Volume 5 Number 1 (2024)
November – April 2024
Page: 35-46
E-ISSN: 2716-0750
P-ISSN: 2715-7997
DOI: 10.37680/amalee.v5i1.3294
Amalee
Indonesian Journal of Community Research and Engagement

Community Empowerment in Making Natural Soap from Used Cooking Oil and Red Ginger

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Article history Submitted: 2023/07/07; Revised: 2023/12/18; Accepted: 2024/01/20

Abstract

Used cooking oil can be reused, one of which is to make liquid soap. Used cooking oil is first filtered and then clarified with activated carbon. This study aims to process used cooking oil into liquid soap by adding red ginger extract to the formula. The method used in this research is a descriptive method with a qualitative approach. The research was conducted at the Chemical Engineering Laboratory, Haji Agus Salim Institute of Technology and Business. The data collection techniques are through observation, interviews, documentation, and direct practice in the laboratory.
Meanwhile, the data analysis technique uses the Miles Humberman model through data reduction, presentation, and conclusion. If necessary, data triangulation will be carried out. The results of this study showed that the liquid soap sample containing a red ginger extract did not meet the applicable standards based on several test parameters. Therefore, further research and development are needed to improve the composition of soap-making ingredients to produce more effective products in everyday life.

Keywords anti bacterial; liquid soap; red ginger; used cooking oil.

1. INTRODUCTION

With the significant increase in population, the demand for various products, including liquid soap for bathing purposes, has also increased (Syriac, 2020). Increasing the supply of raw materials to produce bath soap is necessary to meet this growing demand. One of the key raw materials in making bath soap is oil. In recent years, the global community has witnessed a growing awareness of environmental issues and the urgent need for sustainable practices. Against this backdrop, initiatives that promote community empowerment and environmental responsibility have

become increasingly vital. As we navigate the complexities of modern living, improperly disposing of used cooking oil poses a significant threat to our environment. The transformation of this waste material into a valuable resource addresses ecological concerns and opens doors for community members to engage actively in a meaningful and sustainable enterprise. Concurrently, the infusion of red ginger into the soap-making process introduces a natural and aromatic element, showcasing the potential for community-driven economic endeavors that are in harmony with nature.

The existence of used cooking oil is eventually discarded because it can cause negative impacts on the environment and health. Used cooking oil is waste generated from cooking oil in cooking activities, and if disposed of carelessly, it can pollute water and soil and disrupt the ecosystem (Siwi et al., 2021), (Hermawan et al., 2020). Therefore, communities must manage and recycle used cooking oil in environmentally friendly ways, such as processing it into alternative fuels or sending it to suitable waste treatment sites. Thus, it can reduce negative impacts and promote awareness of the importance of used cooking oil waste management. Therefore, using cooking oil as raw material for making bath soap is better. Red ginger can be added to its formulation to make a bath soap to maintain health and prevent skin infections.

Used cooking oil or cooking oil (waste cooking oil) has been used repeatedly up to 3-4 times frying (Anwar et al., 2022). Used cooking oil has been used in cooking food and is no longer suitable for consumption. These oils generally come from restaurants, households, or the food industry. Used cooking oil contains ingredients that can pollute the environment and potentially damage sewerage and soil if disposed of incorrectly (JULINAR et al., 2023). Therefore, it is important to manage used cooking oil safely and environmentally friendly, such as recycling it into alternative fuels or sending it to a suitable waste treatment facility to reduce its negative environmental impact. Oil damage due to heating can be seen from color changes, increases in free acid content, increases in viscosity, increases in peroxides, rancid oil odors, and decreased iodine number (Erlita, 2019), (Nurdiani et al., 2021).

