

The Utilization of Used Cooking Oil Waste for Aromatherapy Candle in Laban Jaya Village, Citeupuseun, Lebak

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Abstract Cooking oil consumption in Indonesia is relatively high, particularly in households and small-scale food businesses. Improper disposal of used cooking oil contributes to environmental pollution, whereas repeated reuse may pose health risks due to the formation of harmful compounds. Therefore, practical and community-based solutions are needed to promote safer and more sustainable waste management practices. This community service program aimed to enhance community knowledge and skills in utilizing used cooking oil as a raw material for producing value-added aromatherapy candles. The program was conducted in Laban Jaya Village, Citeupuseun, Lebak, through interactive educational sessions, hands-on training, and practical demonstrations. The implementation comprised three stages: preparation, implementation, and evaluation. Program effectiveness was assessed using a pre-test and post-test approach to measure participants' understanding of the characteristics of used cooking oil, its environmental and health impacts, appropriate disposal methods, and the process of producing aromatherapy candles. The results showed a substantial increase in participants' knowledge across all assessed indicators after the training activities. Participants were also able to follow and carry out the candle-making procedures effectively during the practical sessions. Overall, the program was implemented successfully, as indicated by active participant engagement and improved awareness of environmentally friendly waste management practices. The activity encouraged participants to use used cooking oil for non-food applications, thereby supporting environmental protection efforts and strengthening community capacity building through the development of practical skills with potential economic value.

1. INTRODUCTION

Waste cooking oil is a type of waste commonly generated from cooking activities in households and the food industry. Repeated use of cooking oil leads to a decline in its quality, and once it is no longer suitable for use, it is often discarded without appropriate treatment. The management of waste cooking oil is an important issue due to its substantial environmental, health, and economic implications. Oil discharged into soil may inhibit water and air infiltration, thereby reducing soil fertility. In addition, disposal of oil into drainage channels or rivers can pollute water sources

and damage aquatic ecosystems. Oil that floats on the water surface blocks the entry of oxygen required by aquatic organisms and increases Chemical Oxygen Demand (COD) and Biological Oxygen Demand (BOD), which ultimately causes the death of aquatic organisms and disrupts ecosystem function.

From a health perspective, the reuse of degraded cooking poses potential risks. Cooking oil that has undergone oxidation and contains carcinogenic compounds may contribute to various diseases, including cancer, if

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reused for frying food. Therefore, it is important to ensure that used cooking oil does not re-enter the food chain. Beyond its environmental and health impacts, waste cooking oil also has economic potential. Used cooking oil can serve as a raw material for producing biodiesel, soap, and aromatherapy candles. Processing used cooking oil into useful products not only reduces waste but also creates economic opportunities for the community. For example, converting used cooking oil into aromatherapy candle products represents a promising micro-business opportunity for local communities.

Awareness and education, including the introduction of the importance of managing used cooking oil, are closely related to increasing public awareness. Education regarding the negative impacts of improper disposal of used cooking oil and the potential benefits of its processing can change community behavior in managing household waste. Effective education can encourage more responsible and sustainable waste management practices. Program implementation is also essential; to achieve effective management of used cooking oil, structured and sustainable programs are required. Such programs can include collecting used cooking oil from households and restaurants, providing training to process this waste into products with economic value, and offering incentives for community participation in waste management. Support from multiple stakeholders, including government, non-governmental organizations, and the private sector, is needed for program success. Based on the problems identified, we decided to implement a change program by conducting training on processing used cooking oil waste into materials for aromatherapy candle production in collaboration with members of the PKK (Family Welfare Movement) in Citeupuseun. This initiative was motivated by community practices in which household used cooking oil is still discarded without reprocessing to make it more environmentally friendly. With this background, the idea was developed to educate the people of Laban Jaya Village, Citeupuseun, Lebak, through PKK members, regarding the utilization of household waste, specifically used cooking oil, which can be processed into aromatherapy candle products (Rayhan et al., 2023).

