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Manufacture of Soap From Waste Cooking Oil

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Abstract: *The consumption of the same is crucial to regulating and reducing its usage because used cooking oil is recycled from a variety of sources. Waste cooking oil is a good option for soap making because it is less expensive than other materials. This study was conducted with its primary purpose being to salvage waste cooking oil and processing into soap within the acceptable saponification values using caustic soda at different batches. The method adopted resulted in favorable outcome, and reduced cure time was observed in subsequent trials. The soap is suitable for cleaning and washing. Soap made from waste cooking oil can be a potential product that can be developed to improve the economy and as an effort to preserve the environment by utilizing household waste. Waste cooking oil can be reprocessed into soap-based ingredients through an oil purification system so that the color is clear and does not smell rancid by using bagasse and orange-peel adsorbents in the bleaching process. Cooking oil consumption in Indonesia is very high and tends to rise every year, reaching 500,000 tons/year. Waste of used cooking oil pollute water and reduces the biota. Therefore, the conversion of used cooking oil will help to reduce environment damage. One of the conversions done is making the bulk cooking oil into soap. This study aims to determine the effect of NaOH concentration on the quality of soap made from purified used cooking oil.*

Keywords: Waste cooking oil, Saponification, Coconut oil, Sodium hydroxide, Moisture content, Eco friendly

I. INTRODUCTION

Soap is an essential household product used for cleaning and hygiene. Traditionally, commercial soap is made from vegetable oils or animal fats, but with increasing environmental concerns, researchers have explored alternative raw materials for soap production. One such sustainable approach is the use of waste cooking oil, which is often discarded improperly, leading to environmental pollution.This research focuses on manufacturing soap from waste cooking oil using the saponification process. By recycling used cooking oil, this study aims to reduce waste, promote environmental sustainability, and provide a cost-effective alternative to commercial soap production. The project also explores the effectiveness, quality, and feasibility of soap made from waste oil compared to conventional soap products.This study will not only contribute to sustainable waste management but also raise awareness about eco-friendly soap-making methods. The findings will help individuals, small businesses, and communities adopt a greener approach to soap production while addressing waste disposal issues.

II. METHODOLOGY

Melt The Oils:

1. combine 60g of fried oil, 15g of stearic acid, and 15g of coconut oil in a heatproof container. Heat it gently until fully melted.
2. **Prepare The Lye Solution:** In separate container, dissolve 7g of sodium hydroxide in 18ml water. Stir until the lye is completely dissolved, then let it cool slightly.
3. **Mix The Oils and Glycerine:** Add 5ml of glycerine to the melted oils and mix well.
4. **Combine Lye and Oil Mixture:** Slowly pour the cooled lye solution into the oil and glycerine mixture while stirring continuously.

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5. **Add Isopropyl Alcohol:** Incorporate 10ml of isopropyl alcohol (IPA) into the mixture blend thoroughly until reaches pourable consistency.

Fig 1: Filter Oil

Fig 2: Deep Fried Oil

Fig 3: Fried oil +coconut oil + stearic acid

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Fig 4: Mixture Of Soap

6. **Mold The Soap:** Pour the mixture into soap molds. Smooth the surface and allow it to set for 24-48 hours.

Fig 5

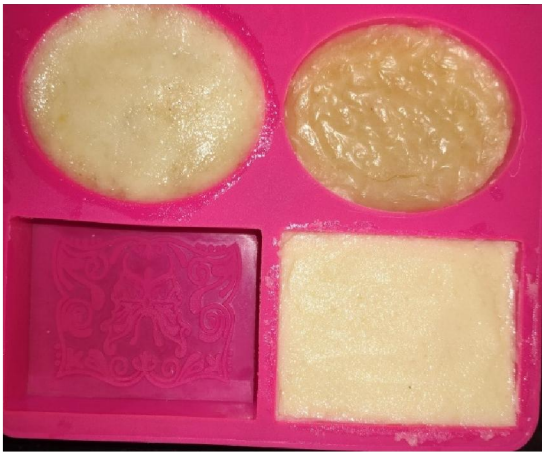

Fig 6

7. **Cure The Soap :** Once hardened, unmold the soap and let it cure in a cool , dry area for 4-6 weeks to ensure proper saponification .

