IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

Manufacture Of Soap From Waste Cooking Oil

Gauri Patil, Manasvi Dhoke, Dina Abdalhafidh,Amruta Mokashi
Department of Chemical Engineering, Vishwakarma Institute of Technology, Bibwewadi, Pune

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 temperatures in different batches. The method adopted resulted in a favorable outcome, and reduced cure time was observed in subsequent trials. The soap is suitable for cleaning and washing.

Index Terms - Sodium soap, Waste Cooking Oil, Saponification, Peanut oil, Caustic soda.

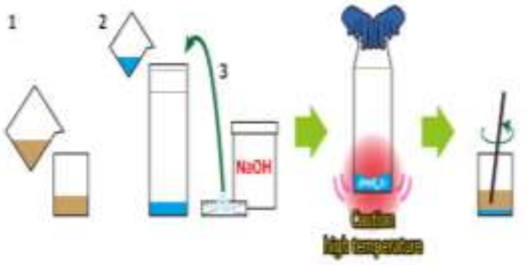
I. INTRODUCTION

When edible vegetable oil is used to fry food, waste cooking oil (Waste Cooking Oil) is created. Waste cooking oil use negatively affects both human and animal health, while improper disposal worsens environmental degradation, clogs drains, and contaminates land and aquatic environments. Reusing cooking oil when preparing meals can also increase the body's level of free radicals, which can lead to inflammation, the main factor in the development of most illnesses like diabetes, heart disease, and obesity. Excessive bodily inflammation might lower immunity and make you more susceptible to diseases.

It has been discovered that regularly using the same oil causes the production of free radicals.Inflammation,cardiovascular conditions, and even cancer can be brought on by free radicals. Reusing oil can potentially promote atherosclerosis, which can increase bad cholesterol and result in artery blockages. Although not completely useless, UCO is not something that should be thrown out carelessly. Its ability to be recycled into practical commercial products gives it a significant amount of commercial value. In addition to being used to make soap, it can be easily converted via a straightforward chemical process known as "transesterification" into glycerine and biodiesel. Cooking oils are necessary "triglycerides or esters" that combine with an alcohol like ethanol or methanol in a catalyst (acid or base) to create glycerol and biofuel. That is basic chemistry. Because much of it, especially from the unorganized F&B industry and private families, ends up in the drains, there aren't any fats and oils available as raw materials for biofuel or biodiesel manufacturing. Small food and beverage businesses in the organized sector occasionally prefer to sell it to soap producers or to unorganized food outlets who repurpose it for frying and cooking. This is primarily due to the fact that these consumers are more willing to pay than biofuel producers. Moreover, not all states have State Biodiesel. The saponification or primary hydrolysis reaction of oils or fats results in the formation of soap, which is a hydroxide base (Na or K) of naturally occurring fatty acids. The soap is the first detergent that mankind has ever used. The cleaning and washing qualities of this are influenced by its chemical makeup as an anionic surface agent and the inclusion of fatty acids such as lauric, stearic, myristic, palmitic, and oleic acids. The degree of waste has been rising recently as a result of the rising demand for cooking oil. Cooking oil waste that is dumped into lakes and rivers pollutes the flora and fauna because it floats on the water's surface, prevents oxygenation, blocks sunlight, and stifles photosynthesis, killing aquatic animals and plants.A million liters of fresh water can be contaminated by a spill of used oil as small as 1L. in order for recycling used cooking oil to be a practical alternative in reducing ecological and environmental issues.

