PROGRESS IN ENGINEERING APPLICATION AND TECHNOLOGY
e-ISSN: 2773-5303

PEAT

Vol. 7 No. 1 (2026) 37-45
https://publisher.uthm.edu.my/periodicals/index.php/peat

Assessing Community Readiness to Convert Waste Cooking Oil (WCO) into Soap in Parit Jelutong, Johor

Nur Athilah Akma Abd Malek[1], Roslinda Ali[1]*, Sumaiyah Mashori[2]

[1] *Department of Civil Engineering Technology/Faculty of Engineering Technology Universiti Tun Hussein Onn Malaysia, Pagoh , 84600, MALAYSIA*
[2] *Department of Electrical Engineering Technology/Faculty of Engineering Technology Universiti Tun Hussein Onn Malaysia, Pagoh, 84600, MALAYSIA*

*Corresponding Author: linda@uthm.edu.my
DOI: https://doi.org/10.30880/peat.2026.07.01.005

Article Info

Received: 12 January 2026
Accepted: 20 February 2026
Available online: 25 May 2026

Keywords

Waste cooking oil (WCO), recycling, soap-making, community readiness, sustainable waste management

Abstract

Improper disposal of waste cooking oil (WCO) remains a significant environmental issue in Malaysia, particularly at the household and community levels, contributing to drainage blockage and environmental pollution. This study aims to assess the readiness of the Parit Jelutong community in Johor to adopt WCO recycling through soap making activities as a sustainable waste management approach. A quantitative research design was employed and implemented in three stages: pre-implementation, implementation, and post-implementation. Data were collected through structured questionnaires from 73 respondents and analyzed using descriptive statistics and Mann–Whitney U tests. The findings revealed that respondents generally demonstrated a high level of awareness regarding the environmental impacts of improper WCO disposal. However, despite this awareness, actual recycling practices remained limited, indicating a noticeable gap between knowledge and behavioral implementation. Statistical analysis showed a significant difference in 3R awareness between student and non-student respondents, suggesting that non-students possessed higher awareness levels, likely due to greater exposure to real life experiences, workplace practices, community programs, and media engagement. In contrast, no statistically significant difference in 3R awareness was observed between male and female respondents, indicating that gender does not play a meaningful role in influencing awareness related to WCO management. Overall, the community showed strong willingness to participate in WCO recycling programs when supported by proper facilities and guidance. It is recommended that continuous training and improved support systems be implemented to encourage long-term adoption of sustainable WCO management practices.

1. Introduction

The improper disposal of waste cooking oil (WCO) has become an increasingly serious environmental issue in Malaysia, largely due to the high consumption of cooking oil and the growing volume of WCO generated by households and food-related activities. Cooking oil is widely used in Malaysian cuisine, particularly for frying, which contributes significantly to the generation of WCO [1]. Malaysia is reported to generate approximately 0.54 million tons of WCO annually [2], with studies showing that about 40% of households produce more than

15 kg of WCO each year [3]. Common disposal practices, such as pouring WCO into sinks or drains, lead to pipe blockages, sewer overflows, and increased maintenance costs [4]. When discharged into water bodies, WCO can severely affect aquatic ecosystems, as one liter of oil can contaminate up to 500,000 liters of water by forming a surface film that restricts oxygen transfer [5].

Although various recycling options for WCO exist, including biodiesel production, oleochemical feedstock, and bio-based products, these large-scale solutions are often costly and technically complex, making them unsuitable for small or semi-rural communities [6]. In contrast, community-based recycling through soap-making offers a simple, low-cost, and environmentally friendly alternative that can be easily adopted at the household or community level [7]. Soap-making from WCO not only reduces environmental pollution but also provides opportunities for income generation among community members [8]. However, despite awareness of the negative impacts of improper WCO disposal, actual recycling practices remain limited due to a lack of understanding and insufficient practical exposure. Practical, hands-on learning has been shown to be more effective than theoretical knowledge alone in promoting behavioral change and sustained participation in environmental initiatives [9]. Therefore, this study aims to evaluate the effectiveness of practical soap-making activities in enhancing awareness and encouraging continuous WCO recycling behavior within the Parit Jelutong community.

