Journal of Tourism, Hospitality and Environment Management
JTHEM
EISSN: 0128-178X
Volume 9 Issue 36 (June 2024) PP. 102-109
DOI 10/35631/JTHEM.936008

JOURNAL OF TOURISM, HOSPITALITY AND ENVIRONMENT MANAGEMENT (JTHEM)
www.jthem.com

RECYCLING DOMESTIC COOKING OIL (DCO) INTO SOAP: KNOWLEDGE TRANSFER THROUGH COMMUNITY SERVICE LEARNING IN PERLIS

Nur Firdaus Abdul Rashid[1*], Abdul Hapes Mohamed[2], Noraini Ismail[3], Eliy Nazira Mat Nazir[4], Mimi Diana Ghazali[5], Nurul Fatihah Abd Latip[6], Mohd Akmal Hashim[7]

[1] Faculty of Plantation and Agrotechnology, Universiti Teknologi MARA Perlis Branch, Arau, Perlis, Malaysia
Email: nurfirdaus@uitm.edu.my
[2] College of Computing, Informatics and Mathematics, Universiti Teknologi MARA Perlis Branch, Arau, Perlis, Malaysia
Email: hapes@uitm.edu.my
[3] Academy of Contemporary Islamic Studies, Universiti Teknologi MARA Perlis Branch, Arau, Perlis, Malaysia
Email: noraini045@uitm.edu.my
[4] Faculty of Business and Management, Universiti Teknologi MARA Perlis Branch, Arau, Perlis, Malaysia
Email: eliy083@uitm.edu.my
[5] College of Built Environment, Universiti Teknologi MARA Perlis Branch, Arau, Perlis, Malaysia
Email: mimidiana@uitm.edu.my
[6] Faculty of Plantation and Agrotechnology, Universiti Teknologi MARA Perlis Branch, Arau, Perlis, Malaysia
Email: nurulfatihahabdlatip@uitm.edu.my
[7] Faculty of Applied Sciences, Universiti Teknologi MARA Perlis Branch, Arau, Perlis, Malaysia
Email: akmalhashim@uitm.edu.my
[*] Corresponding Author

Article Info:

Article history:
Received date: 18.04.2024
Revised date: 13.05.2024
Accepted date: 15.06.2024
Published date: 30.06.2024

To cite this document:

Rashid, N. F. A., Mohamed, A. H., Ismail, N., Nazir, E. N. M., Ghazali, M. D., Latip, N. F. A., & Hashim, M. A. (2024). Recycling Domestic Cooking Oil (DCO) Into Soap: Knowledge Transfer Through

Abstract:

Malaysia generates a significant amount of waste from domestic cooking oil (DCO), which can be used as a raw material for soap production. This study examines the functionality of soap made from household cooking oil in Perlis, Malaysia. The community project provides awareness, exposure, and training to 30 participants of Sekolah Menengah Sains Syed Putra, Kangar to recycle used DCO into soap production at their homes or business premises. The approach includes identifying communities and training locations, developing training modules, preparing teaching and demonstration workshops, interactive training, monitoring, and impact studies. Soap optimizations are carried out in the lab to suit the community's knowledge background and at-home facilities. The aims of this study are to examine and create organic soap using a combination of leftover household cooking oil, decorative plants, medicinal plants, and food plants. An operating temperature of 60°C and a moisture content of 4% are the optimal conditions for degumming. The optimal decolorizing agent is activated kaolinite clay, DCO, with a ratio of 100:5 of

Journal of Tourism, Hospitality and Environment Management
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EISSN: 0128-178X
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Community Service Learning In Perlis. *Journal of Tourism Hospitality and Environment Management, 9* (36), 102-109.

DOI: 10.35631/JTHEM.936008.

activated clay to DCO, at a temperature of 60℃ for a treatment time of 30 minutes. The most efficient technique for saponification involves using a mass ratio of 0.3:1 between sodium bicarbonates and DCO, and maintaining a saponification temperature of 70℃. The end products consist of two distinct varieties of soaps that have the potential to produce revenue for the local community.

