

Socialization and training processing cooking oil waste (jelantah) on household scale

Jujun Ratnasari ^{a,1,*}, Lela Mukmilah ^{b,2}, Salsabilla Dwita Putri ^{a,3}, Siti Nurul Hanipah ^{a,4}

^a Biology Department Universitas Muhammadiyah Sukabumi, Jl. R. Syamsudin SH No. 50 Kota Sukabumi 43113, Indonesia

^b Chemistry Department, Universitas Muhammadiyah Sukabumi, Jl. R. Syamsudin SH No. 50 Kota Sukabumi 43113, Indonesia [©] Third

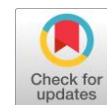
¹ jujun.ratnasari@ummi.ac.id; ² lelathea@ummi.ac.id; ³ salsabila345@ummi.ac.id; ⁴ sitinurulhanipah2004@gmail.com

* Corresponding Author

Received 9 February 2026; accepted 20 February 2026; 28 February 2026

ABSTRACT

Used cooking oil is still widely used by the general public, which can be harmful to health. Otherwise, it is typically disposed of directly into the environment, becoming a hazardous pollutant. This was necessary to provide knowledge about the dangers of used cooking oil to health and to train the community to reduce waste cooking oil pollution in the environment. The outreach provided information on the definition of used cooking oil, its contents, and the negative impacts of using used cooking oil on health. The training was conducted using the PRA method so that the community could directly practice processing used cooking oil for reuse. The effectiveness of the training was measured using questionnaires before and after the activity. The results of the questionnaire showed that more than 80% of participants agreed or strongly agreed with the statement that they really needed training and materials to process used cooking oil. More than 80% agreed and strongly agreed that this outreach and training should be expanded to other communities. Participants were very enthusiastic and have positive responses about recycling used cooking oil that they believed could provide economic benefits and reduce the amount of oil waste dumped into the environment.



KEYWORDS

Jelantah
Aisyiyah
Processing
Used cooking oil
Community empowerment



This is an open-access article under the [CC-BY-SA](https://creativecommons.org/licenses/by-sa/4.0/) license

1. Introduction

Cooking oil represents a fundamental necessity for society. The raw materials for cooking oil production are derived from various plants with high oil content, such as coconut, canola, sesame, olive, corn, and palm oil. Among these, oil palm (*Elaeis guineensis* Jacq) is the most extensively cultivated and processed plant for cooking oil production. Crude palm oil (CPO) is widely produced and consumed due to its lower cost compared to other cooking oils [1]. Nevertheless, for individuals in the lower-middle socioeconomic class, fulfilling cooking oil requirements remains challenging as prices continue to increase. In rural areas, those with access to coconut trees or the means to purchase coconuts may produce keletik cooking oil; however, this process is both time-consuming and costly. Consequently, many individuals reuse cooking oil more than three times.

The repeated use of used cooking oil, commonly known as jelantah, is widely practiced by the public. This is very dangerous. Repeatedly heating cooking oil at high temperatures produces residues from fried ingredients [1]. This causes the oil to contain many free radicals that are potentially carcinogenic (causing cancer), including the formation of oxidizing compounds, peroxides, and free fatty acids [2], [3]. When these compounds accumulate in the body, they can increase oxidative stress and the risk of respiratory and metabolic disorders [3]–[5]. Improper disposal of used cooking oil also contributes to environmental pollution and waste burdens [6]. Therefore, a community-based collection system and management strategy are needed [7]–[9]. Many studies stress transforming used cooking oil into value-added products as a circular economy approach. This includes converting it into biodiesel through various chemical processes [9], [10]. Research shows that fuels derived from used vegetable oil can be evaluated as energy alternatives, focusing on efficiency and combustion characteristics [2], [7], [10], [11].

In addition to the energy sector, the use of used cooking oil is also growing in the materials sector, for example, as an asphalt modification material to improve the performance of road pavement mixtures [12] and as a raw material in the synthesis of vegetable oil-based polymers and polyurethanes [13]. This approach shows that used oil can be diverted from a source of pollution to a source of functional industrial raw materials [8], [13]. Overall, the literature emphasizes the need to limit the reuse of oil for food, raise awareness among food businesses, and strengthen the recycling chain towards the utilization of energy and materials as a sustainable solution [2], [7], [14].

