




From waste to wealth: A novel approach for empowering society through recycling used cooking oil into soap

Rif'atul Mahmudah^{a,1,*}, Nurul Shofiah^{a,2}

^a Department of Chemistry, Universitas Islam Negeri Maulana Malik Ibrahim Malang, Jl. Gajayana No.50, Malang 65144, Jawa Timur, Indonesia

¹rifatul@kim.uin-malang.ac.id*; ²nurulshofiah@uin-malang.ac.id

* Corresponding author

ARTICLE INFO	ABSTRACT
<p>Article history Received: 2023-04-12 Revised: 2023-05-18 Accepted: 2023-05-22 Published: 2023-07-02</p> <p>Keywords Empowerment Laundry soap Oil processing Waste cooking oil</p>	<p><i>Soap made from waste cooking oil can be a potential product that can be developed to improve the economy and as an effort to preserve the environment by utilizing household waste. Waste cooking oil can be reprocessed into soap-based ingredients through an oil purification system so that the color is clear and does not smell rancid by using bagasse and orange peel adsorbents in the bleaching process. This service aims to train students' understanding of Mambaul Hikam Islamic boarding school about processing solid and liquid soap from waste cooking oil through the cold process method and the hot process method. The results of the service show firstly, the transfer of knowledge, skills, and affection for making liquid and solid soap using cold and hot process techniques through appropriate technology. Second, the formation of a community of students who can become facilitators in assisting the manufacture of laundry soap from used cooking oil waste. Soap production from this assistance is still an internal use of the Islamic boarding school but the students are expected to be able to increase the production of soap which can improve the economy of the santri and the Mambaul Hikam Islamic boarding school.</i></p>
<p>Kata kunci Limbah minyak goreng Pemberdayaan Pengolahan minyak Sabun cuci</p>	<p>Dari limbah menjadi kekayaan: Sebuah pendekatan baru untuk memberdayakan masyarakat melalui daur ulang minyak jelantah menjadi sabun. Sabun berbahan dasar minyak jelantah dapat menjadi produk potensial yang dapat dikembangkan untuk meningkatkan perekonomian dan sebagai upaya pelestarian lingkungan dengan memanfaatkan limbah rumah tangga. Limbah minyak jelantah dapat diolah kembali menjadi bahan dasar sabun melalui sistem pemurnian minyak agar warnanya jernih dan tidak berbau tengik dengan menggunakan adsorben ampas tebu dan kulit jeruk pada proses bleaching. Pengabdian ini bertujuan untuk melatih pemahaman santri pondok pesantren Mambaul Hikam tentang pengolahan sabun padat dan sabun cair dari minyak jelantah melalui metode cold process dan metode hot process. Hasil pengabdian menunjukkan pertama, transfer pengetahuan, keterampilan, dan afeksi pembuatan sabun cair dan padat dengan teknik proses dingin dan proses panas melalui teknologi tepat guna. Kedua, terbentuknya komunitas santri yang dapat menjadi fasilitator dalam pendampingan pembuatan sabun cuci dari limbah minyak jelantah. Produksi sabun hasil pendampingan ini masih bersifat penggunaan internal pondok pesantren namun para santri diharapkan dapat meningkatkan produksi sabun yang dapat meningkatkan perekonomian santri dan pondok pesantren Mambaul Hikam.</p> <p style="text-align: right;">Copyright © 2023, Mahmudah and Sofiah This is an open access article under the CC-BY-SA license</p> 

How to cite: Mahmudah, R. & Sofiah, N. (2023). From waste to wealth: A novel approach for empowering society through recycling used cooking oil into soap. *Journal of Community Service and Empowerment*, 4(2), 343-350. <https://doi.org/10.22219/jcse.v4i2.25816>

INTRODUCTION

The correlation of religion with the old environment has been studied by scientists. This is because awakening people to care about themselves and the environment in life from day to day is far from being burnt fire (Mahran, 2009). Various problems of environmental damage occur today so education is needed that leads to how humans properly manage natural resources and the environment as mandated in the Qur'an al-Karim. Boarding school act as facilitators of environmental education needed by students because teaching through Islamic boarding schools results will be much more optimal because they are directly practiced in daily life so that they are ingrained as a life habit of students (Mangunjaya, 2014).

