurniasari, 2026). The soap-making procedure began by carefully dissolving sodium hydroxide (NaOH) into water while stirring slowly until completely dissolved. This process generates heat and therefore must be conducted carefully using protective equipment. After the NaOH solution cooled to a safe temperature, it was gradually mixed with purified used cooking oil while continuously stirred until the mixture thickened and reached a “trace” condition, indicating the beginning of soap formation. The mixture was then poured into molds and allowed to stand for approximately 24 hours until solidified. The solid soap was removed from the mold and cured for approximately 2–4 weeks to allow the saponification process to complete and produce a mild and safe soap for use (Octarya, Yenti, Utami, & Yusbarina, 2025).

Results and discussions

Understanding the characteristics of participants is important to evaluate the relevance and effectiveness of community service activities. The demographic profile of participants can influence the level of understanding, participation, and potential sustainability of the program outcomes. Based on Table 1, most participants were aged 41–50 years (52.4%) and over 50 years (42.9%), indicating that the activity was dominated by adults who are actively involved in household management. In terms of education level, the majority held a bachelor’s degree (42.9%), followed by senior high school graduates (28.6%), showing that participants generally had adequate educational backgrounds to understand the training materials. Regarding occupation, participants had diverse professions, with housewives, employees, and retirees each accounting for 23.8%, while teachers comprised 19.0%. Since many participants were directly involved in household activities, the training on utilizing used cooking oil into natural soap is considered appropriate to improve environmental awareness and practical skills that can also support small-scale economic opportunities.

Table 1. Characteristics of Respondents

Variable	Category	Frequency	Percentage (%)
Age	31–40 years	1	4.8
	41–50 years	11	52.4
	>50 years	9	42.9
Education level	Senior High School	6	28.6
	Diploma	3	14.3
	Bachelor’s degree (S1)	9	42.9
	Master’s degree (S2)	3	14.3
Occupation	Housewife	5	23.8
	Employee	5	23.8

Variable	Category	Frequency	Percentage (%)
	Teacher	4	19.0
	Retired	5	23.8
	Entrepreneur	1	4.8
	Advocate	1	4.8

Evaluation of participants' knowledge is essential to assess the effectiveness of community service activities in increasing awareness and skills related to environmental sustainability. The comparison between pre-training and post-training results shows the extent to which the program improved participants' understanding of the utilization of used cooking oil as an environmentally friendly product. Based on Table 2, participants' knowledge increased significantly after the training. Before the activity, only 33.3% of participants knew that used cooking oil could still be reused, while after the training all participants (100%) understood this concept, indicating an improvement of 66.7%. Knowledge that used cooking oil can be processed into soap increased from 19.0% to 100%, showing an improvement of 81.0%. Understanding of the ingredients required for soap making increased from 9.5% to 100%, indicating an improvement of 90.5%. In addition, participants' willingness to try making soap also increased from 9.5% before training to 100% after training, demonstrating a 90.5% improvement. These findings indicate that the training effectively enhanced both knowledge and motivation of participants in utilizing household waste into useful and environmentally friendly products.

The increase in knowledge is closely related to the theoretical explanation and practical activities provided during the training. Used cooking oil contains impurities such as food residues, oxidation products, and unpleasant odors formed during repeated heating (Madhusanka et al., 2026). Therefore, a purification step is necessary before the oil can be utilized as a raw material for natural soap production. In this activity, the purification process was carried out using bleaching earth (BE) and activated charcoal as adsorbent materials to reduce impurities, dark color, and undesirable odors in the used cooking oil (Aritonang, Ritonga, Harefa, Wiratma, & Herlina, 2024; Arysandi, Arirohman, Zen, & Suhartoyo, 2026). The oil was first filtered to remove solid residues and then treated with bleaching earth and activated charcoal to adsorb oxidation products and other contaminants. This process improves the physical quality of the oil and helps produce soap with better color and odor characteristics.

Natural soap is produced through a saponification reaction, which is the chemical reaction between triglycerides in oil and an alkaline solution such as sodium hydroxide (NaOH) or potassium hydroxide (KOH), producing soap and glycerol as the main products. This reaction requires proper measurement of ingredients and careful mixing to ensure optimal soap formation. The practical session, as shown in Figure 1, demonstrates the mixing process between purified used cooking oil and alkaline solution until reaching the "trace" phase, indicating the beginning of soap formation. Furthermore, Figure 2 shows the implementation of the training session at PRA Tamanan, where participants actively engaged in discussion and hands-on practice. Through direct practice, participants gained better understanding and confidence to independently apply the method at home.