Several studies have been conducted on the purification of used cooking oil using natural and chemical materials that are easily available to the public [15]–[17]. Some of them use activated charcoal or NaOH to absorb free radicals and neutralize free fatty acids [17]. Meanwhile, to remove the aroma, lime/citric acid or silica gel is used. For clarification, bentonite, zeolite, or magnesium silicate is used [17]. However, the results of this research have not been disseminated to the public, and also the publication of articles about the research results has not been widely accessed by the general public from the lower middle class, so they do not know how to practice the processing of used cooking oil, as a result, to save oil they generally use used cooking oil until it becomes black and thick [18]. Therefore, through community service, the results of these studies are disseminated so that they can be useful. This dissemination takes the form of counseling programs and training in refining used cooking oil.

The outreach program can provide information about the dangers of consuming used cooking oil, its negative effects on health, how to store and dispose of it properly, so that the community increases their knowledge and can maintain the health of themselves and their families. Likewise, the community can protect the environment from used oil pollution. The community is also trained how to process used cooking oil so that it can be reused safely. The training is carried out by practicing processing used cooking oil using activated charcoal to absorb harmful compounds in used cooking oil. After removing the harmful compounds, the used cooking oil is clarified with bleaching earth or bentonite, so that it becomes clear and suitable for consumption. Outreach and training to increase the community's knowledge and skills in processing used cooking oil so that it can be reused safely, is one of the community service activities.

The partners who will be the target of training and mentoring are mothers at the Asiyah Jampangtengah branch in Sukabumi Regency. PCA Jampangtengah is a new PCA formed by the PDA of Sukabumi Regency, its members are still enthusiastic about carrying out activities accompanied and guided by the PDA of Sukabumi Regency. PCA Jampangtengah is located in an area quite far from the district capital, so their knowledge is still minimal, especially in processing used cooking oil. Based on the situation analysis, mothers in rural areas still often use used cooking oil for frying, due to economic limitations to always buy and use new oil [18]. Therefore, through this used cooking oil processing training, it is hoped that housewives can at least process their own used cooking oil so that it can be reused.

2. Materials and Method

The training was attended by 26 participants, comprising women from Aisiyah PCA Jampang Tengah, NU Muallimat, and the general public. The participants' professions included housewives, fried food entrepreneurs, teachers, tofu entrepreneurs, and MBG managers. Socialization and training are carried out based on the flow in Fig. 1.

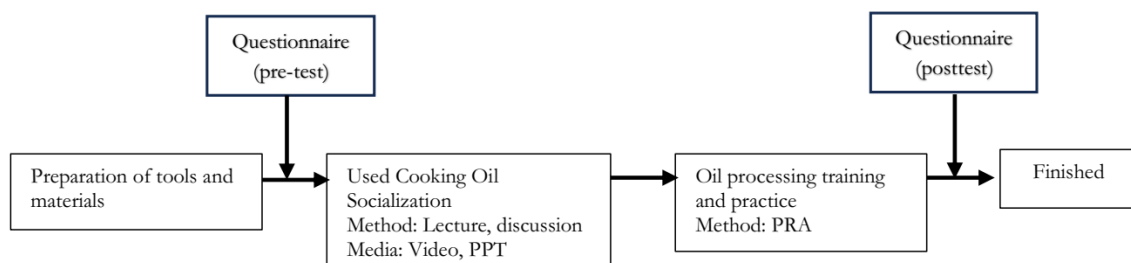


Fig. 1. Socialization and training flow for the used cooking oil processing

The training activities were conducted using the PRA (Participatory Rural Appraisal) method. This method is a community empowerment method that involves the community in the planning and implementation of activities. The participants as our partner play a role in providing used cooking oil and

training facilities, as well as acting as training participants. The effectiveness of socialization and training was measured using a questionnaire instrument before and after the socialization and training. The parameters measured were enthusiasm, activeness, response, and knowledge of participants.