One plant that can relieve pain in arthritis is red ginger rhizomes (Virgo & Sopianto, 2019). Red ginger has the highest content of volatile (essential oil) and non-volatile (oleoresin) components compared to other types of ginger. In addition, red ginger also has antibacterial activity and contains compounds such as flavonoids, oleoresins, essential oils, tannins, and terpenoids (Muttaqin et al., 2022). The use of red ginger can also cause a sensation of heat on the skin (Radharani, 2020). Soap, which is the product of the reaction between fatty acids and strong bases, can be made in liquid

form depending on the composition of the ingredients and the manufacturing process (Maotsela et al., 2019), (Maheswaran & KARTHIKEYAN, 2023). Liquid soap has a different softness and can be used for various purposes such as bathing, hand washing, and other household purposes.

Public demand for antibacterial liquid soap is quite high, but the development of natural-based antibacterial liquid soap still needs to be improved. Conventional liquid soaps generally only clean dirt and are less effective in inhibiting the growth of bacteria and fungi that can irritate the skin (Velazquez et al., 2019), (Daverey & Dutta, 2021). Therefore, antibacterial or antiseptic liquid soaps were developed. Antiseptic soap contains a special composition that serves as an antibacterial agent to reduce the number of harmful bacteria on the skin (Yustisi et al., 2023). A good antiseptic soap should wash away dirt and bacteria while maintaining healthy skin because healthy skin plays a role in the immune system.

Previous studies on community empowerment have focused on various topics such as entrepreneurship, education, health, and environmental conservation. However, there needs to be more research specifically addressing community empowerment through natural soap production using cooking oil and red ginger. This unique combination of utilizing waste cooking oil and incorporating the benefits of red ginger in soap-making presents a novel approach to community empowerment. The novelty lies in using waste materials, promoting environmental sustainability, and harnessing the potential therapeutic properties of red ginger in the soap production process. By exploring this novel approach, the study aims to contribute to community empowerment, waste management, and developing eco-friendly and beneficial products.

This research aims to process used cooking oil into liquid soap by adding red ginger to the formula. Thus, this study aims to reuse used cooking oil as the main raw material in making liquid soap, which has additional benefits from red ginger. This service activity empowers materials previously considered waste to turn them into valuable and useful products.

2. METHODS

The method used in this research is a descriptive method with a qualitative approach. The research was conducted at the Chemical Engineering Laboratory, Haji Agus Salim Institute of Technology and Business. Three different formulations were sampled and then analyzed. This research will use a qualitative approach with the main aim of understanding in depth the experiences and perceptions of the

community regarding community empowerment in making natural soap from used cooking oil and red ginger. A qualitative approach will allow researchers to detail this initiative's processes, dynamics, and social and environmental impacts. The data collection techniques are through observation, interviews, documentation, and direct practice in the laboratory. Meanwhile, the data analysis technique uses the Miles Humberman model through data reduction, presentation, and conclusion. If necessary, data triangulation will be carried out.

The first step in this research will involve identifying and selecting communities involved in natural soap making. The purposive sampling technique will be used to select communities that are actively involved in this activity. Next, participatory observation will be carried out to gain a direct understanding of the soap-making process, the role of community members, and the social interactions that occur during this activity. In addition, in-depth interviews will be conducted with community members directly involved in this initiative. This interview will provide space to understand their views on community empowerment, the challenges they face, and the positive impacts they have experienced. Interview data will be analyzed thematically to identify common patterns and differences in community members' perceptions and experiences. Furthermore, documentation will be an integral part of this method. Secondary data, such as documents or recordings related to soap-making activities, will be analyzed to provide further context and support findings from observations and interviews.

3. FINDINGS AND DISCUSSION

Liquid soap samples are first prepared using cooking oil. The preparation process involves filtration and immersion of oil in activated carbon, followed by re-filtration. After preparing used cooking oil, the next step is to make liquid soap through saponification. Used cooking oil is reacted with KOH to produce a soap base. Next, 96% ethanol, taxation, and equates are added to form a soap solution. The final step involves adding red ginger extract, perfume, and dyes. The flow diagram of liquid soap making can be seen as follows**;**