Through this activity, the community also contributes to addressing environmental pollution caused by used cooking oil. Used cooking oil that is disposed of indiscriminately can pollute water and soil (Mulyaningsih & Hermawati, 2023). In addition, these management activities are expected to support the development of community potential and skills by utilizing available resources, specifically by producing goods with economic value from used cooking oil waste (Syarifuddin & Hamzah, 2019). Improving community skills can indirectly stimulate the local economy and, in turn, enhance the welfare of the people of Laban Jaya Village, Citeupuseun, Lebak, through the production of aromatherapy candles made from used cooking oil waste (Vanessa & Bouta, 2017).

Aromatherapy candles are a type of candle produced using materials that are easy to obtain, such as used

cooking oil and aromatherapy essences, and they offer long-lasting burning properties and relaxation benefits (Adhani & Fatmawati, 2019). To address the problem of used cooking oil waste, various efforts have been undertaken to prevent this waste from becoming an environmental burden by utilizing it as a useful material, including for aromatherapy candle production, which can reduce the negative impacts of this waste. Using cooking oil as the primary ingredient for candle making can reduce environmental pollution associated with household waste (Aini et al., 2020). Aromatherapy candles have various uses, including lighting, room decoration, and aromatherapy applications. These candles are produced by adding fragrant elements that may provide several benefits, such as helping with insomnia, relieving muscle tension and pain, reducing stress, and increasing concentration. When burned, aromatherapy candles release a calming aroma that supports relaxation and provides a mind-therapy effect. The use of used cooking oil as the primary ingredient in aromatherapy candles is a practical action that can be adopted at the household level. Aromatherapy candles also have economic value and are highly feasible to develop as a source of additional income for the community. This community service program aimed to provide education to residents of Laban Jaya Village, Citeupuseun, Lebak, to increase public awareness regarding used cooking oil waste management, provide practical knowledge on producing aromatherapy candles, and encourage the community to convert waste into products with economic value to reduce environmental pollution.

2. METHOD

This community service activity was conducted on February 5th, 2025, in Laban Jaya Village, Citeupuseun, Lebak, using training and mentoring methods for community participants (Furqon et al., 2023). The training and mentoring sessions were implemented in Laban Jaya Village and were divided into three stages: (1) delivery of interactive material on processing used cooking oil into aromatherapy candles to prevent environmental pollution; (2) hands-on training on producing aromatherapy candles through the processing of used cooking oil; and (3) training on understanding the cost of production (Harga Pokok Produksi [Cost of Production], HPP) for aromatherapy candle products. The training and mentoring were attended by 30 participants and supported by a team of 18 students coordinated by one project leader. Each stage of training and mentoring was preceded by preparation and followed by an activity evaluation process.

During the training, pre-tests and post-tests were administered to evaluate participants' knowledge of aromatherapy candle making and their understanding of cost of production calculations. The pre-test and post-test instruments consisted of five structured questions designed to assess participants' knowledge related to the training materials. The questions posed to participants included:

1. Do you know what used cooking oil is and its characteristics?

2. Do you know the environmental and health hazards associated with used cooking oil waste?
3. Do you understand appropriate disposal methods for used cooking oil?
4. Do you understand how used cooking oil waste can be utilized to produce high-value products?
5. Can you name the four main ingredients used to make aromatherapy candles from used cooking oil?

Participants' responses were scored using a percentage-based scale to determine changes in knowledge before and after the training. The training required several tools and materials to produce aromatherapy candles. The tools included pans, spatulas, spoons, glass candle containers, stoves, and gas for heating during the handling of used cooking oil. The materials included used cooking oil, palm wax, aromatherapy essential oil, used crayons, and hemp rope. Direct practical training related to the utilization of used cooking oil was conducted for community members in Citeupuseun, and participants also supported the preparation of training activities. The facilitating group consisted of two students with practical skills in processing used cooking oil for conversion into recycled products. At this stage, information was provided regarding the technology used to process aromatherapy candles from used cooking oil, emphasizing approaches that were simple and feasible to apply. The second stage, which focused on cost of production, was also implemented through training and mentoring. The training and mentoring were supported by educational materials and guided exercises in determining the cost of production for aromatherapy candles. The delivery of material was conducted by members of the Community Service Implementation Team based on their respective areas of expertise (Kenarni, 2022; Pramitasari et al., 2024).

