

**ABSTRAK**  
**PEMBUATAN METIL ESTER SULFONAT DARI MINYAK KELAPA  
MURNI SEBAGAI SURFAKTAN UNTUK ENHANCED OIL RECOVERY  
(EOR)**

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Pembuatan metil ester sulfonat dari minyak kelapa murni sebagai surfaktan untuk *enhanced oil recovery* (EOR) dalam rangka mempelajari kondisi optimum reaksi transesterifikasi metil ester. Menentukan kondisi optimum metode sulfonasi metil ester sulfonat melalui: variasi waktu, dan perbandingan mol. Mempelajari pengaruh variasi waktu sulfonasi dan perbandingan mol terhadap karakteristik surfaktan metil ester sulfonat.

Proses transesterifikasi dilakukan dengan variasi waktu, persen katalis, dan kecepatan pengadukan yang optimum lalu dianalisis menggunakan instrumen kromatografi gas (GC). Proses sulfonasi dilakukan dengan metode pencampuran langsung antara metil ester dengan natrium bisulfit dan katalis aluminium oksida dengan memvariasikan waktu reaksi, dan perbandingan mol antara metil ester dengan natrium bisulfit. pemurnian dengan penambahan metanol dan proses penetralan dengan larutan NaOH sampai mencapai pH netral. Produk MES kemudian diuji dengan FT-IR untuk ilusidasi kimia, uji karakterisasi fisik juga dilakukan antara lain : viskositas, pengukuran densitas kestabilan emulsi, kandungan bahan aktif, tegangan antarmuka dan permukaan.

Hasil transesterifikasi diperoleh kondisi optimum pada lama reaksi 55 menit, pengadukan 500 rpm dan katalis basa sebanyak 2 % dengan hasil kadar metil ester laurat tertinggi ( 60,81%). Surfaktan MES diketahui dengan melihat adanya senyawa sulfonat yang teridentifikasi pada bilangan gelombang 1273; 365 dan 1458  $\text{cm}^{-1}$ . Kondisi terbaik yang menghasilkan MES dengan tegangan antarmuka terendah pada air formasi ( $6,97 \times 10^{-3}$  dyne/cm) dan pada air injeksi ( $2,55 \times 10^{-2}$  dyne/cm), tegangan permukaan terendah (32 dyne/cm), kandungan bahan aktif tertinggi ( 7,95 %), stabilitas emulsi tertinggi ( 97,275 %), viskositas tertinggi ( 30,42 cP), densitas tertinggi ( $0,9866 \text{ g/cm}^3$ ), dicapai pada lama proses sulfonasi 4,5 jam, rasio mol reaktan 1:1,4. Surfaktan metil ester sulfonat dari minyak kelapa murni memenuhi syarat dan dapat digunakan sebagai salah satu surfaktan untuk enhanced oil recovery (EOR).

**Kata Kunci** : Metil ester sulfonat, tegangan antarmuka, tegangan permukaan, dan surfaktan, stabilitas emulsi.

## ABSTRACT

### FORMATION OF METHYL ESTER SULFONATE (MES) FROM PURE COCONUT OIL MATERIAL AS SURFACTANT FOR ENHANCED OIL RECOVERY (EOR)

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Formation of methyl ester sulfonate from pure coconut oil as surfactant for enhanced oil recovery. The aims of the researches were to study the optimum conditions of the transesterification reaction, to obtain optimum conditions of sulfonation methods in the synthesis of methyl ester sulfonate through time variations and the mole ratio and to study the effect of time variations of sulfonation and the mole ratio characteristics methyl ester sulfonate surfactants.

process of transesterification were observed based on the reaction time, percent of catalyst, and optimum stirring speed, and then analyzed using Gas Chromatography (GC). Sulfonation process was conducted by direct mixing method between methyl ester and sodium bisulfite and aluminium oxide catalyst. Parameters studied were reaction time variation, mole ratio. Purification and neutralization processes were carried out with the addition of methanol and NaOH, respectively. Products were then analyzed by FT-IR for chemical elucidation. Physical characterization tests were also conducted including viscosity test, density measurement, emulsion stability test, active ingredient test, interfacial tension and surface tension test.

Result of transesterification showed that optimum condition of reaction was observed at 55 minutes, stirring rotation at 500 rpm and amount of base catalyst as much as 2%. At this condition the result of highest methyl esters lauric contains (60.81%). The surfactant (MES) was known which showed the presence of sulfonate compounds identified in the wavenumber of 1273; 365. and 1458.  $\text{cm}^{-1}$ . The best MES condition result with the lowest interfacial tension of formation water ( $6.97 \times 10^{-3}$  dyne/cm,) and in injection water ( $2.55 \times 10^{-2}$  dyne/cm,) the lowest surface tension (32 dyne/cm), the highest active ingredient (7.95%), the highest stability emulsion stability (97.275%), the highest viscosity (30.42 cP) and the highest density ( $0.9866 \text{ g/cm}^3$ ) based on the duration of sulfonation was 4.5 hours, reactants mol ratio of 1: 1.4. Methyl ester sulfonate surfactants (MES) formed by the pure coconut oil raw material the meet criteria and can be used as a surfactant for enhanced oil recovery (EOR)

Key words: Methyl ester sulfonate, interfacial tension, surface tension, surfactants  
emulsion stability