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# Study on Synthesis of Bio-Surfactant from Cotton Silk Oil

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**Abstract:**

Surfactants are mostly made up from non- renewable sources. The majority of the currently used surfactants is petroleum-based and is produced by chemical means. These compounds are often toxic to the environment and may affect the ecological problems. The main purpose of this study is to synthesize bio-surfactants from cotton silk oil using alkaline base. This paper presents the bio-surfactant synthesis of cotton silk oil using sodium hydroxide to study effect of parameters such as temperature and time of NaOH on the bio-surfactant yield were studied. Cotton silk oil is chosen as raw material in synthesizing bio-surfactant due to its fatty acid content. The resulting bio-surfactant was washed with concentrated sodium chloride, filtered, washed with distilled water twice and dried in the oven at 60 °C for 24 hours. Then, the characteristic of the bio-surfactant was analyzed and compared with the commercialized detergent. The pH, interaction with hard water, emulsification with oil and height of foam fulfilled the set criteria by ASTM D460

**Keywords:** Biosurfactants, cotton silk oil, sodium hydroxide

## 1. Introduction

Biosurfactants or surface active agents are friendly environmental surfactants. Nowadays, biosurfactants become most important surfactant because of their benefit. Surfactants constitute an importance class of industrial chemicals. The industrial demand for surfactants has grown to about 300 % within the US-chemical industry during the last two decades. Nowadays, there are many ingredients for synthesizing bio-surfactants. The majorities of the currently used surfactants is petroleum-based and are produced by chemical means. These compounds are often toxic to the environment and may affect the ecological problems particularly in washing applications as these surfactants inevitably end up in the environment after use. Current surfactants are synthesized by using linear chain alkyl benzene, sulfonate or branched chain alkyl benzene sulfonate. This chemical synthesis causes environment effect. This is because of straight chain surfactant did not work in hard water. To overcome this problem, phosphate will be added to soften the water. Unfortunately, phosphate is considered as food for algae which can growth in sea and river. The algae will decrease the oxygen level in water and will destroying the aquatic

life. This also will affect the habitat in sea or river. While for branched chain molecules, microbes are not able to break down branch chain. This problem will make foam to be left on surface of the water. There are too many biosurfactants synthesis were produced in order to overcome this problem. Most of the biosurfactants are made up from renewable resources, eco-friendly and non- toxic. Other than that, they also were synthesizing biosurfactants from vegetable oil. Nowadays, there are too many research and product of biosurfactants synthesis using vegetable oil such as from waste cooking oil, sugarcane, sunflower oil, soybean oil, palm oil, jatropha oil, cotton silk oil and also from castor oil. The replacement of the main ingredients of surfactant with cotton silk oil is to make a safe and environmental friendly surfactant as well as reducing the feedstock cost and that the bio-surfactant are biodegradable. Hence the present study focuses on synthesize of bio-surfactants from cotton silk oil using alkaline base and the effect of parameters such as temperature; time and concentration of NaOH on the bio-surfactant yield.

## 2. Materials and methods

Cotton silk oil were collected from local vendors and the chemical used for biosurfactants are sodium hydroxide, sulphuric acid, hydrogen peroxide, sodium chloride and magnesium sulphate were purchased from precision equipments, Chennai. The apparatus used for the study were reagent bottle, hot plate with magnetic stirrer, separator funnel; conical flask, Burette, pH paper and retort stand purchased from sigma scientific, Chennai.

### 2.1 Synthesis of bio-surfactants

About 10 mL of sample oil is heated to 313 K. Sodium hydroxide solution is diluted with distilled water and mixed with sample oil. The mixture is then stirred using magnetic stirrer with hot plate. Then, 5 mL of 3M sulphuric acid is added and the pH was monitored using pH meter. About 5 mL of hydrogen peroxide is added until foam subsided. The mixture is then stirred continuously until foam subsides. The mixture is then washed using saturated sodium chloride, filtered and dried in an oven at 60 ℃ for 24 hours. The experiment is repeated for different parameters of temperature (40, 50, 60, 70, and 80)˚ C and time (20, 30, 40, 50, and 60) minutes.

## 3. Result & Discussion

### 3.1 pH test

About 2 g of product is taken in a test tube and 100 mL of distilled water is added to it. The mixture is stirred well using a glass rod. A pH paper is inserted into the glass rod and is compared with other commercialized detergent.

### 3.2 Foamability test

The sample from the pH test sample is taken in a separate test tune and it is closed tightly with a cork and it is shaken continuously for 10 seconds. The amount of foam is Observed and recorded for each soap solution. . These solutions were saved for the other test.

### 3.2 Emulsification test

Emulsification test is to determine the presence of lipids like fat and oil. 5 drops of oil is added to test tube from foamability test. The tubes were shaken continuously for 10 seconds. Oil layer in each tube were observed and compared with the amount of foam in Foamability test.

### 3.3 Hard Water Test

5 mL of product solution is taken in a test tube. Add 20 drops of 1% $CaCl_2$ solution to the tube. Stop and shake the test tube continuously for 10 seconds. Compare the amount of foam in each tube to the amount of suds they each had in Foamability test.

## 4. Conclusion

Based on the experimental study the following conclusions were made. First, biosurfactants was produced from cotton silk oil by alkaline base process. Secondly, the effect of parameters such as temperature and time of NaOH on the bio-surfactant yield were studied and are compared with the commercialized detergents. From the pH test, Foamability test, Emulsification test and Hard Water test results , it is observed that biosurfactants are efficient when compared with synthetic surfactants.

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