Student participates in the implementation of management as the implementation of Islamic teachings related to cleanliness and as follows on the earth to regulate, care for and maintain the earth. This is supported by a government agency, namely the Ministry of Environment (KLH) in 2008 namely the Eco-Islamic boarding school program to encourage residents of Islamic boarding schools to increase compliance, knowledge, and awareness of environmental conservation (Kementrian Lingkungan Hidup, 2010). Environmental preparation programs in Islamic boarding schools need to be carried out to foster awareness and practice of students as well as skills and skills of students with training on waste management into useful and environmentally friendly products (Mangunjaya et al., 2013).

Mambaul Hikam Islamic Boarding School (MMH) has a mission, among others, to familiarize students to preserve the surrounding environment and prevent environmental pollution. The flagship program, which emphasizes Islamic-based education (Sharia) and supports the creativity of students to have an entrepreneurial spirit, this MMH Islamic boarding school is one of the many institutions that have succeeded in creating a Sharia-based entrepreneurial culture program in the form of entrepreneurship training. With this program, it is hoped that students can prepare for a better future, which can lead them to become entrepreneurs and will be beneficial for themselves and the community in spiritual and material terms. The empowerment of entrepreneurship in this Islamic boarding school is that besides the students having religious knowledge, they also have the expertise and skills that are expected to be useful when they leave later. Given the increasing competition for jobs, students are required to be able to create jobs with minimal entrepreneurial skills for themselves so that they can be independent in the midst of society.

Many things around us which are waste or waste generated from human activities can be increased in economic value. Pesantren with a large population of students will also produce large amounts of waste. One of the wastes resulting from cooking activities is used cooking oil which is cooking oil with repeated use by heating at high temperatures above 170°C causing oxidation, hydrolysis, and polymerization processes and causing the oil to be damaged (Nasrun et al., 2017). The heating process will cause damage to the oil which can be seen from color changes, the content of free fatty acids, decreased iodine number, increased viscosity, foam formation, and increased peroxide (Hidayati, 2016). Oil oxidation will produce ketone compounds, hydrocarbons, alcohols, aldehydes, lactones, and aromatic compounds that have a rancid and bitter smell. The rancid smell in the oil is also due to the hydrolysis reaction occurring in the oil caused by the presence of water and the activity of the lipase enzyme to produce diglycerides and monoglycerides (Rouf, 2020). During the frying process, polymer compounds will be formed due to the addition of unsaturated fatty acids with the formation of gums that settle to the bottom of the frying pan (Keteren S., 2012).

Waste cooking oil that is not used wisely or disposed of carelessly will result in water and soil pollution. Disposal of used cooking oil into the ground will pollute the soil so that the soil becomes infertile (Hanjarvelianti, 2020). Waste cooking oil is one of the great potential results of cooking activities in Islamic boarding schools. In addition, there is a program from the MMH Islamic boarding school that requires guardians of students when visiting their sons and daughters to bring waste cooking oil which the pesantren collects. This is done in addition to preventing used cooking oil from being dumped directly into the environment as well as utilizing the potential of used cooking oil as a holy soap to increase its economic value. Based on these problems, it is necessary to have an innovation in the management of used cooking oil which is useful as a product with economic value that will support the flagship program of MMH pesantren, namely supporting the creativity of students to have an entrepreneurial spirit and love the environment

Waste cooking oil can be reprocessed through an oil purification system so that the color is clear and does not smell rancid. However, the content is still damaged so it is not good if it is consumed again (Ervin et al., 2016). Waste cooking oil has the potential as an oil ingredient in soap making. Waste cooking oil without purification is directly used as an ingredient for making laundry soap the results are not good because the soap produced is not attractive in color because it is dirty, dull, and has a distinctive aroma (smelling rancid).