1.1 Environmental Sustainability and Waste Management Practices

Research highlights the critical role of environmental knowledge in shaping waste management behaviors. Environmental sustainability refers to the responsible use and management of natural resources to maintain ecological balance and ensure long-term environmental quality for present and future generations [10]. In the context of waste management, environmental sustainability is closely associated with the application of the 3R principles, namely reduce, reuse, and recycle, which aim to minimize waste generation and promote resource recovery [6]. Effective waste management practices, such as source separation, are crucial in reducing environmental pollution and enhancing recycling efficiency. However, studies in Malaysia indicate that public participation in waste segregation remains relatively low due to limited awareness, insufficient facilities, and weak enforcement mechanisms [11].

Sustainable management of WCO aligns with environmental sustainability by recognizing WCO as a recoverable resource rather than merely a waste product. Improper disposal of WCO can lead to water and soil contamination due to its high organic and lipid content, resulting in long-term environmental degradation [12]. Sustainable disposal approaches include organized collection, basic treatment, and conversion of WCO into value-added products such as biodiesel, oleochemical derivatives, and household products, which help reduce pollution and dependence on virgin raw materials [13]. At the community level, small-scale recycling methods such as soap-making are particularly effective because they are low-cost, accessible, and adaptable to local capacities [14]. Thus, sustainable WCO management not only supports responsible waste practices but also encourages community participation, resource efficiency, and long-term environmental protection.

1.2 Community Readiness for Sustainable Practices

Community readiness plays a crucial role in determining the success of sustainable practices, as it reflects the extent to which a community is aware of, motivated to address, and capable of collectively addressing a particular issue. It encompasses factors such as awareness of the problem, perceived importance, leadership support, availability of resources, and social cohesion [15]. A community that demonstrates higher readiness is more likely to support, participate in, and sustain environmental initiatives. The Community Readiness Model (CRM) further emphasizes that communities progress through different stages of readiness, ranging from low awareness to full ownership, and that interventions must be aligned with the community's current stage to be effective [14]. Assessing readiness prior to implementation helps ensure that sustainability programs are realistic, locally relevant, and supported by the community, thereby reducing the risk of failure.

Practical knowledge is a key factor influencing community readiness, particularly when compared to theoretical knowledge. While theoretical knowledge provides a conceptual understanding, practical knowledge gained through hands-on activities enables individuals to apply what they have learned in real-life situations, thereby enhancing their skills, confidence, and problem-solving abilities [16]. Studies have shown that practical, experiential learning is more effective in promoting behavioral change than theory-based instruction alone, especially in environmental and waste management contexts [17]. Community-based workshops and demonstrations, such as soap-making from waste cooking oil, facilitate effective knowledge transfer by actively engaging participants and making learning relevant to their daily lives [8]. Hence, integrating practical knowledge into community programs not only strengthens readiness but also bridges the gap between awareness and action, encouraging long-term adoption of sustainable practices.

2. Methodology

This study aims to assess the readiness of the Parit Jelutong community to recycle waste cooking oil (WCO) into soap through a practical hands-on approach. A quantitative research design was adopted and implemented across three structured phases: pre-implementation, implementation, and post-implementation. The collected data were analyses using descriptive statistics, reliability analysis (Cronbach's alpha), and Mann–Whitney U tests via SPSS, with Microsoft Excel used for data visualization, enabling a systematic evaluation of awareness levels, behavioral changes, and the effectiveness of practical knowledge transfer in promoting sustainable WCO management practices.