The process of producing aromatherapy candles from used cooking oil began with preparation of the required tools and materials. Palm wax and used cooking oil were placed in a heat-resistant container at a 1:1 ratio. Water was heated in a pan, and the heat-resistant container was then placed in the pan using a double-boiling technique to melt the palm wax without direct contact with water or water vapor, thereby preventing changes in the texture of the mixture. The used cooking oil and palm wax were stirred

continuously until completely melted and uniformly mixed. Afterward, 30 mL of essential oil (for example, lavender or lemongrass), depending on participants' preferences, was added and stirred until homogeneous. The candle container was then prepared by tying the wick to a stick and placing it in a glass container, with a wick support attached to keep the wick upright. Finally, the heated candle mixture was poured into the container and allowed to cool until the wax hardened, resulting in an aromatherapy candle that was ready.

3. RESULT AND DISCUSSION

3.1 Process of utilizing used cooking oil into aromatherapy candle production

The utilization of used cooking oil for aromatherapy candle production involves converting waste cooking oil into a non-food, value-added product through a simple and readily applicable process. In this activity, used cooking oil served as the primary raw material, palm wax functioned as a hardening agent, and essential oils were added to produce aromatherapy candles with functional and aesthetic value.

3.1.1 Cooking oil waste

Waste used cooking oil refers to oil that has been used more than two or three times for frying and is categorized as waste because it can contribute to environmental contamination and may pose health risks. One study reported that individuals who cook and consume foods fried using repeatedly used cooking oil have a higher risk of developing high blood pressure compared with those who replace cooking oil more frequently. From a chemical perspective, used cooking oil may contain carcinogenic compounds that can form during the frying process (Nimah, 2025). Therefore, continued reuse of used cooking oil may adversely affect human health due to the presence of carcinogenic compounds and their potential long-term consequences, including impacts on health and development. Repeated use of cooking oil can generate free-radical compounds such as peroxides and epoxides, among others. In animal experiments, consumption of foods containing high levels of peroxide groups has been associated with colon cancer.

Physically, used cooking oil is typically characterized by a yellowish-brown color, a rancid odor, and the presence

Table 1 . Comparison of waste cooking oil contents with AOCS standards

Parameters	Unit	Research Result	AOCS Standard
Specify gravity		0.911	0.915 _{max}
Density	g/cm ³	0.946	0.98 _{max}
Moisture content	%	23.50	-
Iodine value	gI ₂ /100g	86.00	100 _{max}
Acid value	mgKOH/g	3.142	3.0 _{max}
Saponification value	mgKOH/g	194.14	195 _{max}
Unsaponifiable matter	%	1.72	1.0 _{max}
Free Fatty Acids (FFA)	%	1.571	<1.0 _{max}
Viscosity at 25 C	mm ² /s	-	
Refractive index		1.461	

of sediment. More frequent reuse tends to darken the oil and alter its chemical properties. Table 1 presents Jimoh's findings regarding the composition of used cooking oil in comparison with AOCS (American Oil Chemists' Society) standards for cooking oil.

3.1.2 Aromatherapy candles

Aromatherapy candles represent an alternative aromatherapy approach based on inhalation, namely inhaling aromatic vapor produced from a few drops of essential oil, which is commonly applied using a container filled with hot water. When burned, aromatherapy candles release aromatic compounds that may provide a therapeutic effect. Currently, aromatherapy candles are widely formulated to serve dual functions; in addition to providing aromatherapy, some products also function as mosquito repellents. Aromatherapy candles can be described as a therapy in which vapor from essential oils is packaged into a candle product (Susilawati et al., 2024).

