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Empowering communities through the sustainable transformation of used cooking oil waste into aromatherapy candles: A holistic approach to waste management

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ABSTRACT

Used cooking oil from household frying is often discarded improperly, leading to environmental pollution. One sustainable solution is repurposing it into aromatherapy candles, reducing waste while creating economic opportunities. To address this issue, KKM 210 UIN Malang conducted a community service initiative titled "Optimizing the Transformation of Used Cooking Oil Waste into Aromatherapy Candles: A Sustainable Waste Management Approach" in Petungsewu Village, in collaboration with PKK members. This program aimed to raise awareness of the dangers of reusing used cooking oil, reduce improper disposal, and introduce innovative business ideas. The socialization included brochure distribution, material presentations, hands-on training, interactive Q&A sessions, and entrepreneurship guidance. A pre- and post-assessment was conducted to measure knowledge retention and skill acquisition. Results showed a significant increase in participant understanding, with knowledge of candle-making rising by 65% and 85% of participants gaining confidence in independent production. Additionally, 75% of participants expressed interest in developing a home-based business, demonstrating the initiative's potential for local economic development. These findings highlight the importance of transforming used cooking oil into value-added products as both an eco-friendly waste management solution and a means of empowering local communities. The initiative serves as a model for sustainable development, showcasing how practical innovations can address both environmental and economic challenges. Future programs should focus on expanding training, facilitating market access, and supporting small business growth to ensure long-term impact and scalability.

Kata Kunci
Minyak goreng bekas
Lilin aromaterapi
Pengelolaan limbah
Mendaur ulang minyak goreng

Memberdayakan komunitas melalui transformasi berkelanjutan limbah minyak goreng bekas menjadi lilin aromaterapi: Sebuah pendekatan holistik terhadap pengelolaan limbah. *Minyak goreng bekas dari penggorengan rumah tangga sering kali dibuang dengan cara yang tidak benar, sehingga menyebabkan pencemaran lingkungan. Salah satu solusi yang berkelanjutan adalah dengan memanfaatkannya kembali menjadi lilin aromaterapi, sehingga dapat mengurangi limbah sekaligus menciptakan peluang ekonomi. Untuk mengatasi masalah ini, KKM 210 UIN Malang melakukan inisiatif pengabdian masyarakat yang berjudul "Optimalisasi Transformasi Limbah Minyak Jelantah Menjadi Lilin Aromaterapi: Pendekatan Pengelolaan Sampah Berkelanjutan" di Desa Petungsewu, bekerja sama dengan anggota PKK. Program ini bertujuan untuk meningkatkan kesadaran akan bahaya penggunaan kembali minyak jelantah, mengurangi pembuangan yang tidak tepat, dan memperkenalkan ide bisnis yang inovatif. Sosialisasi ini mencakup pembagian brosur, presentasi materi, pelatihan langsung, sesi tanya jawab interaktif, dan bimbingan kewirausahaan. Penilaian sebelum dan sesudah pelatihan dilakukan untuk mengukur retensi pengetahuan dan perolehan keterampilan. Hasilnya menunjukkan peningkatan yang signifikan dalam pemahaman peserta, dengan pengetahuan tentang pembuatan lilin meningkat sebesar 65% dan 85% peserta mendapatkan kepercayaan diri dalam produksi mandiri. Selain itu, 75% peserta menyatakan ketertarikannya untuk mengembangkan usaha rumahan, yang menunjukkan potensi inisiatif ini untuk pengembangan ekonomi lokal.*

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INTRODUCTION

Waste management is a pressing global issue that demands innovative and sustainable solutions. The improper disposal of household waste, including used cooking oil, poses serious environmental and health risks (Hanjarvelianti & Kurniasih, 2020). Many countries struggle with waste accumulation, which contributes to pollution, habitat destruction, and adverse public health effects (Hariono et al., 2022; Mulia, 2018). Used cooking oil is one of the most commonly discarded household waste products, yet its improper disposal—such as being poured into drainage systems—can lead to severe environmental consequences, including water contamination and ecosystem imbalance (Khuzaimah, 2020; Setyaningsih et al., 2018). Addressing this issue requires practical waste management strategies that not only mitigate environmental harm but also create economic opportunities for communities (Beghetto, 2025).