2.1 Phase1: Pre-Implementation Phase

The researcher underwent a Training-of-Trainers (ToT) session prior to conducting the soap-making demonstration with the respondents. For this study, the researcher received hands-on training from an expert with over 10 years of experience in producing soap from waste cooking oil (WCO), during which practical techniques, safety measures, optimal processing times, and quality improvement methods were shared. Following the ToT session, a comprehensive preparation phase was conducted to ensure smooth program implementation, including coordination, planning, and resource preparation. SK Jelotong was selected as the program site due to its recognition as the *Ikon Wira Lestari* under the JESAWIL 2024 program and its strong commitment to environmental initiatives. With support from the school and the Parent-Teacher Association, 73 respondents were selected from the school community and the local community. Prior to the demonstration, participants were briefed on the program objectives and prepared the required materials, including WCO and soap-making tools, to ensure the smooth execution of the soap-making demonstration.

2.2 Phase 2: Implementation Phase

The second phase involved the actual execution of the program within the Parit Jelutong community. As the soap-making demonstration was conducted live with full community participation, a team of facilitators was formed to ensure smooth implementation, with each facilitator briefed and trained in advance on their respective roles and responsibilities. The session began with an introductory briefing covering the soap-making process, safety measures, and participants' long-term contributions to the research, followed by a live demonstration that showcased each step of transforming waste cooking oil (WCO) into soap. Participants were actively involved and given hands-on opportunities to practice the techniques under the researcher's guidance. At the end of the session, participants were provided with reference materials, including pamphlets and video demonstrations, to support continued practice during the monitoring period. Monitoring was conducted over a three-month period to assess how well participants applied the acquired knowledge and skills. This process combined online communication platforms such as WhatsApp, Instagram, and telephone calls to facilitate continuous interaction, alongside two physical site visits for direct supervision and on-site guidance.

2.3 Phase 3: Post-Implementation Phase

The final phase of the study focused on collecting feedback and evaluating the overall impact of the program on the participants. Data were collected using a structured survey questionnaire administered in both hardcopy and digital formats to maximize accessibility and response rates. Hardcopy questionnaires were distributed through SK Jelotong to facilitate dissemination among community participants, while digital versions were shared via online platforms for respondents who preferred online access. Participants were given one month to complete and return the questionnaire. To minimize non-response and encourage timely participation, weekly follow-up reminders were conducted throughout the data collection period via a dedicated WhatsApp group involving community representatives, ensuring effective coordination and sustained engagement between the researcher and respondents.

3. Results and Discussion

Data from this study were collected through the distribution of questionnaires to participants within the project area, and the analysis was carried out using the Statistical Package for the Social Sciences (SPSS) and Microsoft Excel.

3.1 Background of the Respondents

Data for this study were gathered from a total of 73 participants. There is no one-size-fits-all solution for determining the optimal sample size in research [18], nevertheless, according to Budiu and Moran (2021), a minimum of 40 respondents is considered sufficient to get a reasonable prediction of the population behavior from one study. Therefore, as a total of 73 responses were obtained, the sample size can be considered sufficiently representative for statistical analysis using SPSS.

The first section of the survey required the demographic profile of the respondents in Parit Jelutong

community. The information obtained such as age group, employment status, and frequency of cooking. The summary of these findings is illustrated in Table 1.

Table 1 *Demographic profile of respondents (n=73)*

Item		Frequency (n)	Percentage (%)
Are you a school student?	Yes	51	69.9
	No	22	30.1
Age	Below 30 years old	53	72.6
	31-40 years old	5	6.8
	41-50 years old	4	5.5
	51-60 years old	3	4.1
	61 years old and above	8	11.0
Gender	Male	24	32.9
	Female	49	67.1
Employment status	Unemployed / Retired	55	75.3
	Homemaker	7	9.6
	Government sector	7	9.6
	Private sector	1	1.4
	Self-employed	3	4.1
Frequency of cooking at home	Never	12	16.4
	Rarely (1-2 times in a week)	30	41.1
	Sometimes (3-4 times in a week)	13	17.8
	Often (5-6 times in a week)	9	12.3
	Always (more than 6 times in a week)	9	12.3
WCO disposal method	Pouring into the sink	18	24.7
	Pouring in the drain	7	9.6
	Dispose in the trash with other wastes	4	5.5
	Dumping on the ground	9	12.3
	Collect and send to a recycling center	32	43.8
	Keep and reuse the cooking oil	1	1.4
	Making soap	2	2.7
Did u attend the demonstration program?	Yes	39	53.4
	No	34	46.6

