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Analysis of Produced Bio-Surfactants from Waste Cooking Oil and Pure Coconut

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Abstract:- The waste cooking oil (WCO) is a problematic once its use is expired as it contributes to the environmental pollution especially to pollute our source of drinking water such as river, lakes and seas. Reusing the domestic waste such as cooking oil as an alternate substrate may be an economic solution to this problem. Bio-surfactant is one of among the potential product that distributed many advantages to the industries such as low toxicity, biodegradability and eco-friendly product. The study is done to investigate the potential bio-surfactant which produced from waste cooking oil and then compare it to the bio-surfactant produced from pure cooking oil (PCO). The parameter which has been analyzed are formability, pH, oil emulsification and hardness of water. The bio-surfactant from WCO shows a positive result from all analysis and can be a potential alternative material for bio-surfactant production.

Keywords:- *Biosurfactant, Waste Cooking Oil, Pure Coconut Oil, Formability, pH, Oil Emulsification, Hard Water.*

I. INTRODUCTION

Currently, conventional surfactant are originated from the combination of petrochemical, creature fat, plants, and microorganisms. Studies has shown that larger part of the generation markets depend on the petrochemical (Ruffino et al, 2014, De Almeida et al, 2016). By definition, surfactant which a surface-active materials are a piece of the most adaptable gathering of synthetic concoctions conceivably utilized in different ventures which incorporate cleansers, paints, paper items, pharmaceuticals, beauty care products, oil, nourishment and water treatment (Elazzazy et all, 2015, Varjani & Upasani, 2017, Mahamallik & Pal, 2017).

Many researches have been investigated to find best options as an alternative method to produce surfactant which is environmental friendly which leading to finding of bio-surfactant. This bio-surfactant is an attractive alternative for producing eco-friendly from natural and sustainable source (Marchant & Banat, 2012). The researches in the field of bio-surfactant has extended a considerable amount as of late because of its potential use in various zones, for example, the sustenance business, horticulture, pharmaceutics, the oil business, petro-chemistry and the paper and mash industry among others (Soument, Palashpriya & Ramkrishna, 2006).

Bio-surfactants have numerous focal points contrasted and their synthetic partners, e.g., natural adequacy, biocompatibility, and edibility just as effectiveness under extraordinary states of pH, temperature, and saltiness, the likelihood of their creation through maturation, their potential applications in ecological assurance and the board, raw petroleum recuperation, as antimicrobial operators in human services and sustenance handling ventures (Karsa et al, 1999, Kosaric, 1992, Banat, Makkar & Cameotra, 2000).

There are an excessive number of researches and products of bio-surfactants and oleo-chemicals utilizing vegetable oil and fluid waste which the researches had been done by Amet et al (2010), Salimon et al (2012) and Joshi-Navare et al (2013). They had investigated vegetable oil and fluid waste such as sunflower oil, soybean oil, palm oil, jatropha oil, castor oil, neem seed oil and utilized oil and so on. Also, Ghazali et al (2014) and Mora et al (2015) had researched on fluid waste such as waste cooking oil which could be an elective feedstock as the beginning material for biofuel, oleo surfactants, for example cleansers, and so forth. The aim of this research is to investigate materials from the cooking waste oil and pure coconut oil for an alternative raw material to produce eco-friendly bio-surfactant.

II. METHODOLOGY

Below is the flow process of bio-surfactant synthesis and the parameters used to analyze the produced bio-surfactant.