Used cooking oil is the leftover frying oil that is usually produced from household cooking activities. This waste comes from various types of cooking oils, such as corn oil, vegetable oil, samin oil, and so on. Food processing with cooking oil produces used cooking oil. During the frying process, three degradation reactions occur: hydrolysis, which produces free fatty acids, oxidation, and polymerization (Fatimah et al., 2023; Kenarni, 2023). Cooking oil that is used more than three times will be harmful to the body. This is due to the deterioration of oil, which will affect the quality and nutritional value of fried food and can have an impact on health (Bachtiar et al., 2022; Inayati & Dhanti, 2021). Used cooking oil consumed can increase the potential for cancer and narrowing of blood vessels, triggering hypertension, stroke, and coronary heart disease (Aini et al., 2020; Rahayu, 2021).

The disposal of used cooking oil in waterways remains an environmental problem that requires attention. The nature of used cooking oil that cannot mix with water causes accumulation and results in the covering of the water surface by a layer of oil (Mahmudah & Shofiah, 2023; Maulida & Makmuroh, 2023). The covering of the water surface by the oil layer will block sunlight from entering the water, followed by an increase in chemical oxygen demand (COD) and biological oxygen demand (BOD) levels. This causes the existing biota to die and disrupt the balance of the ecosystem (Hakim et al., 2021; Kenarni, 2023; Nirwana & Ernawati, 2023). This condition is very concerning because waste oil can cause water and soil pollution in the environment. Processing used cooking oil waste into a useful material is one alternative to reduce the level of environmental pollution.

Aromatherapy candles are enhanced by the addition of essential oils, which provide a relaxing or calming scent (Permadi et al., 2022; Wardani et al., 2021). The primary function of these candles is to act as a stress reliever for those who smell them. Stress is the body's response to pressures from life situations or events (Bachtiar et al., 2022; Foundation, 2018). The aromas from essential oils carry molecules into the nasal nerves and brain, stimulating odor receptors and interacting with the body's nervous and limbic systems (Ayu et al., 2020; Ridlwan et al., 2023) . Additionally, aromatherapy candles have economic value and can contribute to community income if properly developed.

To address the dual challenge of environmental pollution and community empowerment, this study focuses on a community engagement initiative aimed at educating and training the women of PKK RT 09 Petungsewu Hamlet in producing aromatherapy candles from used cooking oil. This initiative serves multiple objectives: (1) reducing household reliance on reused cooking oil, (2) preventing improper disposal of oil waste, and (3) fostering creativity and innovation in developing sustainable business ventures. Through hands-on training and skill development, this program aspires to equip community members with practical knowledge, thereby promoting environmental consciousness while enhancing economic resilience. This program supports the Sustainable Development Goals program number 7 and 8, i.e affordable and clean energy and industry, innovation and infrastructure (https://sdgs.un.org/goals).

This study employs a participatory approach, combining educational workshops, hands-on training, and business development guidance. By integrating sustainable waste management with community empowerment, this initiative demonstrates how household waste can be repurposed into valuable products, creating both environmental and economic benefits.

METHOD

The "Socialization of Used Cooking Oil Processing into Aromatherapy Candles" activity was conducted in Petungsewu Timur Hamlet, Petungsewu Village, Wagir District, Malang City, East Java, on January 20, 2024. This offline event was attended by approximately 30 members of the PKK RT 09 Petungsewu Hamlet, aiming to educate and empower the community in sustainable waste management through the production of aromatherapy candles from used cooking oil.

Program Design and Implementation

The program was carefully planned following a preliminary survey and discussions with Bu RT (the local neighborhood head), the head of the PKK in Petungsewu Village, and Bu Ina (the host of the PKK activity). Since the socialization was integrated into a routine PKK meeting, this ensured maximum community participation and engagement.