Based on Table 1, the respondent profile was largely dominated by school students, who accounted for 69.9% of the total sample, while non-students respondents made up 30.1%. This distribution reflects the strong involvement of the school community through SK Jelotong, which served as an entry point for community engagement. In terms of age, the majority of respondents were below 30 years old (72.6%), followed by a smaller proportion of respondents aged 61 years and above (11.0%). This suggests that the study captured perspectives from both younger individuals and older community members, allowing for a broader understanding of awareness and behavior across different age groups. Female respondents formed the majority at 67.1%, compared to 32.9% male respondents, indicating higher participation among women, who are often more involved in household activities related to cooking and waste management.

Regarding employment status, the overall distribution was influenced by the high proportion of student respondents. Among the 55 respondents categorized as students or not working/retired, only four individuals were unemployed or retired, while homemakers and government sector employees each accounted for seven respondents (12.7%). The graphical output is presented in Fig. 2. In terms of cooking frequency, a considerable proportion of respondents reported cooking at home either rarely or sometimes, indicating regular interaction with cooking oil and potential WCO generation. Collectively, these findings demonstrate that the respondents are largely representative of household-level WCO generators, making them a relevant target group for assessing awareness, disposal practices, and readiness to adopt sustainable WCO recycling methods within the Parit Jelutong community.

Progress in Engineering Application and Technology Vol. 7 No. 1 (2026) p. 37-45

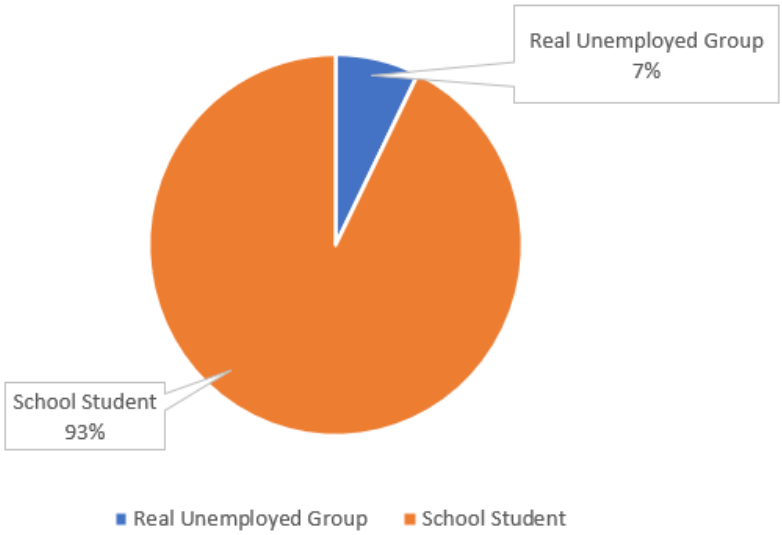

Fig. 1 *Proportion of Umemployment Respondents*

3.2 Awareness Level on Waste Cooking Oil Management

Descriptive statistical analysis was conducted to examine respondents' awareness levels regarding waste cooking oil (WCO) management using a five-point Likert scale, where higher mean scores indicate higher levels of awareness. Prior to analysis, four negatively worded items were recoded to ensure consistency in interpretation, such that higher scores uniformly reflected higher awareness. The descriptive statistics for all items are presented in Table 2.