Table 2. Improvement of Participants' Knowledge on the Utilization of Used Cooking Oil

Statement	Before training knew n (%)	After training knew n (%)	Improvement
Used cooking oil can be reused	7 (33.3)	21 (100)	66.7%
Used cooking oil can be processed into soap	4 (19.0)	21 (100)	81.0%
Knowing the ingredients for soap making	2 (9.5)	21 (100)	90.5%
Willingness to try making soap	2 (9.5)	21 (100)	90.5%

**Figure 1.** Mixing Process of Used Cooking Oil and Alkali Solution in Natural Soap Production**Figure 2.** Training Session on the Utilization of Household Waste (Used Cooking Oil) into Natural Soap at PRA Tamanan

Evaluation of participants' responses is important to determine the effectiveness of the training method and its potential impact on sustainable community empowerment. The level of participant satisfaction and interest in applying the acquired skills reflects the relevance of the program to community needs. Based on Table 3, all participants (100%) agreed or strongly agreed that the training material was easy to understand, the instructor delivered the material clearly, and the hands-on practice helped improve their understanding of the soap-making process. In addition, all participants (100%) stated that the training provided new ideas for potential small-scale business opportunities. These results indicate that the training method, which combined theoretical explanation and direct practice, was effective in improving participants' comprehension and engagement.

Practical activities play an important role in skill-based learning because participants can directly observe the saponification process and practice transforming purified used cooking oil into natural soap. Table 4 shows that most participants (81.0%) expressed their intention to try

making soap independently at home, while 19.0% were still unsure, possibly due to limited time, confidence, or access to materials. Regarding the purpose of soap production, the majority of participants (66.7%) intended to use the soap for personal household needs, indicating increased awareness of environmentally friendly practices. Some participants (14.3%) showed interest in producing soap for sale as an additional source of income, while others considered the product suitable as gifts or handicrafts (23.8%) and as group activity products (23.8%). These findings suggest that the training not only improved environmental awareness but also opened opportunities for creative economic activities at the household or community level. Participants also expressed interest in further training topics related to entrepreneurship, particularly how to start a small business (52.4%), product packaging techniques (42.9%), and marketing strategies (28.6%). This indicates that the community has the potential to develop environmentally friendly products with economic value if supported with additional capacity-building programs.

Table 3. Evaluation of the Soap-Making Training

Aspect	Agree/Strongly Agree n (%)
The material was easy to understand	21 (100)
The instructor explained clearly	21 (100)
Hands-on practice improved understanding	21 (100)
The training provided business ideas	21 (100)

Table 4. Participants' Intention to Apply Skills and Entrepreneurial Interests after Training

Aspect	Category	n	%
Intention to try soap making at home	Yes	17	81.0
	Unsure	4	19.0
Purpose of producing soap	Personal household use	14	66.7
	For sale (additional income)	3	14.3
	Gift/handicraft	5	23.8
	Group activity	5	23.8
Topics of interest for further training	How to start a small business	11	52.4
	Product packaging techniques	9	42.9
	How to sell products	6	28.6

The results of this community service activity indicate that training on the utilization of used cooking oil into natural soap not only improves participants' knowledge and practical skills but also increases awareness of environmentally responsible behavior. The combination of simple purification techniques and the saponification method demonstrates that household waste can be converted into useful and value-added products using appropriate technology that is easy to apply at the household level. The positive response from participants and their interest in further entrepreneurship-related training suggest that this program has the potential to support sustainable waste management practices while encouraging small-scale economic opportunities.

Conclusion

The community service activity on utilizing used cooking oil into natural soap at PRA Tamanan was successfully conducted and showed positive outcomes in improving participants' knowledge and practical skills related to environmentally friendly household waste management. The training increased participants' understanding of used cooking oil purification and the saponification process, as reflected by the significant improvement in knowledge before and after the activity. Participants also demonstrated strong interest in applying the skills independently, both for household use and potential small-scale business opportunities. Therefore, this program contributes to promoting environmental awareness, appropriate technology utilization, and community empowerment through simple, practical, and economically valuable activities.

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