Outreach on the definition of used cooking oil, the compounds that can form in the repeated heating process of oil, and its negative effects on health was carried out using lecture and discussion methods, as well as showing videos on used cooking oil processing.

For the used cooking oil processing training, we use the following tools and materials. The tools used are an aluminum or stainless steel pan larger than the volume of the cooking oil to be processed. Other tools include a cloth for filtering, a stove for heating, and a stirring tool. The materials used are cooking oil collected by housewives from their daily cooking activities. Other ingredients include activated charcoal.

Training on processing used cooking oil to produce reusable cooking oil is as follows: used cooking oil is placed in a large aluminum or stainless steel pan and then heated to a temperature of 80°C. After it is hot, the stove is turned off, and then 20% of the total amount of used cooking oil being processed is put into the oil. Then stir until mixed, after which it is cooled and allowed to settle for at least 3 days. This settling is important so that the activated charcoal particles settle and facilitate filtering. After settling, the used cooking oil is then filtered using a cloth to produce filtrate 1. Filtrate 1 is then reheated to a temperature of 80°C. After it is hot, the stove is turned off, then bentonite or bleaching earth is added to the oil as much as 20% of the total amount of filtrate 1. This mixture is then cooled and settled for at least 3 days. After settling, the oil-bentonite mixture is then filtered using a cloth to produce filtrate 2. Filtrate 2 can be reused for frying. The efficiency of purifying used cooking oil using activated charcoal and bentonite can reach 80-85% of the total amount of used cooking oil processed; the remaining 15-20% is in the form of oil impurities absorbed by activated charcoal and bentonite/bleaching earth. The process flow for processing used cooking oil can be seen in Fig. 2.

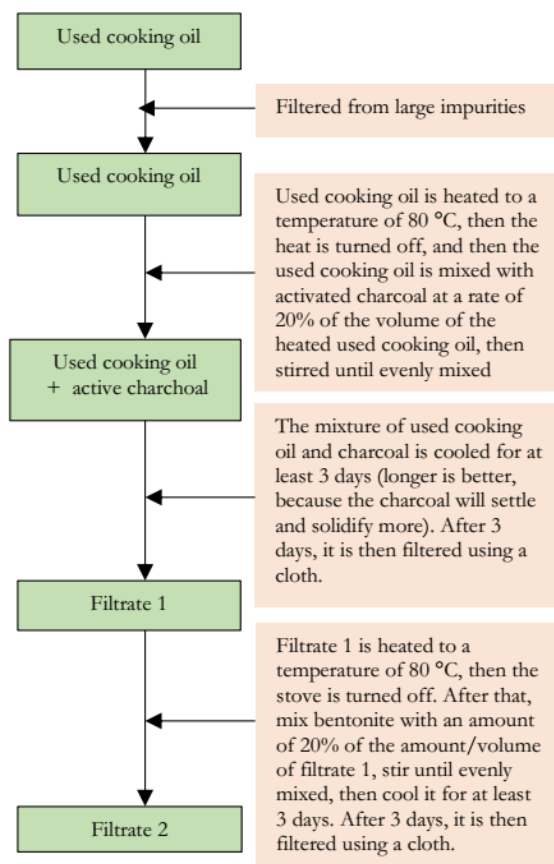


Fig. 2. The process flow for processing used cooking oil can

3. Results and Discussion

This outreach and training program was held at the PCA Aisyiyah Jampang Tengah, Sukabumi Regency. Participants, consisting of women aged between 20 and 65 years from various professional backgrounds, were very responsive to the activities. The event ran smoothly, starting with an outreach session on the definition of used cooking oil, its contents, and the negative impacts of its use. The outreach also covered how to process used cooking oil for reuse (Fig. 3).



Fig. 3. Socialization and training activities on used cooking oil processing with community participants

Based on the questionnaire, participants who agreed (42.31%) and strongly agreed (53.85%) that the training materials were in accordance with the community's needs in managing used cooking oil waste. Participants who agreed and strongly agreed stated that the materials presented by the resource person were easy to understand, clear, and interactive (79.62%), so that participants who agreed and strongly agreed were satisfied because the training could improve participants' knowledge and skills (80.77%). Participants who agreed and strongly agreed with the statement would try to implement the used cooking oil waste processing process at home (80%) (Fig. 4 and Fig. 5).