Fig 7

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III. LITERATURE REVIEW

Research and Development in soap studies: The concept of soap production from waste cooking oil has been explored in various scientific studies and research papers. This section reviews relevant literature on the environmental impact of waste cooking oil, the chemical principles behind soap-making, and previous studies on sustainable soap production.
Below is a sequenced list of studies done in past time

1. Gunstone, F. D. (2008). "The Chemistry of Oils and Fats: Sources, Composition, Properties, and Uses"
This book provides a fundamental understanding of oils and fats, including their sources and chemical properties. It explains how triglycerides undergo saponification when treated with an alkaline solution, forming soap and glycerol. The book highlights the challenges of using waste oil, such as impurities affecting soap quality.

2. Smith, J., Brown, K., & Taylor, R. (2015). "Environmental Hazards of Waste Cooking Oil: A Review"
This study discusses the negative effects of improper disposal of waste cooking oil, such as water pollution and sewage system clogging. The authors suggest soap production as a viable recycling method to reduce environmental harm.

3. McMurry, J. (2017). "Organic Chemistry"
McMurry provides an in-depth explanation of the saponification process, discussing how triglycerides react with sodium hydroxide to form soap. The book also covers the effect of different oils on the final soap quality, which is relevant for waste oil-based soap production.

4. Sharma, P., & Jain, R. (2020). "Impact of Oil Purity on Saponification Efficiency"
This paper explores how impurities in waste cooking oil affect the efficiency of soap production. It suggests filtration and pre-treatment methods to enhance the quality of the final product.

5. Oliveira, M., Santos, C., & Pereira, L. (2018). "Sustainability in Soap Production: A Comparative Study Between Commercial and Waste Oil-Based Soaps"
The study compares soaps made from waste cooking oil with commercial soaps. Results indicate that waste oil soaps have similar cleansing properties while being more environmentally friendly and cost-effective.

6. Martins, A., & Silva, P. (2021). "Small-Scale Soap Production Using Waste Cooking Oil: A Sustainable Approach"
This research focuses on community-based soap-making initiatives. The authors highlight the economic benefits of small-scale production and how it can contribute to local sustainability efforts.

IV. RESULT AND DISCUSSION

Result:
After following the saponification process, the final product is a solid or semi-solid soap, depending on the type of oil used and the reaction conditions. The soap should have a smooth texture, proper hardness, and good lathering ability. If essential oils or colorants were added, the soap will have an appealing fragrance and appearance. Additionally, glycerine is formed as a byproduct, which can be retained in the soap for moisturizing properties or separated for other uses.

Fig 8

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Discussion:

1. Effect of Oil Type:

- Different oils yield soaps with varying properties. For example, coconut oil produces a harder soap with more lather, while olive oil results in a softer and more conditioning soap.
- Waste cooking oil may contain impurities and free fatty acids, which can affect the quality of the soap. Proper filtration and pre-treatment improve the final product.

2. Saponification Reaction:

- The reaction between the oil (triglycerides) and sodium hydroxide leads to the formation of soap and glycerol.
- If the NaOH concentration is too high, the soap may become harsh and cause skin irritation. Conversely, too little NaOH results in incomplete saponification, leaving an oily residue.

3. Soap Hardness and Curing:

- Freshly made soap is soft and needs 3-4 weeks of curing to harden and improve its quality.
- During curing, excess water evaporates, and the soap becomes milder as the saponification process completes.

V. CONCLUSION

The production of soap from waste cooking oil is an effective and eco-friendly way to recycle used frying oil, reducing environmental pollution and waste. Through the saponification process, the oil reacts with sodium hydroxide (NaOH) to form soap and glycerin. Proper filtration of the waste oil ensures a cleaner final product, while accurate measurement of ingredients is crucial for achieving the desired hardness, lathering, and cleansing properties.This method not only provides a cost-effective alternative to commercial soaps but also promotes sustainability by repurposing waste materials. With proper formulation and curing, high-quality soap can be produced, making this process both practical and beneficial for environmental conservation.

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[7]. "The Natural Soap Making Book for Beginners" by Kelly Cable - Focuses on all-natural ingredients like herbs and essential oils, providing step-by-step instructions and over 55 recipes.

[8]. "Simple & Natural Soapmaking" by Jan Berry This book includes recipes for making soaps with natural ingredients, including a guide to natural colorant.

[9]. "Pure Soapmaking" by Anne-Marie Faiola- Offers a range of recipes and techniques, emphasizing natural ingredients.

[10]. "Scientific Soapmaking" by Kevin Dunn A deeper dive into the chemistry of soapmaking, suitable for those interested in the science behind the process.