I. RESEARCH METHODOLOGY

Materials Materials used in the experiment are distilled water, NaOH, Essential Oil, Waste Cooking Oil and Aluminium foil. Experimental setup and Synthesis 1)Saponification Saponification is a process that converts fats, oils, or lipids (the acid) into soap by combining them with Sodium Hydroxide (the base).Friction and heat from the chemical reaction are essential. The base and acid are balanced through saponification. It is advisable to take into account the quantity of soda present in the oil or fat while making soap, which is why a saponification value sample is first carried out. Saponification of oils is the process in which ethanolic KOH combines with oil to generate glycerol and fatty acids. The amount of potassium hydroxide needed to saponify one gramme of fat is measured in mg to express saponification values. The type of fatty acid in the oil will determine whether the saponification reaction is endothermic or exothermic. Creating cold process soap (Exothermic). This reaction could happen on its own and increase the system's entropy or randomness ($dS > 0$). They are identified by a negative heat flow (heat is lost to the environment) and a drop in enthalpy (dH0). combines natural oils (coconut, palm, olive, or butter), hydroxide, and water in the production of soap. The soap is typically allowed to solidify overnight. The texture of the soap may be very smooth or fine after this procedure; normally, only 95% of the oils are transformed into soap; the remaining 5% of the oils stay in the soap to enhance its great conditioning properties. Making hot process soap (Endothermic). Endothermic reactions don't happen on their own; instead, as energy is absorbed, the reaction's temperature drops, creating a positive heat flux and an elevated enthalpy (+dH) (Helmenstine, 2017). In this regard, the creation of hot soap is similar to the exothermic process until the combination reaches a certain consistency. It hardens upon cooling and becomes ready for use right away. While endothermic soap still has a silky texture, it is not quite as fine or smooth as exothermic soap. The type of oil used, the purity of the alkali, the capacity for saponification, and the age of the soap all affect the chemical properties of soap. The chemical properties include things like pH, total fatty matter (TFM), and moisture content. 2)Saponification with cold process A 300 ml bottle should hold 100 ml of leftover cooking oil. Put some water in the box. Water in 2 is then mixed with NaOH (in the quantity indicated above), the carton lid is then sealed. There is a heat discharge here, thus safety precautions must be used. Add it to the oil in 1 when the flakes vanish (the mixture turns translucent). Stir thoroughly until the mixture has a stew-like consistency. In a space with good ventilation, let it dry. (1 month or longer) stir the ice bath.



Experiment 1

Saponification began as soon as the used frying oil and NaOH aqueous solution were mixed, and the mixture hardened.

It took 15 to 20 minutes of stirring with a stirrer to achieve a thin, stew-like texture. In instances (1) and (2), the combination got cloudier than it had been when mixing first began, but it did not get thick enough to enter the "trace" state (i.e.,the condition of the soap dough at which a line can be drawn thereon).

The 300-ml container used in these tests had an upper temperature limit of 80oC. We began mixing the ingredients when the NaOH aqueous solution's temperature became a little bit lower because There was a lot of heat produced when NaOH was dissolved in water (over 70oC in Step 3 of the procedure). This is due to the stirrer's revolving action raising the temperatures of the ingredients.Before mixing, the temperature was 37oC, and for the following 60 seconds, the temperature was monitored while we examined the state of the contents. In contrast to our fears and expectations, the temperature barely increased and remained essentially constant between 30°C and 40°C each time it was monitored.

Experiment 2

In Experiment 2, we added more NaOH because the viscosity was not quite as high as what we had anticipated. We also immediately combined oil with the NaOH aqueous solution that had been dissolved in Step 4 after confirming that the mixture's temperature did not go above the container's upper-temperature limit. While the temperature was still high, we began mixing.

Compared to Experiment 1, Experiment 2 showed an early increase in viscosity. After 15 and 20 minutes, a mixer had a consistency similar to stew.

On the emergency escape landing, The mixtures were left in the containers to dry(outdoors). The mixes consolidated and the stew-like consistency varied considerably from the state they were in immediately after mixing, despite the fact that We couldn't avoid obtaining dust and tiny particles on their surfaces.

Characterisation

A process known as saponification is used to create soap. When an alkali (NaOH) and water are combined, Fatty acid sodium salt (soap) is made from the resulting fatty acids and sodium after fat (triglyceride) has been digested into fatty acids and glycerol.

Discussion of experimental findings and the saponification reaction are aided by three variables.