The purification of waste cooking oil includes three stages, namely despicing, neutralization, and bleaching (Susinggih, 2005). First, remove the seasoning (despicing). Despicing is a process of separating impurities by precipitation from oil which aims to remove suspended or colloidal particles such as salt sugar, spices, proteins, and carbohydrates by depositing the oil for 1-2 days and altering it (Lestari, 2010; Mulia, 2018) The second is neutralization. Neutralization is the process of reacting used cooking oil with an alkaline solution, namely sodium hydroxide (NaOH) and potassium hydroxide (KOH) which makes the color of used cooking oil clearer. Third, Bleaching. Bleaching is the process of removing dyes which are the result of the degradation of natural substances, due to oxidation and metal content (Keteren S., 2012). The method used at this stage is heating the neutralized oil to a high temperature and adding 10% adsorbent from agricultural waste such as bagasse and orange peel.

Bagasse can be used as an alternative adsorbent for the purification of used cooking oil (Hakim et al., 2021). Jombang Regency is one of the centers of sugarcane production. In 2022, in the Jombang district, there are 7,800 hectares of sugarcane plantations that can produce 3,445,000 quintals of production each season so bagasse has the potential to be used as a derivative product. Next, orange peel. Essential oil in the orange peel can affect the soap to be fragrant, and pale yellow in color, the rancid smell disappears and is similar to the smell of soap in general (Khuzaimah, 2020)

The purpose of this community service is to enable the students to understand the potential of used cooking oil, acquire skills in purifying used cooking oil, and produce laundry soap from the purified oil. This initiative supports the boarding school's flagship program, which aims to foster entrepreneurial creativity among the students. The community service

aligns with the goals of the Sustainable Development Goals (SDGs), specifically in enhancing the economic well-being of the community and preserving the quality of the environment. Ma'had Mambaul Hikam serves as a producer of used cooking oil soap, which contributes to the economic development of the boarding school and supports its program of promoting environmental consciousness, self-sufficiency, and empowerment

METHOD

The location of this community service was carried out at Mambaul Hikam Diwek Jombang Islamic Boarding School, located at JL. Masjid, No. 12, Jatirejo, Diwek, Ceweng, Jombang District, Jombang Regency, East Java 61471 (see Figure 1). The community service was conducted for a duration of two months. One of the approaches used is Asset-Based Community Development (ABCD Method), which is a mentoring approach that seeks community development that must be carried out from the beginning to out what strengths they have and all the potential and assets they have the potential to be utilized. The ABCD approach is an approach that leads to the understanding and internalization of assets, potential, strengths, and their utilization independently and maximally. In this activity, the service stages consist of material preparation and practice. In addition, the steps taken in community service activities are as follows. *First*, Focus Group Discussion (FGD). This activity began with in-depth interviews and focus group discussions (FGD) with the leader and teacher of Mambaul Hikam Islamic Boarding School. Interviews and discussions with leader and teachers aimed at mapping and identifying problems. After that, a trial and quality test was carried out for the process of cleaning waste cooking oil and making soap in the laboratory. *Second*, Implementation of Mentoring. Implementation of mentoring for cleaning used cooking oil and making laundry soap from used cooking oil as an effort to utilize household waste with a leader, teachers, and 30 students of the Mambaul Hikam Islamic boarding school. *Third*, Reflection. Reflection is carried out in the form of monitoring and evaluating activities including process evaluation and result evaluation.