The training employed a multimodal approach consisting of the following methods:

1. Brochure Distribution – Participants received brochures at the beginning of the session, serving as a structured guide that summarized key concepts, step-by-step procedures, and benefits of transforming used cooking oil into candles.

This method was chosen for its accessibility and ease of reference, allowing participants to review the information after the session.

2. Material Presentation – A structured presentation explained the functions and uses of all tools and materials required for candle-making. This method ensured that participants understood the rationale behind each component before engaging in hands-on activities.
3. Processing Demonstration – A step-by-step demonstration showcased the entire candle-making process, from oil filtration to adding essential oils and molding the final product. Live demonstrations were chosen because they provide visual learning, making it easier for participants to replicate the process.
4. Hands-on Practice – Participants actively engaged in making their own aromatherapy candles under supervision. This hands-on approach helped reinforce learning through direct experience.
5. Interactive Q&A Session – Attendees were encouraged to ask questions, which were directly addressed by KKM 210 UIN Malang facilitators. The Q&A format promoted deeper understanding and resolved any uncertainties.

Entrepreneurship Education – The session concluded with guidance on selling aromatherapy candles, covering basic marketing strategies, pricing considerations, and potential business opportunities. This component was included to equip participants with the knowledge to turn their new skills into an economic opportunity.

Criteria for Measuring Success

To evaluate the effectiveness of the intervention, several success criteria were established:

1. Knowledge Retention – Participants' understanding of the environmental impact of used cooking oil and the process of making aromatherapy candles was assessed through informal questioning before and after the session.
2. Skill Acquisition – Success was measured by the ability of participants to independently complete each step of the candle-making process, as observed during the hands-on practice.
3. Participant Engagement – The level of interaction during the Q&A session and willingness to practice the techniques demonstrated was recorded as an indicator of interest and learning effectiveness.
4. Entrepreneurial Interest – A follow-up discussion was held to determine how many participants were interested in continuing candle-making as a potential business venture.

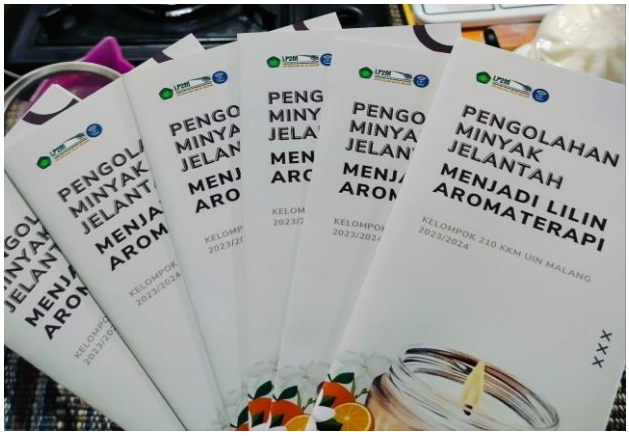
By integrating interactive learning, practical demonstrations, and economic empowerment, this socialization program aimed to enhance community awareness, encourage skill development, and provide a sustainable approach to waste management.

RESULT AND DISCUSSION

Implementation of demonstration

The work program carried out by KKM 210 UIN Malang in Petungsewu RT 09 Hamlet is to socialize the processing of used cooking oil waste into aromatherapy candles and provide directions for selling these products. The implementation of activities uses the method of providing brochures, material presentations, processing practices, and questions and answers. This empowerment is aimed at mothers with the aim of socializing and increasing knowledge about processing used cooking oil waste and providing business ideas for establishing MSMEs. The socialization was carried out in person and attended by 30 people who were the women of PKK RT 09 Petungsewu Hamlet, Petungsewu Village, Wagir Sub-district. PKK cadres are selected community members who have understood and implemented the 10 main PKK programs who are willing and able to provide counseling and mobilize the community to carry out the necessary activities. The ability of PKK cadres who already have additional knowledge and skills is more expected to be able to realize the skills that will be given and develop for economic improvement in Petungsewu Village, Wagir Subdistrict. (Arfan dan Sumiati, 2018).