Socialization and training on processing used cooking oil waste are very necessary because they can increase community empowerment in utilizing waste and maintaining environmental health. Empowerment can increase community participation, skills, and independence in utilizing existing resources, thus resulting in greater community prosperity [19]–[23]. An independent and empowered community will create a physically and spiritually healthy community [19]. They will be able to develop a positive perspective on everything [1], [22], increase knowledge and self-confidence, and become more open-minded in researching various economic, health, environmental, and social problems [23], [24], thereby improving their quality of life [23]. Training provided to the community, organized by community organizations, will be more structured because it can be done routinely, thus facilitating the achievement of independence [24]–[26].

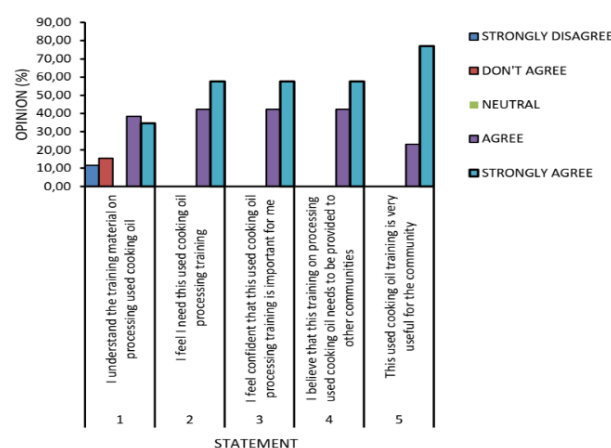


Fig. 4. Participant questionnaire regarding socialization and training activities for used cooking oil processing

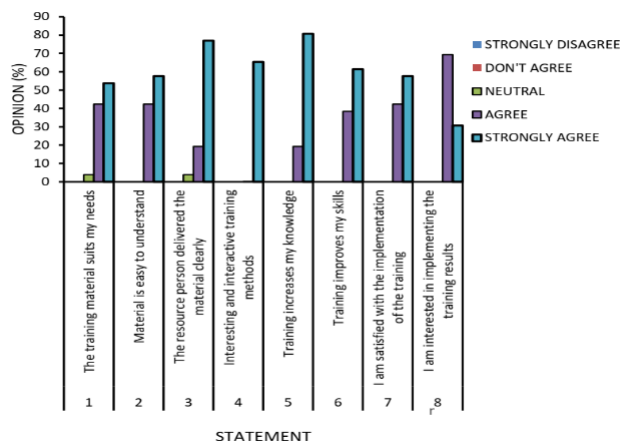


Fig. 5. Results of the participant response questionnaire regarding the material and delivery of the socialization and training material for processing used cooking oil.

Processing used cooking oil is very important because it is an organic waste that is quite difficult to dispose of [18], and if disposed of, it will pollute the environment and take a long time to decompose. Processing used cooking oil has been widely researched and tested using chemicals and natural materials. Processing used cooking oil using absorbent activated charcoal can bind harmful compounds resulting from heating the oil at high temperatures repeatedly. The smaller the particle size of the activated charcoal, the more compounds can be absorbed, especially peroxide compounds [27], [28], so the particle size of the activated charcoal also needs to be considered. This method is carried out with the concept of physics, that activated charcoal can absorb more harmful compounds in used cooking oil compared to ordinary charcoal, because activated charcoal has a larger surface area and more open pores to absorb compounds and are not easily released again. The type and size of activated charcoal, in addition to being able to bind and absorb peroxide compounds and free fatty acids, can also reduce the water content in used cooking oil [28]. Furthermore, the use of bentonite or bleaching earth, in addition to removing harmful compounds that are still present in the oil, can also absorb the color and odor of the oil so that the oil becomes clear [15]–[17] (Fig. 4). Of all the methods used, the most effective, efficient, and easy to do is processing using activated charcoal and bentonite/bleaching earth [16]. charcoal, harmful compounds in used cooking oil are greatly reduced. Furthermore, the use of bentonite or bleaching earth can absorb compounds and colors in used cooking oil, so that the used cooking oil can be clear again [29]–[31] Fig. 4.