Keywords:

Domestic Cooking Oil, Soap, Waste Management, Community, Knowledge Transfer

Introduction

The proper management of domestic cooking oil (DCO) presents a substantial environmental dilemma due to its capacity to obstruct sewage systems, pollute water sources, and endanger wildlife. Although there have been advancements in creating different methods for the appropriate disposal of cooking oil, a significant number of homes still choose to pour it down the drain or throw it in the trash, resulting in detrimental effects on the environment. This issue is exacerbated by the widespread use of domestic cooking oil, especially in underdeveloped nations where it is a fundamental component of many meals. Hence, it is imperative to develop efficient and enduring measures to tackle the ecological repercussions of disposing home cooking oil. Converting household waste cooking oil into organic goods through recycling can help safeguard the environment, namely by preserving the cleanliness of water supplies. The existence of remaining hydrophobic cooking oil produces oil droplets that might be detrimental to soil microbes and aquatic species. This study seeks to create an organic and antibacterial soap using residual cooking oil and substances with strong antioxidant properties. In the present day, as the need for cooking oil continues to rise, the amount of waste is also increasing. Discharging cooking oil residues into water bodies leads to contamination of the flora and fauna. The oil floats on the surface, preventing oxygenation and sunlight penetration, which in turn suffocates photosynthesis. This ultimately results in the death of aquatic animals and plants (Okafor, 2011; Omodanisi et al., 2011). A mere 1L spill of old oil has the potential to contaminate up to one million liters of pristine fresh water.

The study methodology was segmented into five distinct sections. Phase 1 involves the gathering and re-evaluation of discarded household cooking oil. Phase 2 involves identifying ornamental plants, herbs, and edible plants that are well-suited for integration with mixes, bentonite clay, and waste domestic cooking oil. In Phase 3, we generated use-safe cold process soap by subjecting the oil to a saponification reaction, which separated it into butyric acid and glycerol. This was followed by a solidification reaction and a curing procedure to neutralize the alkali. Phase 4: The hydrolysis of cold process soap in boiling water often results in the formation of liquid organic soap. Phase 5: Promoting and gathering testimonials. The last stage was sharing knowledge with B-40 regarding product development and marketing. The study approach was predicted to be adequate in producing organic hygienic care products that are eco-friendly, retain skin moisture, possess antibacterial properties, and are projected to be a feasible substitute for non-biodegradable synthetic soaps. Moreover, it is anticipated that the communities will reap the benefits of the information acquired as a result of the study's findings.

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Literature

Recycling waste cooking oil is increasingly being considered as a practical solution for addressing environmental and ecological issues (Singh-Ackbarali et al., 2017; Sanaguano et al., 2017). Moreover, the recycling of waste cooking oil would not only benefit the environment but also generate income for the community through the production of eco-friendly products.The utilization of spent oil for soap production significantly enhances the economic development of local communities in Indonesia (Septiowati et al., 2019). The research conducted by Kusumaningtyas & Qudus (2019) demonstrates that the production of this soap has contributed to the enhancement of the local economy in Sekaran Village, Gunungpati District, Semarang, Indonesia. The successful production of this initiative was initiated by the villagers' heightened awareness of the need to preserve the environment in light of the increasing accumulation of cooking oil waste. In a study conducted by Septiowati et al. (2019), it was discovered that housewives in Bambu Apus Pamulang, Indonesia actively engage in the manufacturing of used oil as a means to enhance their family economy. In addition, the research conducted by Susanti & Priamsari (2019) examined the production process of this soap specifically in the Sidorejo region of Semarang Regency, Indonesia. The soap generated from waste cooking oil demonstrated excellent quality and conformed to the criteria for commercial soap, as stated by Al-Qodah et al. (2008). The utilization of response surface methodology in the production of soap from waste oils and fats revealed that waste cooking oil is a viable raw material for soap production. It was determined that the most favorable conditions for soap production can be attained by combining waste cooking oil with other waste oils and fats (Hamedi et al., 2013). The study conducted by Al-Shannag et al. (2015) demonstrated the successful synthesis of soap using spent bleaching earth and waste cooking oil as raw materials. The soap obtained from this process exhibited high quality and complied with the standards required for commercial soap. This study examined the utilization of spent bleaching earth and waste cooking oil for the creation of soap from used cooking oil. The soap created from these materials was found to have comparable quality and fatty acid composition to commercial soap. Additionally, it was determined that this soap could be manufactured at a reduced cost compared to commercial soap (Jafari et al., 2019).

Materials and Methods

Perlis has been chosen for the area of the study because it is Malaysia's smallest province, situated on the northern tip of Peninsular Malaysia's west coast. There are only two districts in Perlis which are Arau and Kangar. Specifically, Arau has been chosen in this study as most Malays live in Arau with a medium population density. There are three institutions in Arau (Universiti Teknologi MARA Perlis, Kolej Vokasional Arau, and MRSM Arau) that make Arau a strategic location to spread awareness about recycling domestic cooking oil (DCO) among the community. The total municipal waste contribution (including domestic cooking oil) by Perlis is 200 tonnes per month (SwCorp, 2020). For a small state like Perlis, it is a huge problem. Recycling domestic cooking oil as a side income can help the communities to increase their income as well. This study used a dataset which is a questionnaire paper from respondents. A total of 60 respondents from the School teacher, staff and student staff was measured and calculated by following the rule of Krejcie & Morgan (1970). The questionnaire was distributed by Google form and hand-to-hand answers.