This socialization was conducted at the PKK routine gathering on Saturday night, more precisely on 20 January 2024 at 18:30. The event began with an opening, then singing the PKK march, reading the 10 main PKK programs, remarks, then socialization. KKM 210 UIN Malang started the socialization by distributing brochures. A brochure is one of the informative media consisting of one or several pages used by many people for promotion and introduction, be it products or services (Lengkey et al., 2014: Islam, 2024). Brochures were distributed containing tools, materials, and steps for making aromatherapy candles from used cooking oil to PKK women before the material presentation. The brochure fully explained the functions and uses of the tools and materials. Participants then skimmed the brochures that had been distributed.



Picture1. Brochure on Processing Used Cooking Oil into Aromatherapy Candles

The material presentation was delivered by KKM 210 UIN Malang by showing the materials and tools along with their functions and uses. The next socialization was the practice of making aromatherapy candles from used cooking oil by KKM 210 UIN Malang, which was listened to very enthusiastically by the PKK women. The process of making aromatherapy candles from used cooking oil consists of several tools and materials. The materials used are as follows: 1) used cooking oil (1/2 liter); 2) stearin (200 grams); 3) charcoal (50 grams); 4) crayon dye; 5) essential oil; and 6) candle wick. The tools used are as follows: 1) stove, 2) measuring cup, 3) pot, 4) stirrer, 5) container for candles, 6) plastic bag (crackle), 7) sieve, 8) rubber, and 9) scissors.

Picture 2. Aromatherapy Candle Making Activity from Used Cooking Oil

The steps for making aromatherapy candles from used cooking oil begin with soaking the used cooking oil using activated charcoal to remove the unpleasant aroma for 24 hours (Anugrah et al., 2023).Activated charcoal is a material in the form of amorphous carbon which has a very large surface area of 300 - 2000 m2 /gram so that it has pores that have the ability to absorb. Used cooking oil is then filtered and stearin is added. Stearin is a mixture of various fatty acids and unsaturated fatty acids with the largest components being palmitic acid and oleic acid. Stearin serves to harden and form a solid wax solution after it cools (Amrin et al., 2024; Jamilatun et al., 2022) . The two ingredients were put in a pot with a ratio of 125 ml of used cooking oil to 75 grams of stearin. In addition, crayon colouring was also added to add aesthetics and essential oil fragrance as aromatherapy (Nirwana & Ernawati, 2023). Furthermore, all ingredients were cooked on the stove over low heat and kept stirring until smooth. Then it is immediately transferred to a glass cup and a candle wick is added. Finally, the aromatherapy candle is allowed to harden. After it has hardened a little, additional decorations are given from dried flowers. The appearance of the candle ready for use is shown in Figure 3.

Aromatherapy candles made from used cooking oil have an orange color and a citrus fragrance. Aromatherapy candles from used cooking oil have an appearance that is not much different from aromatherapy candles in general, as shown in Figure 3. This is because the used cooking oil has no odor because it has been soaked with charcoal for 24 hours. Processing used cooking oil waste into aromatherapy candles in addition to protecting the environment from pollution can also be of economic value to the community when sold both offline and online (Kumar et al., 2025; Murti et al., 2025). This craft is a very promising prospect for the international market because candles are not only useful as a means of lighting. However, candles also function as stress-reducing or stress-relieving drugs (Vinet & Zhedanov, 2011). This anti-stress property is contained in aromatherapy candles that are favored by foreign tourists (Ginting et al., 2020).

Picture 3. Aromatherapy Candle from Used Cooking Oil Waste

The next socialization was a question-and-answer session. The PKK women were very enthusiastic about asking questions, and KKM 210 UIN Malang immediately answered these questions very clearly and easily. The last socialization was about business opportunities from processing used cooking oil waste into aromatherapy candles. The women were given education on how to set up an MSME business by utilizing digital marketing in order to become a source of income for the community. The community was also given examples of how to package products to be attractive. The results of the socialization activities for PKK women can be seen from the positive responses given throughout the socialization process, where the women were very enthusiastic and active in asking questions about the ingredients and the process of making aromatherapy candles. At the end of the session, KKM 210 UIN Malang gave the aromatherapy candles that had been made before with attractive packaging to the PKK women, who would then be given to the Head of the Village and the Chairperson of the PKK. In addition, KKM 210 UIN Malang also provided the remaining materials for making aromatherapy candles to the women so that they can practice independently at home.