Aromatherapy is a method that uses essential oils to support physical and emotional well-being. It refers to the use of aromatic or volatile compounds to treat, reduce, or prevent conditions such as disease, infection, or anxiety through inhalation. Essential oils are natural oils extracted from plants that may have immunostimulant properties. Traditional medical practices, including Ayurveda in India, have also used various essential oils, and these practices were discussed historically in classical medical writings. Hippocrates, a medical figure from Greece, stated that bathing and massage using fragrant ingredients (essential oils) can help maintain freshness and health. A similar view was expressed by Theophrastus, who suggested that aromatic substances in plants can elicit positive responses in the mind, feelings, and bodily health. Essential oils have been reported to exhibit diverse effects, including immunostimulant activity, antimicrobial, antiviral, and antifungal properties, anti-inflammatory effects, antitoxin activity, balancing effects, and roles as insecticidal agents and repellents, as well as mucolytic and expectorant functions. To reduce the use of synthetic chemicals in mosquito repellents, optimizing the use of plants with natural insecticidal properties, particularly against mosquitoes, is considered a relevant approach (Theofila et al., 2026).

3.1.3 Palm wax

Palm wax is produced in a manner similar to soy wax and is derived from vegetable oil, specifically palm oil. Approximately 75% of global palm oil is harvested for use in the food industry, whereas the remaining 25% is used in a variety of products, including soaps, candles, detergents, and agricultural products. Palm wax produces a relatively hard wax texture, which is suitable for pillar candles. It can also create a crystal-like effect or fine-line patterns that enhance the aesthetic appearance of the candle. In addition, palm wax can be mixed with soy wax to produce a harder soy wax candle while maintaining the natural qualities of the wax (Nugrahini et al., 2025; Wardani et al., 2021).

3.2 Training implementation and demonstration activities

The training activities were implemented through interactive material delivery, hands-on practice, and demonstrations to ensure participants' understanding of the process of utilizing used cooking oil for aromatherapy candle production.

3.2.1 Interactive material on used cooking oil

The program implemented by the Community Service Team included demonstrations and training on producing aromatherapy candles from used cooking oil, as well as introductory sessions on basic product marketing, including pricing and simple selling strategies. The activity used an interactive approach that combined material delivery with practical processing exercises. Participants were aged 15–40 years, and the activity aimed to provide information dissemination and increase knowledge regarding the utilization of used cooking oil waste, as well as how to sell products to support income generation. The demonstration and training were conducted directly and were attended by 30 participants from Laban Jaya Village, Citeupuseun (Garnida et al., 2022). The event was preceded by an information session on used cooking oil waste. Participants listened and paid attention to the explanations delivered by the speaker through presentations and videos. Based on the material delivered, community awareness regarding the processing of used cooking oil waste to prevent environmental pollution increased. This was indicated by positive responses from participants, who expressed interest in continuing candle-making activities as a household-level product initiative that can reduce environmental pollution because used cooking oil is not discharged directly into the environment but is instead processed into aromatherapy candle products, as shown in Figure 1.



Figure 1. Demonstration of Making Aromatherapy Candles

3.2.2 Demonstration of making aromatherapy candles

This community service activity was conducted in two stages, namely mentoring in processing used cooking oil into aromatherapy candles. The production of candles from used cooking oil waste involves several key processes, beginning with the selection and preparation of the required materials and tools. The primary ingredient was used

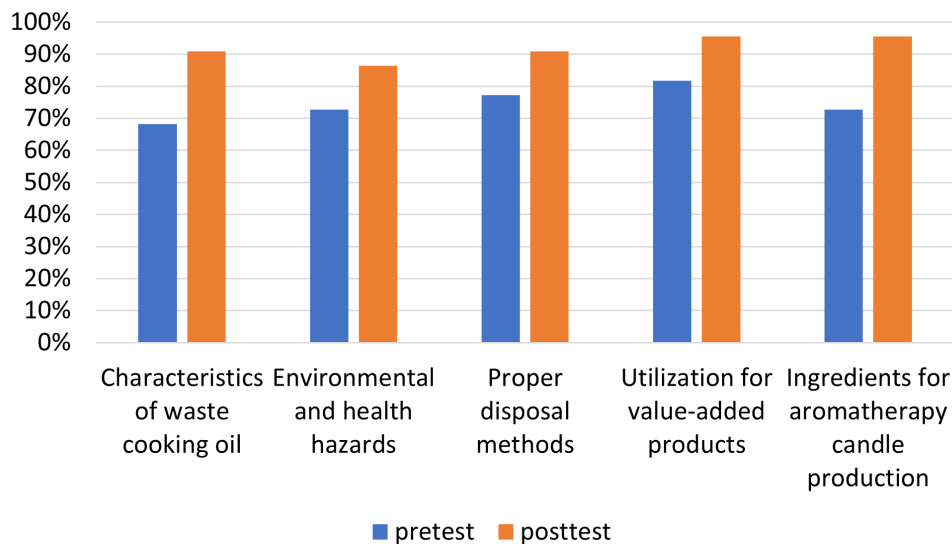


Figure 2. Changes in participants' knowledge before and after the training (pretest vs posttest)