The soap preparation was conducted at the Sekolah Menengah Sains Syed Putra, Kangar, Perlis, Malaysia.

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Soap Preparation

The bar soap was prepared by using domestic cooking oil (DCO), water, lemon, sodium hydroxide, and fragrance as shown in Figure 1. A total of 1000ml of domestic cooking oil was first filtered to separate the unwanted leftovers. A ratio of 1:3 of sodium hydroxide and lemon extract were mixed and stirred until all the sodium hydroxide dissolved. The mixture of these two ingredients produced a hot mixture and was then left until it became cold. Then, this mixture was stirred for 5 seconds together with DCO by using a hand mixer until it became sticky. 2.5ml of fragrance was then put in and stirred by using a spatula. Lastly, put the sticky mixture into the container and leave for 4 weeks.

(a) *(b)* *(c)* *(d)* *(e)*

Figure 1: Preparation Of Bar Soap a) Domestic Cooking Oil Was Filtered b) Lemon Was Squeezed c) Lemon And Sodium Hydroxide Were Then Mixed d) Put The Mixture Of Lemon And Sodium Hydroxide Into DCO And Stirred By Using A Hand Blender e) Put In A Teaspoon Of Dye And Stir And Lastly Put The Sticky Mixture Into A Container And Leave For 4 Weeks.

The liquid soap was prepared by using bar soap, hot water, and vinegar as shown in Figure 2. A total of 50g of the bar soap was shredded and mixed with 300ml of hot water. The mixture was then stirred until all the bar soap was dissolved. 15ml of vinegar were then mixed into the mixture and continued to stir. Lastly, the liquid was then put into a container.

(a) *(b)*

Figure 2: Preparation Of Liquid Soap a) Shredded Soap Was Mixed With Hot Water And Stirred b) Put The Liquid Into A Container.

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Training Module With Target Group

The selection of the target group communities was done in Sekolah Menengah Sains Tuanku Syed Putra, Kangar Perlis. A team consisted of six Communicare members and a total of 30 students ranging from Form 1 to Form 4 students was established. The training module included teaching materials in the form of printed brochures, PowerPoint slides, in-person demonstration materials, and promotional materials. Following that, training sessions were held in a Science Laboratory.

Results and Discussion

As a result this study initially examined the physical state of cooking oil. The production of soaps with distinctive qualities requires a meticulous choice of oil varieties. The selection factors for choosing oil for soap manufacture, whether for commercial or domestic use, include the presence of natural aroma and color, as well as the effectiveness, impact on the skin, and the quality of the final product (Araújo et al., 2013; Okoye et al., 1999). The quality factors to be evaluated include the overall appearance (including soap density, luminosity, and abrasiveness), excellent solubility, strong foaming ability, stability, high cleaning power, and resistance to rancidity, effectiveness in soft water, and good stability in terms of color. According to the literature, variations in oil and fat result in a soap that possesses distinct characteristics, such as color, foaming consistency, and cleaning efficacy (Ahmad, 1981).

Evaluate the readability of various soap varieties to determine the level of satisfaction. The data was validated using the reliability test in the SPSS software to determine the level of satisfaction for all varieties of soap in Arau, Perlis. The reliability test was employed to assess the internal consistency and validity of each scale (Jangra et al., 2021). This is because the procedure aims to identify the data that has been processed as good data, ensuring the accuracy of the resulting output. The table below presents the range of values for Cronbach's alpha, as reported by Zach (2021). The data gathered shows a high level of general consistency, as indicated by a Cronbach Alpha reliability coefficient of 0.904 for 25 indicators. Given that the value of the test exceeds 0.6, it indicates that the data is in a favorable condition.