Assessment of Participant Knowledge and Skill Improvement

To measure the impact of this socialization program, a pre- and post-assessment was conducted using structured questionnaires to evaluate participant knowledge and skill acquisition. The assessment results are summarized in Table 1 below:

Table 1. Pre- and Post-Assessment of Participant Knowledge and Skills

Assessment Criteria	Pre-Test (% of Participants with Knowledge)	Post-Test (% of Participants with Knowledge)	Knowledge Increase (%)
Understanding the environmental impact of used cooking oil waste	40%	95%	+55%
Knowledge of materials and tools for making aromatherapy candles	30%	92%	+62%
Ability to explain the step-by-step process of candle-making	25%	90%	+65%
Confidence in making aromatherapy candles independently	20%	85%	+65%
Interest in starting a home-based aromatherapy candle business	15%	75%	+60%

These findings demonstrate a significant improvement in knowledge retention and practical skills among participants. The largest increase was observed in understanding the step-by-step candle-making process (+65%) and confidence in producing candles independently (+65%), indicating the effectiveness of hands-on learning and direct demonstrations. Additionally, 75% of participants expressed interest in commercializing their candle-making skills, suggesting strong entrepreneurial potential. This highlights the broader economic impact of the initiative and its potential role in strengthening household income and local MSME development. This suggests that the initiative not only improved technical competencies but also fostered economic empowerment at the household level, contributing to the growth of local MSMEs (Micro, Small, and Medium Enterprises). From an environmental perspective, the notable increase in understanding the environmental impact of used cooking oil waste (from 40% to 95%) is particularly important. According to Endang Yani et al., (2025) ; Wal Ikram et al., (2025) improper disposal of used cooking oil can

contaminate groundwater and severely affect aquatic ecosystems. Thus, by raising participants' environmental awareness, the program contributes to broader sustainability goals and promotes responsible waste management practices.

Women's Interest in Socialization

The socialization of making aromatherapy candles from used cooking oil went smoothly and received a very good response from the women of PKK RT 09 Petungsewu Hamlet. The response of the women was assessed from the number of women who met 100% of the target participants and also from the many questions asked by the women in the question-answer session on making aromatherapy candles, which extended the duration of the activity beyond the proper duration. The women also said they wanted to immediately practice making aromatherapy candles from used cooking oil themselves and asked about the location of purchase and the price of the ingredients. This is an indicator of the success of the socialization activity where it is expected that the PKK women, who are mostly young, have an interest in entrepreneurship. The obstacle experienced in the demonstration of making aromatherapy candles from used cooking oil was that there were some women who did not see the practice of making aromatherapy candles directly because they were blocked by a wall and could not stand to get closer. However, the students provided brochures and showed the aromatherapy candles in turn. Documentation of PKK women who participated in the socialization of processing used cooking oil into aromatherapy candles can be seen in Figure 4.

Aromatherapy candles made from waste cooking oil use affordable and readily available materials. In addition, it is easy to make, so it can be followed by housewives or teenage children. This activity can be an entrepreneurial opportunity to support the family economy. Making aromatherapy candles from used cooking oil from an economic point of view does not require large costs but the production of high economic value (Hilabi et al., 2024; Inayati & Dhanti, 2021; Putra et al., 2023). Now the products can be sold online, which has a wide target market. It is hoped that this utilization will not only reduce environmental problems but also create an environmentally friendly creative economy for the community (Arifin et al., 2024; Damayanti et al., 2020).