Table 2 *Demographic profile of respondents (n=73)*

Statement	N	Minimum	Maximum	Mean	Std. Deviation
It is the responsibility of the authorities to provide WCO collection facilities in residential areas.	73	1	5	3.26	1.270
It is the responsibility of every individual to dispose of WCO properly.	73	1	5	4.08	0.846
I agree that training or workshops related to WCO management should be implemented to raise community awareness.	73	1	5	4.15	1.009
I am willing to participate in WCO recycling programs if the facilities are provided.	73	1	5	4.04	0.934
I believe that the use of social media can help increase awareness about recycling WCO.	73	1	5	4.11	0.921
I am aware that disposing of WCO into the sink can pollute the environment and the drainage system.	73	1	5	4.23	0.936
I know that WCO can be recycled into products, such as soap and candles.	73	1	5	4.12	1.142
I believe that WCO still has	73	1	5	4.21	0.999

value if managed properly.					
I believe that the community still has limited exposure to WCO recycling.	73	1	5	4.05	0.864
I will encourage my family and friends to avoid disposing of WCO carelessly.	73	1	5	4.21	0.912
I am willing to pay a reasonable fee to participate in a WCO recycling workshop.	73	1	5	3.12	1.117
I believe that unplanned management of WCO does not cause negative effects on the environment and human health.	73	1	5	3.10	1.483
I have never recycled WCO.	73	1	5	3.14	1.182
I feel that recycling WCO is something difficult to do.	73	1	5	3.27	1.121
I am not sure about the correct way to store or recycle WCO at home.	73	1	5	2.99	1.047

The findings indicate a high level of awareness among respondents regarding the environmental impacts and proper management of waste cooking oil (WCO), as evidenced by mean scores exceeding 4.00 for most items. Respondents strongly agreed that improper disposal of WCO, such as discharging it into sinks, can cause environmental pollution and drainage blockage (M = 4.23, SD = 0.936). They also recognized the residual value of used cooking oil when managed appropriately (M = 4.21, SD = 0.999) and expressed a willingness to promote proper disposal practices among family members and peers (M = 4.21, SD = 0.912). High awareness was further reflected in their knowledge of recycling possibilities, including repurposing WCO into products such as soap or candles (M = 4.12, SD = 1.142). In addition, respondents showed strong support for awareness-enhancing strategies, such as educational programs or workshops (M = 4.15, SD = 1.009) and the use of social media as an information dissemination platform (M = 4.11, SD = 0.921).

In contrast, items related to financial commitment and practical constraints recorded comparatively moderate mean scores. Respondents' willingness to pay a reasonable fee to participate in WCO recycling workshops was moderate (M = 3.12, SD = 1.117). Furthermore, after recoding, statements associated with uncertainty, perceived difficulty, or lack of confidence in practising WCO recycling yielded mean scores ranging from approximately 3.00 to 3.27. These results indicate that although respondents demonstrate strong awareness and positive attitudes towards WCO management, practical and financial barriers may hinder actual participation.

3.2.1 Reliability Test

Reliability analysis was conducted to evaluate the internal consistency of the questionnaire items used to measure respondents' awareness of used cooking oil (WCO) management. The 15-item awareness scale yielded a Cronbach's alpha coefficient of 0.733, indicating a satisfactory level of internal consistency, as presented in Table 3. According to Arof et al. (2018), a Cronbach's alpha value of 0.70 or higher is considered acceptable for social science research, suggesting that the scale is reliable. Therefore, the results suggest that all items reliably measure the intended construct and are suitable for use in subsequent analyses.

Table 3 *Reliability Analysis*

Cronbach's Alpha	N of items
0.733	15

3.3 Comparison between the Respondents' Background and Awareness Level on WCO Management

In this section, the comparison between the background of respondents and their awareness level regarding waste cooking oil (WCO) management was analyzed using the Mann–Whitney U test. The result is presented in

Progress in Engineering Application and Technology Vol. 7 No. 1 (2026) p. 37-45

Table 4. The result showed a statistically significant difference between the two groups ($Z = -2.300$, $p = 0.021$). Since the p-value is lower than the 0.05 significance level, the null hypothesis is rejected, indicating that both groups reported different levels of 3R awareness. This finding suggests that non-school students may have greater exposure to environmental information through real-life experiences, workplace practices, community programs, or media platforms [21]. In contrast, school students may rely primarily on formal education, where opportunities for practical application and long-term exposure to 3R practices are relatively limited.