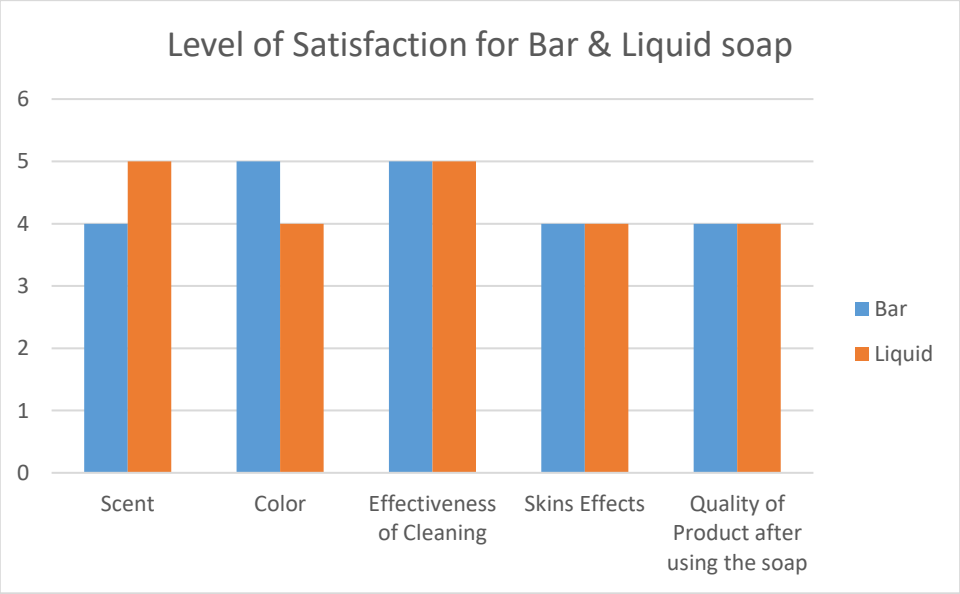

Figure 3: Level Of Satisfaction For Bar And Liquid Soap

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From all 60 respondents, results showed the following:
1) The highest satisfaction for effectiveness of cleaning for both types of soap are the same which is 5 (Strongly Recommended).
2) The sample color most likeable is Bar Soap while scent is liquid soap.
3) For skin effects and quality after using the soap both get 4 (Recommended).

An environmentally friendly approach is offered, which involves using waste resources like domestic cooking oil to produce soap. In foreign nations, a significant amount of waste is produced from the disposal of wasted cooking oil, and the accumulation of nut shell remnants is increasing annually. The disposal of domestic cooking oil waste differs throughout countries and regions, influenced by factors such as cultural norms, economic circumstances, and environmental policies.

Used cooking oil can be recycled by households and businesses in the United States through municipal recycling programs. Recycled oil is commonly utilized for the production of biodiesel fuel, animal feed, or other industrial goods. Certain localities may have designated drop-off areas where individuals can dispose of old cooking oil. Additionally, certain waste management businesses provide the convenience of curb side pickup services for used oil.

The European Union has enforced legislation for the disposal of domestic cooking oil waste, mandating the appropriate gathering and disposal of utilized oil. A number of European Union countries have successfully adopted collection and recycling programs, with certain countries even imposing penalties for the inappropriate disposal of leftover cooking oil.

Japanese homes are incentivized to gather spent cooking oil in specialized containers and discard it at designated collection places. The oil that is gathered is frequently utilized for the production of biodiesel fuel or repurposed for other industrial applications.

The management of domestic cooking oil waste poses a considerable difficulty in many developing nations, mostly due to the lack of adequate waste management infrastructure and economic resources. The improper disposal of used cooking oil, either by throwing it in the garbage or pouring it down the drain, has detrimental effects on the environment and public health. Several organizations and governments have launched initiatives to encourage the appropriate disposal and recycling of wasted cooking oil in these nations, however, the execution and enforcement of these programs continue to pose difficulties.

Overall, the management of home cooking oil waste differs throughout countries, with certain nations successfully implementing collection and recycling initiatives, while others face challenges in efficient disposal and recycling due to inadequate resources and infrastructure. Collaboration between governments, organizations, and individuals is crucial in promoting sustainable waste management methods for household cooking oil waste. This is necessary to minimize environmental consequences and enhance public health, as stated in the Global Waste Index of 2019.

Furthermore, the incorporation of kaolin clay and essential oil in the soap formulation has the potential to enhance the product's quality. Hence, it is imperative to employ a variety of methods to repurpose these waste materials, with the aim of transforming them back into their original raw form. In accordance with this prevailing pattern, this task was executed through

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the process and treatment of used oil, the formulation and production of soap, and the conduction of an acceptance analysis of the finished product. The results confirmed the idea's significant potential in both environmental education and economic aspects. Additionally, it can be beneficial for the management of trash and can facilitate the advancement of community initiatives focused on an ecological framework. The performance of finished soap is mostly determined by the chemical composition of the lipophilic component (Viorica, 2011).

Conclusion

In this research, the process experimental of degumming, decoloration and saponification of DCO were determined by standard experiment, the experimental conditions were optimized.

Acknowledgements

The authors are thankful to the editors and anonymous reviewers for their insightful comments and suggestions which helped to bring the manuscript in a better shape. The authors gratefully acknowledge the financial assistance from the Universiti Teknologi MARA Perlis Branch in providing DKS Grant 600-TNCPI 5/3/DDN (09) (001/2023) and Communicare RIG for making available for this research.

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