Picture 4. Documentation of PKK women who participated in the socialization of making aromatherapy candles from used cooking oil

Profit Projection of Aromatherapy Candle from Used Cooking Oil

Making aromatherapy candles from used cooking oil is one of the creative business ideas that can generate economic value and can reduce used cooking oil waste. The projected profit of selling aromatherapy candles from used cooking oil is determined by considering the variable fixed costs and variable costs as well as the production capacity of used cooking oil aromatherapy candles. Determination of production costs is carried out with a full costing approach that takes into account all elements of production costs into production costs. This method makes it easier for entrepreneurs in the calculation process because the determination of the selling value depends on the determination of the margin value, which is determined directly from the amount of the cost of goods according to the entrepreneur (Wardani et al., 2021)). The calculation of the cost of goods manufactured is explained as follows:

Fixed cost = depreciation cost
= Rp0,00
Variable costs = consumables + travel and transport costs
= Rp197.200,00 + Rp20.000,00
= Rp217.200,00
Cost of production $= \frac{217.200}{8} =$ Rp27.150,00

Notes: Labor costs have not been included as a cost component because the scale of production is still small, so it can still be carried out by families or family members. In addition, the production time is very short so that production can be done on the sidelines of daily activities.

Based on the production price, a projection of the profit from selling the used cooking oil aromatherapy candles can be made. Determination of profit is done by comparing the selling price with the cost of production. The selling price of one package of aromatherapy candles (assuming a net weight of 100 g) was determined by a method based on market price references so that the profit calculation was carried out as follows (Table 1). Based on the projected profit obtained, the relative profit ratio (R/C ratio) can be determined. This ratio is used to project the relative profit obtained in a business. The business will be said to be feasible to run if the R/C value obtained is greater than 1. The calculation of the ratio is as follows:

R/C = 280,000 / 217,200 = 1.28

The R/C value obtained shows results greater than 1. Based on these results, it shows that the used cooking oil aromatherapy candle business is a feasible business idea to develop because it produces profitable economic value (Kune, 2017 in Bachtiar et al., 2022). Therefore, the aromatherapy candle business from used cooking oil can be developed into a small business for the women of PKK RT 09 in Petungsewu Village because this business generates economic benefits, as explained in Table 1.

Tabel 1. Perhitungan Analisa Keuangan

Uraian	Harga
Selling price of a product	Rp35.000,00
Production cost of a product	Rp27.150,00
Net profit (price-cost of production)	Rp7.850,00/wrap
Total revenue (price x production quantity)	Rp35.000,00 x 8=Rp280.000,00/production
Total production cost (fixed cost + variable cost)	Rp217.200,00/ production
Profit (total revenue - total cost of production)	Rp62.800,00/ production

Broader Implications for Local Economic Development

The strong entrepreneurial interest among participants suggests significant potential for community-based economic development. If even a fraction of participants commercialize their candle-making skills, the initiative could:

1. Enhance household income, contributing to financial stability for women and families.
2. Foster local MSME (Micro, Small, and Medium Enterprises) growth, strengthening the regional economy.
3. Promote sustainable practices, reducing environmental pollution from used cooking oil disposal.
4. Encourage women's empowerment, positioning them as key contributors to economic development.

The initiative aligns with global sustainability efforts, demonstrating how waste management strategies can drive both economic and environmental progress. Future efforts should focus on expanding the program, providing access to funding, marketing strategies, and business incubation support to scale up production.

CONCLUSION

The processing of aromatherapy candles using used cooking oil was carried out by direct socialization to the women of PKK RT 09 Petungsewu Hamlet. Through this socialization, it is expected that the women can reduce the use of used cooking oil for frying food, reduce the disposal of used cooking oil to the environment, and utilize used cooking oil to make aromatherapy candles, create creative business ideas, and increase economic value. The profit earned from the production of aromatherapy candles reached IDR 7,850 per unit, with a relative profit ratio of 1.28. The relative profit ratio exceeding 1 indicates that this business is worth developing because it can generate profitable economic value. Furthermore, this business's strategy may lessen the effects of wasteful use of cooking oil in the neighborhood.

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