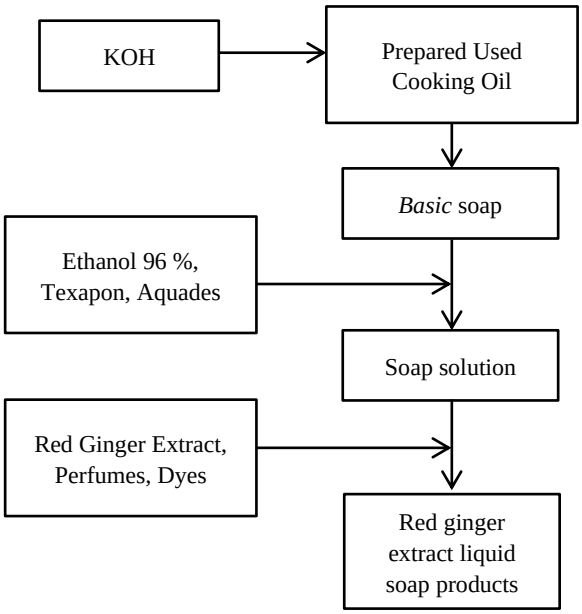

Figure 1. Red ginger extract liquid soap making flow diagram

Liquid soap samples are prepared based on the following formulation,

Table 1. Red ginger extract liquid soap formulation

No.	*Material Name*	*Formulation (%)*		
		I	*II*	*III*
1	Red Ginger Extract	10	12	15
2	Ethanol 96%	4	4	4
3	Texapon	3	3	3
4	Used Cooking Oil	10	10	10
5	KOH	5	5	5
6	Aquades	65	63	60
7	Deodorizer	2	2	2
8	Dye	1	1	1

After making samples, analysis is carried out by testing several parameters: pH, moisture content, foam stability, antibacterial activity test, and free fatty acids. pH measurement is carried out using a pH meter on a 10% sample solution formed from dissolving 1 gram of sample in 9 mL of water. pH measurement is carried out at a temperature of 25oC by inserting a rinsed pH meter electrode into the sample solution, and the pH value is determined after stabilizing. Measurements were made three times.

To test the moisture content, 5 grams of samples were placed in a heatproof container and heated in an oven at 105oC for 2 hours. After cooling, the sample is weighed, and measurements are made for three repetitions.

The foam stability test is performed by dissolving 1 gram of sample in 10 mL of water in a test tube, then shaking for 30 seconds. The height of the formed foam is measured, and after 5 minutes, the height of the foam is measured again.

$$\text{Foam test} = \frac{\text{Final foam height}}{\text{Initial foam height}} \times 100\%$$

In antibacterial power testing, the disc diffusion method is used. The bacteria tested were inoculated on Mueller-Hinton Agar (MHA) media. A 6 mm paper disc is dipped in a sample of soap solution and then placed on the surface of the substrate. This process is done on positive and negative control soaps and soap bases without extract. The sample was then incubated at 35±2oC for 18-24 hours, and an inhibitory zone was observed. The clear zone around the disc indicates the absence of bacterial growth.

To test free fatty acid levels, 5 grams of sample were weighed using an analytical balance and fed into the Erlenmeyer. Then, 10 ml of alcohol is added and heated for five minutes. After heating, three drops of phenolphthalein indicator are added and then titrated with NaOH until a pink color is formed. The level of free fatty acids can be calculated using the following formula.

$$\%\text{FFA} = \frac{\text{mL NaOH} \times \text{N NaOH} \times \text{BM FFA}}{\text{Berat sampel} \times 1000} \times 100\%.$$

The following are the results and discussion of the research that has been done:

1. pH Value Measurement

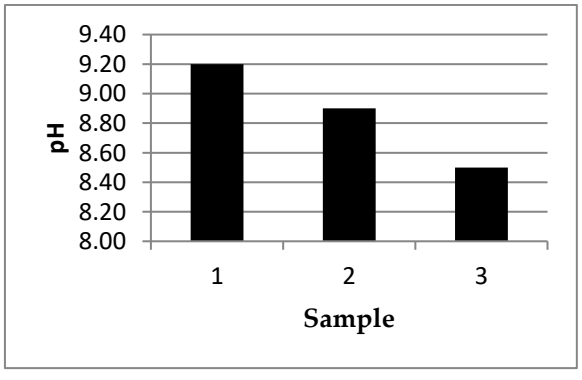

Figure 2. pH measurement results

Measurement of acidity or pH is a chemical parameter used to determine whether the soap produced is acidic or alkaline. The soap itself is an alkaline salt that has alkaline properties. The graph of acidity (pH) test results shows that the

concentration of red ginger extract is inversely proportional to the pH of the soap produced. The higher the concentration of red ginger extract, the lower the pH of the soap formed. This is due to the increased content of acidic compounds in soap due to adding more ginger extract. These acidic compounds, such as phenol derivatives (e.g., Gingerol and Shogaol) and other alcohol derivatives, have weakly acidic properties that affect the acidity (pH) of the soap produced.

Based on the Indonesian National Standard (SNI) Number 06-4085-1996 for good-quality shower soap, the pH that qualifies for the type of detergent is 6-8, while for the type of surfactant is 8-11.

2. Water Content

Table 2. Moisture content test results

Treatment	Sample		
	I	II	III
1	63,67	61,49	62,58
2	65,13	62,60	61,03
3	64,32	61,19	61,26
Average	64,37	61,76	61,62

Table 2 shows that the three samples have water content that has not met SNI standards, where the water content in soap is a maximum of 60%. This is influenced by mixing speed and improper concentration, resulting in moisture content exceeding the maximum limit. Some hygroscopic materials and the addition of equates can also affect the high moisture content.

3. Foam Stability Test

Table 3. Jasil foam stability test

Sample	Initial Height(mm)	Final Height(mm)	Yield (mm)
1	50	30	1.67
2	45	30	0.66
3	45	35	0.77

Based on Table 3, the foam test results show that sample 1 has a foam height of about 1.67 mm, sample 2 is about 0.66 mm, and sample 3 is about 0.77 mm. By the Indonesian National Standard (SNI), the foam height requirement for liquid soap is 13-220 mm. Judging from the data obtained, the foam height in the sample does not meet the predetermined SNI requirements. Factors that affect this can include the stirring time because the longer the stirring time, the higher the foam will be. In addition, the degree of solubility of taxation and completeness of saponification reactions can also affect the height of the foam formed.

4. Antibacterial Activity Test with Disc Diffusion Method

In the analysis of antibacterial activity testing using the disc diffusion method, it was seen that there was an inhibitory zone in soap against Staphylococcus Aureus bacteria. Further information can be found in Table 4 below:

Table 4. Antibacterial activity test against S bacteria *Aureus*

Sample	Diameter Measurement Results
1	10 mm
2	13 mm
3	17 mm

Based on research (Davis & Stout in Yulianti Lestari, 2016) states that:

a. Diameter > 20 mm: Very strong inhibitory power (bacteria are very vulnerable)
b. Diameter 10–20 mm: Strong inhibitory power (Susceptible bacteria)
c. Diameter 5–10 mm: Sufficient resistance/medium (Moderately resistant)
d. Diameter < 5 mm: Less inhibitory power (Resistant bacteria)

From this statement, it can be concluded that the results of antibacterial activity tests on the three samples showed strong inhibitory power against bacteria (susceptible to soap). This can be seen from the measured diameter of the inhibitory zone, which is between 10 to 20 mm. That is, the tested soap sample can inhibit bacterial activity, which can ultimately lead to bacterial death.

The formed inhibitory zone is due to the antibacterial and antiseptic compounds in the red ginger extract. The red ginger extract contains phenol derivatives that can inhibit bacterial growth. These phenol derivatives can alter the permeability of

bacterial cell membranes, thereby causing leakage of important components in cells and eventually causing bacterial death.

