

SINTESIS DAN UJI SIFAT FISIKOKIMIA ASETAL SIKLIK *n*-PROPIL 9,10-DIHDROKSISTEARAT SEBAGAI BIOPELUMAS TERBARUKAN

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INTISARI

Sintesis dan uji sifat fisikokimia senyawa asetal siklik *n*-propil 9,10-dihidroksistearat (ASnPDHS) sebagai biopelumas terbarukan telah dilakukan. Tujuan dari penelitian ini adalah melakukan sintesis asam 9,10-dihidroksistearat (DHSA), *n*-propil 9,10-dihidroksistearat (nPDHS), dan ASnPDHS, serta penentuan sifat fisikokimia dan kelayakan produk ASnPDHS sebagai biopelumas. Sintesis ASnPDHS diawali dengan hidroksilasi asam oleat menjadi DHSA menggunakan KMnO_4 pada 0-10 °C. Tahap selanjutnya adalah esterifikasi DHSA dan *n*-propanol menggunakan katalis H_2SO_4 membentuk nPDHS serta asetalisasi nPDHS dan pentanal menggunakan katalis montmorilonit KSF membentuk ASnPDHS dengan metode sonokimia. Struktur produk dikonfirmasi dengan spektrometer FT-IR, GC-MS, dan $^1\text{H-NMR}$. Pengujian sifat fisikokimia meliputi angka asam total, angka basa total, dan angka iodin dilakukan dengan metode Pearson.

Reaksi hidroksilasi asam oleat menghasilkan padatan putih DHSA dengan titik leleh 128-130 °C dan rendemen 31,70%. Reaksi esterifikasi DHSA dengan *n*-propanol menghasilkan padatan putih kekuningan nPDHS dengan titik leleh 92,4-92,7 °C dan rendemen 97,20%. Reaksi asetalisasi nPDHS dengan pentanal menghasilkan semi-padatan putih ASnPDHS dengan rendemen 69,12%. Senyawa ASnPDHS memiliki angka asam total, angka basa total, dan angka iodin senilai 18,08 mg KOH/g, 27,50 mg KOH/g, dan 0,84 mg I_2/g . Hasil pengujian sifat fisikokimia menunjukkan senyawa ASnPDHS memiliki sifat fisikokimia yang lebih unggul sebagai pelumas dibandingkan dengan asam oleat dan pelumas komersial.

Kata kunci: asam oleat, asetal siklik *n*-propil 9,10-dihidroksistearat, biopelumas, sonokimia

**SYNTHESIS AND PHYSICOCHEMICAL CHARACTERIZATION OF
CYCLIC ASETAL n-PROPYL 9,10-DIHYDROXYSTEARATE
AS A RENEWABLE BIOLUBRICANT**

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ABSTRACT

Synthesis and physicochemical characterization of cyclic acetal n-propyl 9,10-dihydroxystearate (ASnPDHS) compound as a renewable biolubricant had been conducted. The aims of this research were to synthesize 9,10-dihydroxystearic acid (DHSA), n-propyl 9,10-dihydroxystearate (nPDHS), and ASnPDHS, along with the determination of the physicochemical properties and the feasibility of ASnPDHS as a biolubricant. The synthesis of ASnPDHS was initiated by hydroxylation of oleic acid into DHSA using KMnO_4 at 0-10 °C. The next steps were esterification of DHSA and n-propanol in the presence of H_2SO_4 catalyst to form nPDHS and acetalization of nPDHS and pentanal in the presence of montmorillonite KSF catalyst to afford ASnPDHS as the final product by sonochemical method. The product structures had been elucidated by FT-IR, GC-MS, and $^1\text{H-NMR}$ spectrometers. Physicochemical properties including total acid number, total base number, and iodine number test were evaluated by Pearson methods.

Hydroxylation of oleic acid produced DHSA as white solid with the melting point of 128-130 °C in 31.7% yield. Esterification of DHSA with n-propanol gave nPDHS as yellowish-white solid with the melting point of 92.4-92.7 °C in 97.2% yield. Acetalization of nPDHS and pentanal yielded ASnPDHS as white semi-solid in 69.12% yield. The ASnPDHS compound has the total acid number, total base number, and iodine number of 18.08 mg KOH/g, 27.50 mg KOH/g, and 0.84 mg I_2 /g respectively. The physicochemical characterizations showed that ASnPDHS compound has better physicochemical properties as a lubricant compared to oleic acid and commercial lubricant.

Keywords: oleic acid, cyclic acetal n-propyl 9,10-dihydroxystearate, biolubricant, sonochemistry