1. Mixing

Since the NaOH aqueous solution and oil interface is where the saponification reaction takes place, the area of the contact is increased by blending and dispersing the NaOH aqueous solution into the oil, hence promoting the reaction. Moreover, the reaction's soap film must be removed by mixing because it can interrupt the process and stop it from moving forward.

Mixing with a stirrer caused the creation of tougher soap in both Tests 1 and 2. (i.e., saponification progressed further)

2. Temperature

In Experiment 1, we delayed pouring the heated NaOH aqueous solution into the oil because we were concerned that it would exceed the container's maximum temperature tolerance.As a result, mixing took place between 30°C and 40°C, which probably slowed down the reaction rate. The temperature may have played a role in attaining the trace state earlier in Experiment 2 than in Experiment 1, where mixing was conducted between 40oC and 50oC.

3. Emulsifier

Surfactants, which act as surface-active agents, can help the interfacial interaction progress. As a result, by including a surfactant right away, the saponification reaction can be sped up. Being a surfactant in and of itself, soap produced by the saponification reaction forms micelles when mixed, which function as emulsifiers. In turn, this expands the liquid's stable interface area and speeds up the saponification process.

IV. RESULTS AND DISCUSSION

2. The appearance of cut surface

We used a saw to break the containers in half so that we could examine the contents because the soaps were difficult to remove from the containers due to their hardness.

Both the ones with the spotted surface (1) (2) and the ones with the white surface (3) (4) had two layers, and the contents were all the same shade of yellow, with no colour variances between the two.

3. Hardness comparison

The soaps were taken out of the containers. Regarding (1), it was soft throughout, not only on the surface, and significantly distorted when taken out of the container. Although there was a faint smell of used oil, the surfaces of the soap were hard and smooth, and the mixture did not immediately take on a stew-like consistency. Overall, the soap was successfully created.

We next inserted a stick into their sliced surfaces to gauge their hardness.

4. Foaming capacity

Even after two months, the soap from Experiment 1 was still usable. However, the surface appearance of the two soaps produced in Experiment 2 did not differ from each other, Moreover, the soaps from Experiment 2 seemed to be closer to real soap than those from Experiment 1. As a result, we hypothesized that mixing was not as crucial as the larger concentration of NaOH aqueous solution.

Yet, (1) was soft and (2) was hard as we poked a chopstick through the sliced surface, indicating a distinct difference in hardness.

We also discovered that mixing features might be used for the process of manufacturing soap (saponification).

II. 4.1 RACKNOWLEDGMENT

This work was supported by the Department of Chemical Engineering, Vishwakarma Institute of Technology, Bibwewadi, Pune

REFERENCES

[1]Bautista, Luis Fernando, et al. "Optimisation of FAME production from waste cooking oil for biodiesel use." *Biomass and Bioenergy* 33.5 (2009): 862-872.

[2]Panadare, D. C. "Applications of waste cooking oil other than biodiesel: a review." *Iranian Journal of Chemical Engineering (IJChE)* 12.3 (2015): 55-76.

[3]Maotsela, Tlamelo, Gwiranai Danha, and Edison Muzenda. "Utilization of Waste Cooking Oil and Tallow for Production of Toilet “Bath” Soap." *Procedia Manufacturing* 35 (2019): 541-545.

[4]Sanaguano-Salguero, H., A. Tigre-Leon, and I. F. Bayas-Morejon. "Use of waste cooking oil in the manufacture of soaps." *Int. J. Ecol. Dev* 33 (2018): 19-27.

[5]Paul, Okolie Chukwulozie, et al. "Optimization of a soap production mix using response surface modeling: A case of Niger bar soap manufacturing industry onitsha, Anambra State, Nigeria." *International Journal of Scientific & Technology Research* 3.9 (2014): 346-352.

[6]Legesse, Adane. "Preparation of laundry soap from used cooking oils: getting value out of waste." *Scientific Research and Essays* 15.1 (2020): 1-10.

[7]Awogbemi, Omojola, et al. "Advances in biotechnological applications of waste cooking oil." *Case Studies in Chemical and Environmental Engineering* 4 (2021): 100158.