Table 4 *Comparison of Awareness Levels by Respondents' Status using the Mann-Whitney U Test*

Ranks				
Grouping Variable	Variable	N	Mean Rank	Sum of Ranks
Are you a school student?	Yes	51	33.25	1696.00
	No	22	45.68	1005.00
Test Statistics				
Mann-Whitney U	Wilcoxon W		Z	Asymp. Sig. (2-tailed)
370.00	1696.00		-2.300	0.021

Apart from the respondents' status, the remaining four demographic factors, which are gender, participation in the demonstration program, willingness to produce soap from WCO, and willingness to teach soap-making from WCO, examined in this study did not exhibit statistically significant differences in awareness levels. This suggests that variations in these factors did not have a significant impact on the study outcomes. The non-significant findings suggest that respondents across these demographic groups had relatively similar levels of knowledge, attitudes, or practices regarding the study subject. Hence, these demographic factors were not identified as strong determinants in influencing awareness or readiness toward sustainable WCO recycling practices.

3.4 Feedback on the Program

In this section, only respondents who attended the demonstration programme were invited to provide feedback on its implementation. A total of three open-ended questions were administered. Based on Table 1, 34 respondents participated in the demonstration programme, and the analysis therefore focuses exclusively on feedback from these participants.

For the first question, the respondents were asked to state the benefits of the program. Most respondents (22, 30.1%) reported gaining knowledge of soap-making, while 14 respondents (19.2%) highlighted that they were able to recycle WCO, demonstrating that the program effectively raised both practical skills and environmental awareness. Only a small portion (3.1%) felt that the program was not relevant to them, indicating that the majority of participants found the activities to be relevant and beneficial. The result is presented in Table 5.

Table 5 *The benefits of Attending the Program*

Items		Frequency (n)	Percentage (%)
Benefits of the program	Able to recycle WCO	14	19.2
	Gained knowledge of soap-making	22	30.1
	Not related	3	4.1

Despite these benefits, the second question explored the weaknesses in the program's execution. Referring to Table 6, a total of 12 respondents (16.4%) felt that certain aspects of the program were not related to them, suggesting that some content may not have been applicable to all participants. Other challenges included the difficulty of producing soap (7, 9.6%), students lacking skills in soap-making (5, 6.8%), and limited time to complete the activities (5, 6.8%). Additionally, participants mentioned a lack of explanation (4, 5.5%), unsafe conditions (3, 4.1%), no fragrance in the soap (2, 2.7%), and insufficient materials (1, 1.4%), highlighting areas where the program could improve in terms of guidance, safety, resources, and engagement.

Table 6 *Identified Weaknesses of the Demonstration Program*

Items		Frequency (n)	Percentage (%)
Weaknesses of the program	No fragrance	2	2.7
	Students are not skilled in soap-making	5	6.8
	Soap is difficult to produce	7	9.6
	Insufficient materials	1	1.4
	Unsafe conditions	3	4.1
	Limited time	5	6.8
	Lack of explanation	4	5.5
	Not related	12	16.4

In the third question, respondents were also required to provide some suggestions for improving the program. The most frequent recommendation was to expand the implementation of the program (19, 26.0%), followed by focusing soap-making on crafts (3, 4.1%), extending the program duration (3, 4.1%), providing program materials (2, 2.7%), and enhancing safety (1, 1.4%). Additionally, 11 respondents (15.1%) felt that the suggestions were not related to them, indicating that some participants were already satisfied or unaffected by these proposed changes. Collectively, these insights suggest that while the program was effective in promoting knowledge and environmental practices, improvements in time allocation, instructional clarity, resources, and safety measures could enhance participant experience and engagement. The findings are shown in Table 7.