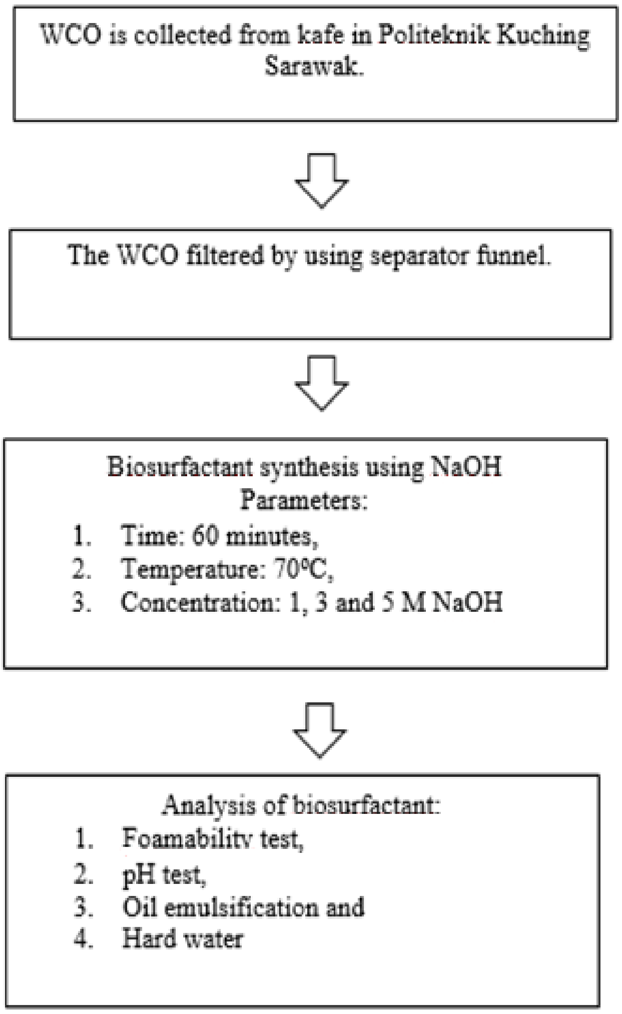

Fig 1:- The flow chart for the tests for analysis of produced bio-surfactant

III. RESULT AND DISCUSSION

Four experiments had been carried out on the produced bio-surfactants from the raw materials of Waste Cooking Oil (WCO) and Pure Coconut Oil (PCO). The comparison has been made for the results to investigate which raw material is better to use to produce the required bio-surfactant.

A. Foamability Test

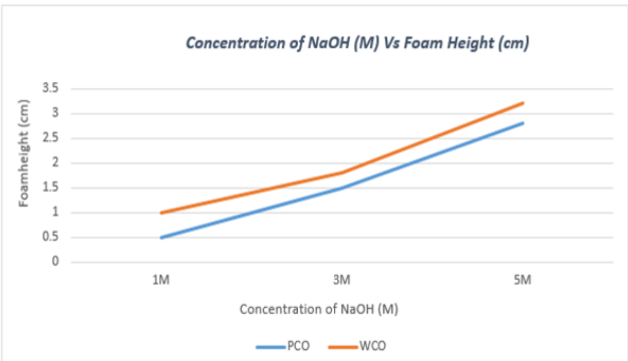

Fig 2:- Effect of alkaline concentration on foamability

Foamability test is carried out to see either WCO or PCO has better quality to produce bio-surfactant. From the experiment, concentration of NaOH had been added increasingly from 1M to 5 M for both WCO and CPO. The result is shown above in Figure 2.

Both has shown positive increase with the increase of the concentration of NaOH, but which WCO result is higher than PCO. This is due to the WCO contains more number of bacteria, as it is a wasted and used material. Because of that, the more bacteria it contains, the more vigorous activity it has, thus leading to produce emulsification of bio-surfactant which means produce more foams. According to Meshram et al (2014) the higher the foam's height showed a better cleaning progress due to its surface tension was reduced.

B. pH Test

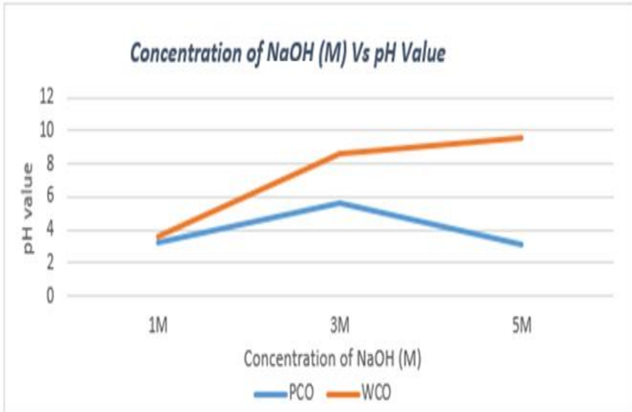

Fig 3:- Effect of alkaline concentration on pH value.

pH test was done to investigate the value of pH for the produced bio-surfactants were within the standard range, which is 7 to 10 for recommended pH for cleaning agent , for example detergent etcetera (Nuredah Aisyah et al., 2016), 7 to 8 for the optimal value of bio-surfactant (Wang Jing et al., 2011) . Figure 3.0 shows the result from the experiment:

The result showed pH test for WCO had increased when the concentration of NaOH was increased from 1M to 5M. The increase of the pH for WCO tends to change from acidic toward basic pH from the range value of 3 to 9. However, for PCO, at the first two concentrations of NaOH from 1M to 3M, the value of pH showed the pattern of increasing from range value of 3 to 5, but suddenly starting to decrease when the concentration of NaOH is added to 5M, which dropping down to below value of 3.