cooking oil collected from household cooking waste. In addition, stearin was required as a wax hardener, and aromatherapy fragrance was added to provide the desired scent. The tools included a heating container, a stove and gas, a spatula, and a candle mold or a glass container for pouring the wax mixture (Delta, 2019).

The first step in the process was cleaning the used cooking oil. The collected oil was filtered to remove food particles and other impurities. After filtration, the oil was heated at a controlled temperature until it reached the boiling point. At this stage, the oil was stirred continuously to ensure uniform heating and maintain oil quality. After the oil boiled, stearin was added to the hot oil. Stearin functioned as a hardener that helped the candle maintain its shape after cooling. The mixture was stirred continuously until the stearin dissolved completely in the oil. Aromatherapy essential oil was then added according to the required dosage. This essential oil not only provided a pleasant aroma but also offered potential therapeutic benefits, such as reducing stress and improving sleep quality. Once the mixture of oil, stearin, and essential oil was ready, it was poured into the prepared container or mold. The mixture was poured carefully to prevent spillage and to ensure a flat candle surface. The container or mold used was heat-resistant and appropriately sized. After the wax mixture cooled to a semi-solid state, the candle wick was installed at the center of the container. The wick was positioned upright and stabilized to ensure proper burning. After the wick was installed, the wax was left to harden completely. This cooling process required several hours, depending on the size and type of container used.

Overall, producing aromatherapy candles from used cooking oil involved a series of structured steps and required attention to detail. Beginning with cleaning the used cooking oil, followed by heating and mixing with stearin and aromatherapy fragrance, and continuing with careful pouring and wick installation, each stage played an important role in producing quality candles (Sundoro

et al., 2020). Mastery of these techniques not only enabled effective utilization of used cooking oil waste but also created opportunities to produce environmentally friendly, economically valuable products (Budiyanto et al., 2020). This training used readily available tools and materials. The first stage was attended by 30 members of the Citeupuseun community. The training period was divided into two sessions. In the first session, participants obtained materials (used cooking oil) to be processed into candles. The procedure involved heating used cooking oil, eight tablespoons of stearin, and rayon until boiling while stirring continuously. Aromatherapy fragrance was then added as needed. After the mixture became uniform, it was poured into a glass container and allowed to cool until semi-solid. Finally, the candle wick was installed, and the mixture was left to harden (Budiarti et al., 2020).

During the training, a discussion session was conducted regarding the processing steps. Participants asked questions related to procedures that had been completed and alternative materials that could be used if the materials introduced during the training were not available. Before the training began, participants completed a pre-test questionnaire to measure baseline knowledge. After the training was completed, participants completed a post-test questionnaire. The pre-test and post-test results were analyzed based on the five assessment indicators described in the method section and are presented in Figure 2.

Based on the pre-test results presented in Figure 2, participants demonstrated varying levels of baseline knowledge across the assessed indicators, indicating that some initial understanding related to waste cooking oil and candle making already existed prior to the training. However, the post-test results showed a substantial increase in participants' knowledge across all indicators. This improvement indicates that the training activities enhanced participants' understanding of the characteristics of waste cooking oil, its environmental and health impacts, appropriate disposal methods, and its utilization

for producing value-added products such as aromatherapy candles. The pre-test questionnaire responses also indicated that participants perceived the training as useful, the material was delivered clearly, opportunities for questions were provided, there was intention to practice, and skills improved. For the post-test items assessing understanding of the material, the average score was 95.5%, indicating that participants achieved strong comprehension of the training content regarding the process of converting used cooking oil into aromatherapy candle products. During the discussion session, participants reported that they gained new knowledge about candle-making techniques that differed from those they had previously used (Inayati & Dhanti, 2021).