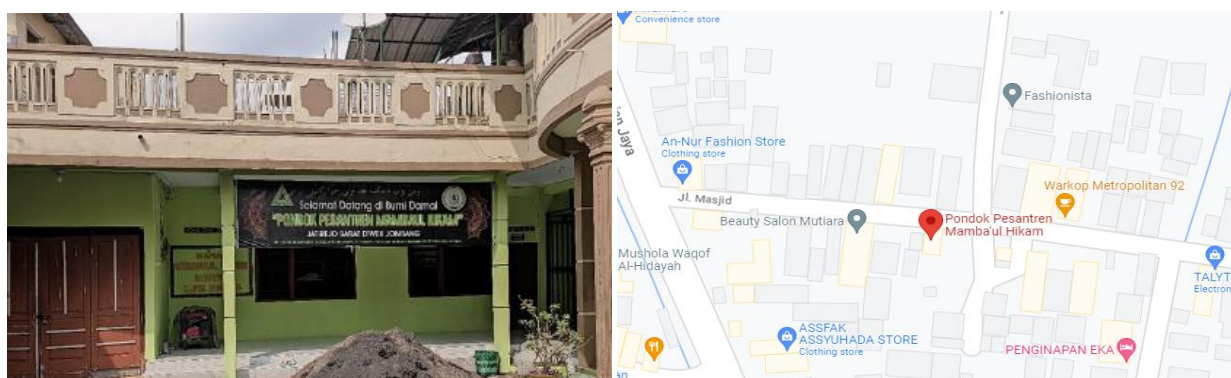


Figure 1. The location of community service activities

RESULTS AND DISCUSSION

Focus Group Discussion activities, the results of interviews and discussions with pesantren caregivers and Mambaul Hikam teacher Diwek Jombang revealed that the problems: In general, the leader of Mambaul Hikam Islamic Boarding School already understood that waste cooking oil could be increased in economic value by using it as an ingredient for making laundry soap. Therefore, he made it obligatory for the parents or guardians of the students when visiting their sons and daughters at the Islamic boarding school to bring waste cooking oil that they collected. This is done in addition to preventing waste cooking oil from being dumped directly into the environment causing pollution, as well as utilizing the potential of waste cooking oil as a holy soap to increase its economic value. From these conditions, assistance from experts from universities is needed for processing waste cooking oil and making soap. The mentoring process is carried out until the process of producing small-scale soap is marketed among themselves.

The implementation of assistance in making laundry soap from waste cooking oil is carried out by providing material understanding to Mambaul Hikam students to understand the function of each ingredient and process in refining waste cooking oil. The stages of purification of waste cooking oil include despicng, neutralization, and bleaching. The results are shown in Figure 2 and the results of the analysis for water content, free fatty acid content, and pH are in Table 1.



Figure 2. Results of purification of waste cooking oil with orange peel adsorbent: waste cooking oil, despicing, neutralization, bleaching (left to right)

Table 1. Test Results of Used Waste Cooking Oil Purification Analysis from Various Treatments

Analysis	Treatment				
	Waste cooking oil	Despicing	Neutralization	Bleaching (baggase)	Bleaching (orange peel)
Water Content (%)	0,09	0,09	0,1198	0,1448	0,19
free fatty acid (%)	1,6365	1,6365	0,6647	0,5501	0,5116
pH	6	6	8	8	8

The results of analytical tests carried out at the Chemical Laboratory of UIN Maulana Malik Ibrahim Malang for parameters of water content, free fatty acids, and pH showed that the neutralization process using a technical NaOH solution of 10% with heating at 70 °C for 2 hours, the results obtained that the pH of the oil to 8 (neutral) and the free fatty acid content decreased to 0.66%. The bleaching process uses 10% adsorbent with immersion for 3 days. For the results of the water content in the neutralization process, it rose to 0.119 due to equates of aquades when making alkaline solutions in the neutralization process. While the bleaching process also increased because of the water content of the adsorbent material (bagasse and orange peel) used, the results were still below the oil quality requirements of SNI 01-3741-1995.

The next assistance is the provision of materials for making solid and liquid laundry soap using the cold process and hot process (Figure 3). The difference between the hot process and the cold process technique is that first, the hot process is done by mixing the ingredients for making soap through heating for about 50-60 minutes in a slow cooker. Second, the cold process is carried out without heating. The results are poured and stored in the mold for one to two days and air-dried for at least 4 weeks until the pH is less than 9. The principle of soap making is the saponification reaction, namely the hydrolysis of fatty acids in bases into fatty acids and glycerol. There are 2 forms of soap, namely solid and liquid (Khuzaimah, 2020). Using natrium hydroxide, the product is solid soap, whereas if potassium hydroxide is used, the product is liquid soap (Sukeksi et al., 2021; Sulastri & Yayan, 2016). In addition, additional coconut oil is needed so that the resulting soap has abundant foam. Because if you use 100% of used cooking oil, it will produce soap that has minimal foam. Coconut oil is a vegetable oil that has a good saponification effect (Vinet & Zhedanov, 2011). The dominant fatty acid in coconut oil is lauric acid, which is 52% which plays a role in saponification because it produces excellent foam for soap products (Karo, 2011; Sutarmi & Rozaline, 2005). Soap produced using 30% coconut oil and 70% used cooking oil will have abundant foam.