C. Oil Emulsification Test

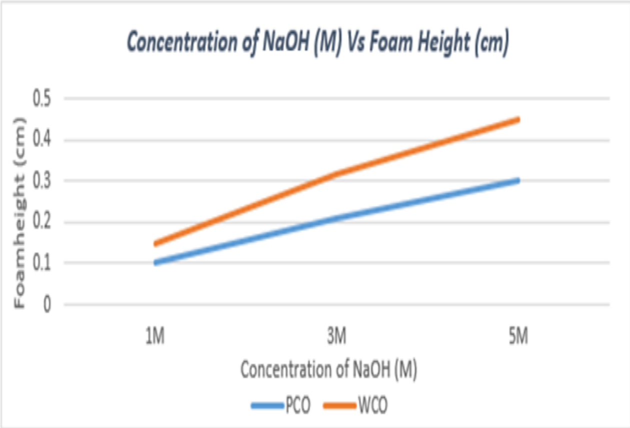

Fig 4:- Effect of alkaline concentration on oil emulsification

Emulsion is a mixture of two immiscible liquids where one liquid, is dispersed in the form of small drops in another liquid that forms a continuous phase. The common types of emulsions include oil-in-water and water-in-oil. They are important for a variety of applications such as macromolecule delivery, oil recovery, and food processing (Shah et al, 2008). This oil emulsification test was carried out to see which bio-surfactant can emulsify better from WCO and PCO.

From the Figure 4 above, both showed positive result in increase of height of foam when concentration of NaOH was added from 1M to 5M. However, WCO showed higher increase compare to PCO in all heights of foam from all concentrations of NaOH. This is because the bio-surfactant produced from WCO contains more microorganisms and undergoes highest emulsification activity compared to the other bio-surfactants. In addition, the previous study also show the higher rhamnolipid production as well as the higher emulsification efficiency was shown by WCO (George & Jayachandran, 2012). The emulsification is reliable in detecting biosurfactant and it designates the strength of a surfactant (Velioglu & Urek, 2015).

D. Hard Water Test

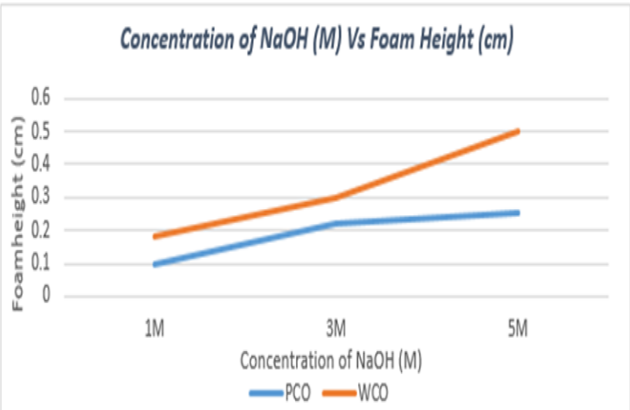

Fig 5. Effect of alkaline concentration on hard water

For the hard water test, the measurement also based on the height of foam produced from both WCO and PCO. The test reflected based on the contains of minerals resided in each of WCO and PCO which will either producing high foam or not.

Based on the result shown from the Figure 5.0, both WCO and PCO showed increased of height of foam produced with increase of concentration of NaOH from 1M to 5M. However, WCO has shown higher increase of heights of produced foam compared to PCO. The height of foam produced indicate the total of hardness in the WCO is more lather .This means WCO has contained high mineral to reason on the higher produced of high foam.

IV. CONCLUSION

Based on the tests which been carried out, the WCO shows good potential as one alternative material in producing bio-surfactant. The utilization of waste cooking oil in this study is significant as the wasted cooking oil can be reused as high-energy source for producing a high value product like rhamnolipid. As the same time, with the re-use of WCO can reduce the disposal used coconut oil and directly make our environment less polluted

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