Fig 4. Unprocessed (1) Processed used cooking oil(2 &3) and fresh unused cooking oil (4)

4. Conclusion

Participants were very enthusiastic about recycling used cooking oil. They believed that recycling used cooking oil could provide economic benefits and reduce the amount of oil waste dumped into the

environment. The training program received a positive response from participants and should be extended to other community groups.

Acknowledgment

Thank you to Muhammadiyah University of Sukabumi and the RisetMu program for the funding provided. Thank you and appreciation to the Regional Leadership of Aisiyah Sukabumi Regency as a partner in this activity, and the leadership of the Aisiyah Jampang Tengah branch as a target partner for this activity

Declarations

Author contribution. All authors contributed equally to the main contributor to this paper. All authors read and approved the final paper.

Funding statement. This activity was funded by Muhammadiyah University of Sukabumi and the ResearchMu Program.

Conflict of interest. The authors declare that they have no conflict of interest.

Additional information. No additional information is available for this paper.

References

- [1] M. Mulyaningsih and H. Hermawati, "Socialization of the Impact of Used Cooking Oil Waste on Health and the Environment," *J. Penelit. dan Pengabd. Kpd. Masy. UNSIQ*, vol. 10, no. 1, pp. 61–65, 2023, [10.32699/ppkm.v10i1.3666](https://doi.org/10.32699/ppkm.v10i1.3666).
- [2] O. M. Oladunjoye and O. O. Aluko, "The perception of food vendors on the associated effects of used cooking oil in Lagos State, Nigeria," *Int. J. Environ. Health Res.*, vol. 34, no. 12, pp. 4096–4109, Feb. 2024, doi: [10.1080/09603123.2024.2338888](https://doi.org/10.1080/09603123.2024.2338888).
- [3] V. K. Nambiar, V. Mudliar, and I. Salababa, "Analysis of oral cancer carcinogens in repeatedly heated cooking oils," *Heliyon*, vol. 11, no. 2, p. e41858, Feb. 2025, doi: [10.1016/j.heliyon.2025.e41858](https://doi.org/10.1016/j.heliyon.2025.e41858).
- [4] T. Hu *et al.*, "Enhanced removal organic compounds and particles from cooking fume using activated sludge scrubber filled loofah: From performance to the mechanism," *Environ. Res.*, vol. 233, p. 116445, Feb. 2023, doi: [10.1016/j.envres.2023.116445](https://doi.org/10.1016/j.envres.2023.116445).
- [5] N. Jing, K. Liu, L. Long, and L. Zhang, "Effects of Different Cooking Methods on Cd Content and Health Risk Assessment of Cabbage Under Cd Stress," *J. AOAC Int.*, vol. 108, no. 6, pp. 868–875, Feb. 2025, doi: [10.1093/jaoacint/qsaf035](https://doi.org/10.1093/jaoacint/qsaf035).
- [6] D. Singh-ackbarali, R. Maharaj, N. Mohamed, and V. Ramjattan-harry, "Potential of used frying oil in paving material : solution to environmental pollution problem," pp. 12220–12226, 2017, doi: [10.1007/s11356-017-8793-z](https://doi.org/10.1007/s11356-017-8793-z).
- [7] R. Rosmeika *et al.*, "Environmental impact of palm cooking oil: a case study in Sumatra, Indonesia," *Environ. Sci. Pollut. Res.*, vol. 32, no. 43, pp. 24839–24857, Feb. 2025, doi: [10.1007/s11356-025-37056-1](https://doi.org/10.1007/s11356-025-37056-1).
- [8] V. Beghetto, "Strategies for the Transformation of Waste Cooking Oils into High-Value Products: A Critical Review," *Polymers (Basel)*, vol. 17, no. 3, p. 368, Feb. 2025, doi: [10.3390/polym17030368](https://doi.org/10.3390/polym17030368).
- [9] V. Beghetto, "Waste Cooking Oils into High-Value Products: Where Is the Industry Going?," *Polymers (Basel)*, vol. 17, no. 7, p. 887, Feb. 2025, doi: [10.3390/polym17070887](https://doi.org/10.3390/polym17070887).
- [10] E. Getahun and K. Wagaw, "Experimental Investigation and Performance Evaluation of Jatropha Oil-Biodiesel Blending with Kerosene for Domestic Cooking and Lighting Applications," *Sci. World J.*, vol. 2024, no. 1, p. 7758441, Feb. 2024, doi: [10.1155/2024/7758441](https://doi.org/10.1155/2024/7758441).
- [11] M. Bahwan *et al.*, "Exploring the impact of various cooking techniques on the physicochemical and quality characteristics of camel meat product," *Anim. Biosci.*, vol. 36, no. 11, pp. 1747–1756, Feb. 2023, doi: [10.5713/ab.22.0238](https://doi.org/10.5713/ab.22.0238).
- [12] J. Sun, H. Chen, H. Shen, X. Luo, Z. Lin, and H. Zhang, "Optimization of Biodiesel Production from Waste Cooking Oil Using a Construction Industry Waste Cement as a Heterogeneous and Reusable Catalyst," *Nanomaterials*, vol. 16, no. 2, p. 108, Feb. 2026, doi: [10.3390/nano16020108](https://doi.org/10.3390/nano16020108).