Table 7 *Suggestions for Improving Future Program Implementation*

Items		Frequency (n)	Percentage (%)
Suggestions for improvement	Focus soap-making on crafts	3	4.1
	Expand the implementation of the program	19	26.0
	Provide program materials	2	2.7
	Enhance safety	1	1.4
	Extend the program duration	3	4.1

4. Conclusion

In summary, this study successfully assessed he readiness of the Parit Jelutong community in Johor to recycle waste cooking oil (WCO) into soap as a sustainable waste management practice. Using a quantitative approach supported by descriptive analysis, reliability testing, and Mann–Whitney U tests, the findings indicate that respondents generally demonstrated good awareness of the environmental and health impacts of improper WCO disposal and showed positive attitudes toward sustainable WCO management. Statistically significant differences in awareness were observed between student and non-student respondents, as well as between working and non-working groups. Non-students and working respondents exhibited higher awareness levels, likely due to greater exposure to real-life environmental practices. In contrast, gender did not significantly influence awareness levels. Importantly, respondents expressed strong support for practical, hands-on interventions, and the soap-making demonstration proved effective in translating awareness into actionable behavior. Overall, the findings suggest that the Parit Jelutong community demonstrates a positive level of readiness to adopt WCO recycling through soap-making initiatives. Future research should involve larger samples, integrate qualitative methods to capture deeper community perspectives, and conduct long-term evaluations to assess the sustainability of behavioral change.

Acknowledgement

This author would like to thank the Faculty of Engineering Technology at Universiti Tun Hussein Onn Malaysia for providing the necessary resources and facilities used for the progression of this study. This study could not have been completed without the invaluable guidance and unwavering support of project supervisor, to whom extend the deepest appreciation, along with heartfelt thanks to everyone who kindly contributed to the success of this research.

Conflict of Interest

Authors declare that there is no conflict of interests regarding the publication of the paper.

References

[1] Arifin, A. S., Johari, S., & Mohamad, N. (2024). Oil to Earth: Raising Consciousness on Used Cooking Oil Recycling in Shah Alam. *Conference on Community Engagement Project*, *4*(1).

[2] Suzihaque, M.U.H., Alwi, H., Ibrahim, U. K., Abdullah, S., & Haron, N. (2022). Biodiesel production from waste cooking oil: A brief review. *Materials Today: Proceedings*, *63*.

[3] Kamilah, H., Sudesh, K., & Yang, T. (2013). The Management of Waste Cooking Oil: A Preliminary Survey. *Health and the Environment Journal*, *4*(1).

[4] Olu-Arotiowa, O. A., Odesanmi, A. A., Adedotun, B. K., Ajibade, O. A., Olasesan, I. P., Odofin, O. L., & Abass, A. O. (2022). Review On Environmental Impact And Valourization Of Waste Cooking Oil. *Lautech Journal of Engineering and Technology*, *16*(1).

[5] Panadare, D. C., & Rathod, V. K. (2015). Applications of Waste Cooking Oil Other Than Biodiesel: A Review. *Journal of Chemical Engineering*, *12*(3).

[6] Foo, W. H., Ning Koay, S. S., Chia, S. R., Chia, W. Y., Tang, D. Y. Y., Nomanbhay, S., & Chew, K. W. (2022). Recent advances in the conversion of waste cooking oil into value-added products: A review. *Fuel*, *324*.

[7] Kamarul Azme, S. N., Mohd Yusoff, N. S. I., Chin, L. Y., Mohd, Y., Dol Hamid, R., Jalil, M. N., Mohd Zaki, H., Saleh, S. H., Ahmat, N., Abdul Manan, M. A. F., Yury, N., Firdaus Hum, N. N., Abd Latif, F., & Mohd Zain, Z. (2023). Recycling waste cooking oil into soap: Knowledge transfer through community service learning. *Cleaner Waste Systems*, *4*.

[8] Medhiatika, N. L. M. V. (2021). Making Soap From Waste Cooking Oil As A Creative Product And Behavioral Change In Housing Area. *Community Empowerment In Tourism & Creative Economy*, *3*(1).