5. Test Free Fatty Acid Levels

Testing the level of free fatty acids in soap determines the amount of unbound fatty acids. These free fatty acids can affect the foam produced and change its pH. The higher the amount of oil still present compared to KOH in soap preparations, the more free fatty acids will also increase.

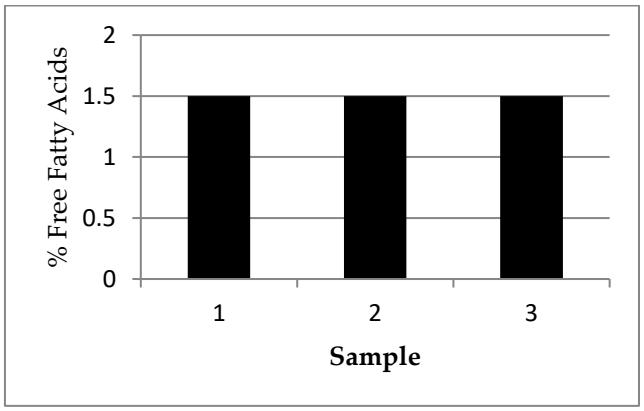

Figure 3. Free fatty acid content test results

Testing free fatty acid levels in the soap industry aims to measure the amount of free fatty acids present in fat after undergoing hydrolysis. It is important to determine whether the soap product produced complies with the Indonesian National Standard (SNI) 06-2878-1992, where the content of free fatty acids in the soap product should be less than 2.5%. Too high levels of free fatty acids in soap can irritate the skin. Figure 3 shows that the free fatty acid content produced from the test is compared to the SNI standard, which is less than 2.5%. This shows that the free fatty acid levels in the tested soap samples meet SNI requirements. The test results showed a free fatty acid content value of 1.5%.

In exploring the concept of community empowerment through making natural soap from used cooking oil and red ginger, previous research findings that looked at empowerment through sustainable economic activities can be integrated (Aisha, 2022). Community empowerment theory highlights the importance of providing active involvement to community members in the decision-making process and project implementation, which in turn can increase the sense of ownership and responsibility in carrying out initiatives like these. Regarding sustainability aspects, previous research emphasizing the environmental impact of traditional economic activities and production methods can provide a foundation for analyzing the contribution of these projects to waste management and environmental recovery (Akhirul et al., 2020); (Asfahani et al., 2023). By applying sustainability theory, the analysis can detail how

using recycled raw materials, such as used cooking oil, positively affects local ecosystems and shapes more sustainable production patterns. Previous research examining community involvement in local projects can be used as a reference to analyze the social impact of soap-making initiatives. Social interaction theory can help understand the dynamics of communication and collaboration between community members during the soap-making process and how it can strengthen social relationships and promote togetherness (Instincts, 2018).

Previous research findings on local economic empowerment through production activities can be applied to involve local economic analysis. Participatory economic theory can provide a further understanding of how these projects can provide economic opportunities to community members, increase incomes, and reduce dependence on external economic resources (Sukarma et al., 2023). In analyzing the use of cooking oil and red ginger, previous research findings highlighting natural ingredients' health benefits and antimicrobial properties may enrich the analysis. Alternative health theories and herbal medicine can provide a basis for understanding how using these ingredients in soaps can provide added value in health and aesthetics.

By combining previous research findings and relevant theories, the discussion analysis can be more in-depth, provide a richer context, and produce a more holistic understanding of community empowerment by making natural soap from used cooking oil and red ginger.

4. CONCLUSION

From the research results, it can be concluded that liquid soap samples containing a red ginger extract have yet to meet applicable standards based on several test parameters. Therefore, further research and development are needed to perfect the composition of soap-making ingredients to produce more effective products in everyday life. In addition, further research also needs to be done regarding the quality of the oil produced after treatment to ensure that the oil is safe and of high quality.

ACKNOWLEDGE

On this happy occasion, I would like to express my gratitude to the presence of God Almighty because of His blessings and grace; the collaboration of researchers in this article was able to complete the research well from the beginning to the end of this research.

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