3.2.3 Aromatherapy candle Cost of Goods Sold (COGS) calculation training

The subsequent stage involved mentoring and training on calculating the Cost of Goods Sold (COGS) for aromatherapy candles. This stage consisted of three sessions. The first session delivered material on basic financing concepts and COGS to provide participants with foundational understanding of costs and cost categories. The second session focused on training in COGS calculation using examples of candle products and the materials required. The final session provided mentoring through a simulation of COGS calculation for aromatherapy candles by considering various production cost components and alternative material options to improve cost efficiency. The delivery of material on financing concepts and COGS aimed to provide participants with a solid foundation regarding cost considerations in the context of aromatherapy candle production (Kharisna et al., 2024).

Using examples of candle products, participants were shown directly how the COGS concept was applied to aromatherapy candle production. They learned to analyze the composition of raw materials, including essential oils and other ingredients, and to examine how the purchasing cost of these inputs influenced the overall COGS. In the production cost calculation session, participants were guided step by step in calculating the production costs of aromatherapy candles. This included classifying costs into labor, overhead, raw materials, and other relevant cost components. Participants were instructed to use accurate and systematic calculation procedures to obtain valid and useful COGS estimates. In addition to raw materials, participants were encouraged to consider the costs of supporting materials and equipment used in production, such as mixing tools, wax molds, and other necessary equipment. They learned how this equipment costs could be incorporated and how equipment use influenced the overall COGS calculation.

In the COGS simulation session, participants were mentored to conduct practical calculations of COGS for aromatherapy candles. They were tasked with identifying and calculating all relevant costs, including raw material costs, labor costs, factory overhead, and other operational

expenses. This simulation provided direct experience in applying COGS calculation theory within a production context. During the simulation, participants were also asked to explore alternative COGS scenarios by considering substitute materials for candle production. They were given the opportunity to analyze how changes in input materials could affect production costs overall. Intensive discussions were conducted to compare the advantages and disadvantages of each alternative, as well as their implications for the market selling price of candle products. This session also included discussion of strategies to improve production cost efficiency, including the use of more efficient candle containers and optimization of production processes. Participants were encouraged to propose practical ways to reduce production costs while maintaining product quality and value. Market considerations were also addressed, and participants were encouraged to consider external factors such as market demand and competitor pricing when determining product selling prices, thereby reinforcing the importance of aligning cost calculations with market dynamics.

The program identified solutions to partners' challenges in processing used cooking oil into candles through an applied and innovative approach. By introducing improved steps and alternative materials in the conversion process, the program not only supported the production of higher-quality candle products but also provided a meaningful learning experience for partner participants. The implementation of COGS training was also valuable because it demonstrated how cost management and product pricing can positively influence business sustainability and operational efficiency. Participants consistently reported that the training provided strategic insights that were needed to manage production costs and respond to market dynamics more effectively.

4. CONCLUSION

Introducing the importance of used cooking oil waste management is not only intended to reduce negative environmental and health impacts but also to utilize existing resources to generate economic value. With appropriate education and structured programs, used cooking oil management can represent a practical step toward sustainability and community empowerment. This community service program provided tangible benefits to the Laban Jaya Village community, Citeupuseun, Lebak Regency. The activity stages not only increased participants' knowledge and skills in converting used cooking oil into aromatherapy candles and calculating the Cost of Production but also aimed to serve as a model for household-level used cooking oil management. The primary objective of this community service program was to mitigate the adverse environmental impacts of used cooking oil waste and improve community well-being through capacity building, education, and training. As an outcome, this program contributed to increased monthly community income through the sale of produced aromatherapy candles and encouraged entrepreneurial

motivation, thereby supporting the development of new micro-business units in Citeupuseun, Lebak Regency. This activity should be implemented continuously to strengthen residents' knowledge and skills regarding additional benefits of processing used cooking oil waste so that it attains higher utility value and can be marketed to support economic improvement.

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CONFLICT OF INTERESTS

The authors declare no conflict of interest regarding the writing and publication of this article.

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