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# Synthesis of Non Ionic Gemini surfactants and used As Demulsifier to Treatment Water in Crude Oil (W/O) Emulsions

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*Abstract*— **Three new non ionic Gemini surfactants with different spacer (number carbon atoms = 2 – 4), but have alkyl chain length of 16 carbon atoms. The new compounds were synthesized and characterized by FT/IR, mass spectroscopy and 1H-NMR spectroscopy. The basic surface properties of these Gemini surfactants were investigated through measuring the relationship between the electrical conductivity and the surfactant concentration to determine critical micelles concentration CMC. Demulsification (emulsion breaking) is necessary in many practical applications as the petroleum industry and waste water treatment in environmental technology. The demulsification performances of these demulsifiers were investigated by conventional graduated bottle test. The results show that the demulsification efficiency is dependent on critical micelles concentration CMC value of these demulsifiers. It was also correlated to the interfacial activity and the dilational elasticity at the water-oil interface. The lower CMC value of demulsifiers, the better the demulsification efficiency is.**

*Index Terms* — **non ionic Gemini surfactants, electrical conductivity, critical micelle concentration, Water in oil emulsion.**

## I. INTRODUCTION

The surfactants play critical roles in all industry, particularly in Gemini surfactants, which consist of two conventional surfactants joined by a spacer at the head group, as they exhibit significant surface activity properties that cannot be achieved by conventional surfactants [1], [2], [3]. These surfactants are superior to the corresponding conventional surfactants in a number of aspects such as a lower critical micelle concentration (CMC), a higher efficiency in reducing the oil/water interfacial tension, unusual aggregation morphologies, and better wetting, solubilizing, foaming, and antibacterial activities [4], [5]. It is well known that crude oil plays an important role in providing the energy supply of the world among various sources of energy [6]. Through numerous studies on the stability of water-in oil emulsion, more light has been shed on the mechanism of emulsion stabilization in the petroleum field. Many researchers now attribute the stability of emulsion to the viscoelastic interfacial film made up of surface active molecules such as asphaltenes, resins, and other organic and inorganic particles [7]. The degree to which solids increases emulsion stability depends on several factors such as particle size, shape and morphology, density, concentration and surface coverage, and wettability [8],[9], [10], [11], [12], [13].

Emulsion stabilized by fine solids and asphaltenes were most stable at a 2:1 fraction area ratio of asphaltene to solids. There is a strong correlation between asphaltene content and emulsion tightness [14]. The presence of wax in addition to asphaltene and resins are known to promote the stabilization of water-in-oil emulsion. Asphaltenes are flat sheets of condensed polyaromatcic hydrocarbons linked together by sulfide, ether, and aliphatic chain groups. The edges of the sheets are alkyl chains. The polar parts of the asphaltene molecules interact with each others forming aggregates or micelles. As such, these micelles are very much polar. Resins are less polar and made up of smaller molecules with one end being hydrophilic made up of functional groups and the other end hydrophobic made up of alkyl chains. In crude oils,the resins are attached to the asphaltene micelles at the polar end and the non polar end of the resin interact with crude oil. The resins solvate the asphaltene aggregates and keep them in colloidal suspension in the oil [15].

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## II. EXPERIMENTAL

### A. Materials and Instruments

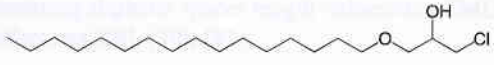
The following materials purchased from different companies: Butylene glycol (99.5 % purity), Propylene glycol (99.5 % purity), Ethylene glycol (99.5 % purity), Cetyl alcohol (95% purity), Epichlorohydrin (99.0% purity), Toluene (99% purity), Sulfuric acid, Sodium hydroxide (99 % purity), Ethanol (99.8 % purity), Twice distilled water was used in the preparation of all solutions.

The characterization by $^1$H NMR was recorded on a Bruker AM 300 spectrometer. The NMR spectra of the prepared gemini surfactants were recorded in $CDCl_3$ and chemical shifts recorded were internally referenced to TMS (0 ppm) and Fourier transform infrared (FT-IR) verified the structural characters of these new gemini surfactants on a Shimadzu IR. Anffinity-1. Mass spectra were obtained on Agilent mass spectrometer 5975 quadro pole analyser (70 ev). The CMC values of the surfactant solution were determined from Electrical conductivity with a Jenway PCM3 conductivity meter.

### B. Synthesis of ($A_1$), ($A_2$) and ($A_3$)

There are two steps to get the target compounds:

1. Synthesis of (A)




1-chloro-3-(hexadecyloxy)propan-2-ol