- [13] Ź. Ciastowicz, R. Pamuła, and A. Białowiec, "Utilization of Plant Oils for Sustainable Polyurethane Adhesives: A Review," *Materials (Basel)*, vol. 17, no. 8, p. 1738, Feb. 2024, doi: [10.3390/ma17081738](https://doi.org/10.3390/ma17081738).
- [14] N. Bardella, M. Facchin, E. Fabris, M. Baldan, and V. Beghetto, "Waste Cooking Oil as Eco-Friendly Rejuvenator for Reclaimed Asphalt Pavement," *Materials (Basel)*, vol. 17, no. 7, p. 1477, Feb. 2024, doi: [10.3390/ma17071477](https://doi.org/10.3390/ma17071477).
- [15] M. A. Ferdian, R. G. Perdana, and P. P. Rahardjo, "The Purification of Used Cooking Oil by Adsorption Method Using Bagasse," vol. 8, pp. 147–154, 2022, doi: [10.30997/jah.v8i2.4713](https://doi.org/10.30997/jah.v8i2.4713).
- [16] A. K. Tukan, N. Hariyani, and M. A. Ferdian, "Transparan Process Of Purification Of Cooking Oil Using Coffee Waste For The Production Of Transparent Soap," vol. 1, pp. 66–71, 2023. [Online]. Available at: <https://share.google/IHJtW6VHSge8HsHo>.
- [17] N. Febrianti, "Purification of used cooking oil using physical methods using bentonite and activated carbon," vol. 02, pp. 16–23, 2023. [Online]. Available at: <https://share.google/dfug46WaX3mzMLOLw>
- [18] F. Damayanti, T. Supriyatin, and S. P. Biologi, "Utilization of Waste Cooking Oil as an Effort to Increase Public Awareness of the Environment," vol. 5, no. 1, pp. 161–168, 2021. [Online]. Available at: <https://journal.unilak.ac.id/index.php/dinamisia/article/view/4434>.
- [19] N. Syamsi and N. Lalla, "Indonesian Journal of Community Service Education (JPMEI) Community Empowerment in Improving Health Levels," vol. 1, pp. 9–14, 2024, doi: [10.61099/jpmei.v1i1.32](https://doi.org/10.61099/jpmei.v1i1.32).
- [20] W. Ma and Z. Shen, "Impact of community care services on the health of older adults : evidence from China," vol. 1, pp. 1-15, 2000. [Online]. Available at: <https://www.frontiersin.org/journals/public-health/articles/10.3389/fpubh.2023.1160151/full>
- [21] A. M. Nugraha, A. R. Rosyadi, and B. Handrianto, "Village community empowerment education from the perspective of Achmad Nuril Mahyudin," *Tawazun J. Pendidik. Islam*, vol. 16, no. 3, pp. 423–442, 2023, doi: [10.32832/tawazun.v16i3.14677](https://doi.org/10.32832/tawazun.v16i3.14677).
- [22] D. Z. Rahmadani, M. Kamil, and S. Salahudin, "Community Empowerment in Improving the Quality of Slums: A Structured Literature Review," *Mimb. J. Sos. dan Pembang.*, vol. 37, no. 2, pp. 410–418, 2021, doi: [10.29313/mimbar.v37i2.8072](https://doi.org/10.29313/mimbar.v37i2.8072).