[9] Pickering, G. J., Pickering, H. M.G., Northcotte, A., & Habermebl, C. (2020). Participation in residential organic waste diversion programs: Motivators and optimizing educational messaging. *Resources, Conservation & Recycling*, *158*(0). https://doi.org/10.1016/j.resconrec.2020.104807

[10] S, D. A., A., V., Todi, S., & Akanksha, P. (2023). A Study on Environmental Sustainability- Growth, Trends and Concerns. *International Journal for Multidisciplinary Research (IJFMR)*, *5*(2).

[11] Mat Daud, M. S., Ngadiman, N. I., & Suliman, M. S. (2020). The Awareness Of Recycling The Used Of Cooking Oil. *Journal of Critical Reviews*, *7*(8). http://dx.doi.org/10.31838/jcr.07.08.06

[12] Mokhsin, M., Harun, A. F., Abu Bakar, M. B., Abdullah, F. B., & Japar, A. E. B. (2020). The Conceptual Idea Of Recycling Used Cooking Oil Mobile Application: A Recommendation For Environment Sustainability. *Borneo Akademika*, *4*, 9-18.

[13] Feo, G. D., Domenico, A. D., Ferrara, C., Abate, S., & Osseo, L. S. (2020). Evolution ofWaste Cooking Oil Collection in an Area with Long-Standing Waste Management Problems. *Sustainability*, *12*.

[14] Subri, U. S., Ghani, N. M., Mastam, N. M., Zakaria, A. F., Mustafa, M. S. S., Muhammad, A. A., & Damanhuri. (2024). Sustainable solutions for household waste management: Transforming UCO into soap in local communities. *Multidisciplinary Reviews*, *8*. https://doi.org/10.31893/multirev.2025196

[15] Edwards, R. W., Jumper-Thurman, P., Plested, B. A., Oetting, E. R., & Swanson, L. (2000). Community readiness: Research to practice. *Journal of Community Psychology*, *28*(3). https://doi.org/10.1002/(SICI)1520-6629(200005)28:3<291::AID-JCOP5>3.0.CO;2-9

[16] Putri, D., Supriatna, A., & Rahmawati, T. (2024). Soap Making Projectfrom Waste Cooking Oil for High School Students' Chemistry Learning: QualitativeContent Analysis. *Jurnal Penelitian Pendidikan IPA*, *10*(6).

[17] Paghasian, M. C. (2017). Awareness and Practices on Solid Waste Management among College Students in Mindanao State University Maigo School of Arts and Trades. *Advances in Social Science, Education and Humanities Research*, *128*.

[18] Memon, M. A., Ting, H., Cheah, J.-H., Thurasamy, R., Chuah, F., & Cham, T. H. (2020). Sample Size For Survey Research: Review And Recommendations. *Journal of Applied Structural Equation Modeling*, *4*(2). eISSN: 2590-4221

[19] Budiu, R., & Moran, K. (2021). How Many Participants for Quantitative Usability Studies: A Summary of Sample-Size Recommendations. *NN/g*, *0*(0). https://www.nngroup.com/articles/summary-quant-sample-sizes/

[20] Arof, K. Z. m., Ismail, S., & Saleh, A. L. (2018). Contractor's Performance Appraisal System in the Malaysian Construction Industry: Current Practice, Perception and Understanding. *International Journal of Engineering & Technology*, *7*(3.9), 46-51.

[21] Anua, S. M., Khairul Anwar, N. N., Zain, N. M., Abd Rahman, W. N. W., Hamzah, N. A., & Rahman, H. A. (2022). Reduce, Reuse and Recycle (3r) Awareness Programme to Increase the Knowledge, Attitude and Practice on 3r among Primary School Students. *International Journal of Academic Research in Business and Social Sciences*, *12*(13), 62-74. http://dx.doi.org/10.6007/IJARBSS/v12-i13/14144