Figure 3. Liquid soap (left) and solid soap (right) from waste cooking oil

The implementation of assistance in making laundry soap from used cooking oil is carried out by providing material understanding about the function of each ingredient and process used in refining waste cooking oil and making laundry soap (Figure 4). After that, the practice of making laundry soap using the hot process and cold process methods was carried out for the manufacture of liquid and solid soap.



Figure 4. Resource persons provide an understanding of making laundry soap from used cooking oil (left) and MMH students practice making liquid soap using the cold process method (right)

Evaluation of activities became the focus of post-assistance activities for refining waste cooking oil and making laundry soap from waste cooking oil. Evaluation is carried out after one week of mentoring. The evaluation was carried out using a questionnaire related to the 30 participants' understanding of the material and the mentoring process.

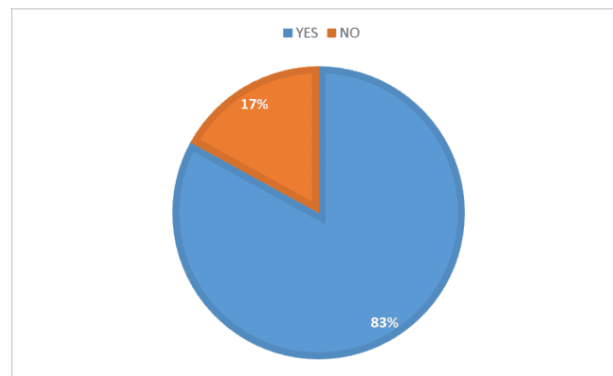


Figure 5. Ease of making soap made from waste cooking oil

Participants' perceptions of the ease of applying waste cooking oil at home were found to be 83% easy and 17% not easy (Figure 5). Participants who answered it was not easy to explain that they still needed to see a demonstration of the sequence of stages of making the process and in practice, it was necessary to pay attention to the pH balance record, while participants who answered easily added that the knowledge received during mentoring was easy to understand, and was followed up by students independently. Second, the perception of the ease with which the type of laundry soap was made was found and 26 participants answered solid soap using the cold process technique (Figure 6). This is because the process of making soap with this technique is easier and faster to do.

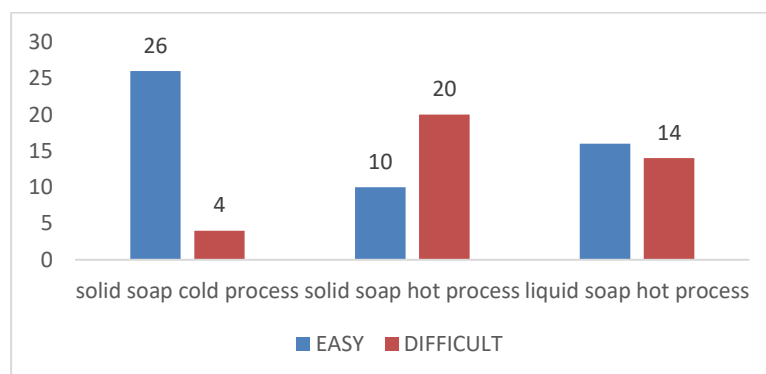


Figure 6. The easy method of making soap made from used cooking oil

The output of this activity that can be measured is the transformation of knowledge, skills, and affection from the service team to students at the Mambaul Hikam Islamic boarding school so that they can form a community of students who can become facilitators who have an understanding of the process of refining waste cooking oil and making soap (see Table 2). Furthermore, the measured outcome is the result of solid and liquid soap produced. From this activity, it is expected that students can improve their entrepreneurial skills and utilize waste cooking oil to preserve the environment. Assistance is still being carried out to this day for the development of the soap-making students community, namely the production of soap that is worthy of being traded by considering the production process, packaging, market research,

calculating economic value, and developing product marketing through online e-commerce. The development of soap products that are worthy of being traded is expected to improve the economy of the Mambaul Hikam Diwek Jombang Islamic Boarding School.