- [23] V. Okech, Š. Neszméry, and M. Mačkinová, "Empowering the Marginalized Through Community Work: a Literature Review," *Proc. CBU Soc. Sci.*, vol. 1, pp. 173–178, 2020, doi: [10.12955/pss.v1.67](https://doi.org/10.12955/pss.v1.67).
- [24] S. Suwandi and A. Kurniawan, "The Role of Organizations in Improving Community Skills and Knowledge Through Training and Mentoring," *Triwikrama J. Ilmu Sos.*, vol. 9, no. 4, pp. 51–60, 2025. [Online]. Available at : <https://share.google/5AmywMk2b2GubWGnW>.
- [25] S. L. Musdhalifah, A. I. Setiawan, and R. Dewi, "Community Empowerment Through the Role of Vocational Training Centers in Banjar City," *Tamkin J. Pengemb. Masy. Islam*, vol. 8, no. 2, 2023. [Online]. Available at: <https://share.google/qlBLB1j9Ps8KNanLN>.
- [26] T. Widiastuti, G. M. Widayat, D. Kharisma, E. T. Prasetyani, and D. F. I. Fatkhur, "Community empowerment through online marketing training for MSMEs in Mlatibaru Village, Semarang," *Budimas J. Pengabd. Masy.*, vol. 4, no. 1, pp. 173–180, 2022. [Online]. Available at: <https://doi.org/10.29040/budimas.v4i1.3261>.
- [27] M. N. Afro, T. Ardianto, S. Rahayu, and D. W. Kurniawidi, "Jurnal Biologi Tropis A Purification Process of Wosting Oil Using CaO Adsorbent Based on Blood Shell Shells (Anadara granosa)," 2025. [Online]. Available at: <https://share.google/7GqmTs80XuyzqNEGh>.
- [28] A. Mutiah, A. Hidayat, A. H. Daulay, and E. Jumiati, "The Effect of Adding Activated Carbon from Durian Seeds on the Reduction of Water and Free Fatty Acid Content in Waste Cooking Oil," vol. 9, no. Djaeni 2010, pp. 37–42, 2024, doi: [10.31851/redoks.v9i1.14551](https://doi.org/10.31851/redoks.v9i1.14551).
- [29] R. Perry, F. J. Henry, and D. Bremmer, "Industrially produced trans fat and saturated fat content of food products in Jamaica," *Rev Panam Salud Publica*;47, mar. 2023, vol. 47, p. 1, Feb. 2023, doi: [10.26633/rpsp.2023.45](https://doi.org/10.26633/rpsp.2023.45).
- [30] S. Zhang, X. Shen, L. Zhu, and J. Zhang, "Study on degradation of cooking fume by compound filter material and UV photodegradation," *Environ. Sci. Pollut. Res.*, vol. 30, no. 27, pp. 70649–70660, Feb. 2023, doi: [10.1007/s11356-023-27491-3](https://doi.org/10.1007/s11356-023-27491-3).

- [31] Y. Lv, Z. Ye, Z. Zhang, and Y. Liu, "Effect of free fatty acids with different chain lengths and unsaturation degrees on hazardous compounds in canola oil cooking fumes," *Food Chem.*, vol. 500, p. 147400, Feb. 2025, doi: [10.1016/j.foodchem.2025.147400](https://doi.org/10.1016/j.foodchem.2025.147400).