Table 2. Mentoring Success Indicators

No	Criteria	Indicators of Success	Results of Evaluation
1	Student participation	Participants are students who are accompanied by teachers who have experience in making laundry soap from used cooking oil. Participants followed the guidance in an orderly and enthusiastic manner. Participants filled out questionnaires related to process evaluation and post-training	100% of the students explained that they participated in the training on the recommendation of the accompanying teacher. 100% of the students explained that they were enthusiastic and interested in participating in the training as a form of perfecting the understanding of making soap that was suitable for use and trade 100% of students participate in mentoring and fill out questionnaires
2	The process and practice of assisting oil refining and soap making	The process of assisting the refining of used cooking oil and soap making went well so as to produce soap outcomes	75% of the students explained that oil refining using bagasse as an adsorbent was easier to find. However, bagasse as an adsorbent requires sun drying and needs to be pulverized. 85% of students know the steps of making soap correctly. 100% of students can make soap independently if the material has been provided by the companion.
3	Mentoring skills	The achievement of outputs is that students are able to produce soap independently, and the outcome is soap produced by students	92% of students stated that they are willing to practice soap-making independently and in groups 85% of students stated that they were successful in producing soap 92%
4	Soap from the training can be traded and used	Soap from the training can be used for daily needs in the pesantren environment	83% of students explain that the soap they produce is good 17% of students stated that soap still cannot be traded because it needs printing equipment and attractive packaging

Based on Figure 2, it can be observed that the purified used cooking oil appears clearer, and Table 1 shows a decrease in the free fatty acid (FFA) content of the used cooking oil after purification with sugarcane bagasse and orange peel adsorbents. The initial FFA content of 1.6365% decreased to 0.5501% and 0.5116%, respectively. This finding is consistent with the research conducted by Hidayati, (2016) and Yustinah & Hartini (2011) an, which showed that the oil's degradation color improves after purification, and the free fatty acid content decreases when using corn cob charcoal as an adsorbent. The high content of cellulose and hemicellulose in these agricultural waste materials indicates their potential as adsorbents.

Based on the results of the SNI 3532:2016 test, it was determined that the solid bathing soap produced from used cooking oil is suitable for use (Arlofa et al., 2021). The pH values of the soap we produced ranged from 8 to 9, which is in accordance with the SNI standard. Extremely high or low pH values can increase skin absorption and cause irritation and dryness. The pH range of the soap indicates that the saponification reaction has been completed (Agustini & Winarni, 2017; Khuzaimah, 2013). Regarding community service conducted by other researchers with a similar theme, it can be observed that there are slight differences in the materials and compositions used to make soap from used cooking oil (Ginting et al., 2020; Handayani et al., 2021; Hanjarvelianti & Kurniasih, 2020). Based on our laboratory testing, using 100% used cooking oil resulted in less lather. However, in our study, we added 30% coconut oil, which contributed to increased lathering due to the lauric acid present in coconut oil, playing a role in foam formation (Karo, 2011)

CONCLUSION

The implementation of assistance in making laundry soap from waste cooking oil is carried out by providing material understanding and practical experience of each ingredient and refining process of waste cooking oil, and the cold process and hot process methods for making liquid and solid laundry soap. The activities were evaluated using a questionnaire related to the participant's understanding of the material and the mentoring process, where the participant's perception of the ease of applying waste cooking oil at home was positive. The participants of the activity are aware of the benefits of using used cooking oil as laundry soap and the negative effects of disposing of waste cooking oil directly into the environment. They are able to learn and apply the techniques of purifying used cooking oil and creating solid and liquid soap through both hot and cold process methods. Additionally, they have a good understanding of the challenges that come with cleaning waste cooking oil and soap-making and are equipped to overcome these challenges. The study suggests that assistance from experts from universities is needed for processing waste cooking oil and making soap, and the mentoring process is carried out until the process of producing small-scale soap is marketed among themselves

ACKNOWLEDGEMENT

The researcher would like to thank the Institute for Research and Community Service (LP2M) UIN Maulana Malik Ibrahim Malang for the fund UIN Mengabdikan Qoryah Thayyibah DIPA-025.04.2.423812/2022, SK Rektor Universitas Islam Negeri Maulana Malik Ibrahim Malang No. 374, 14 April 2022.

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