UNIVERSITI TEKNOLOGI MARA

5th I-CReST 2025

INTERNATIONAL CONFERENCE ON RESEARCH AND PRACTICES IN SCIENCE, TECHNOLOGY AND SOCIAL SCIENCES

SYNERGY FOR FUTURE SUSTAINABILITY:
BRIDGING SCIENCE, TECHNOLOGY AND HUMANITIES

Abstract Book

UNIVERSITI TEKNOLOGI MARA
CAWANGAN SELANGOR, KAMPUS DENGKIL
MALAYSIA

13th SEPTEMBER 2025

ORGANISED BY: Centre of Foundation Studies

STRATEGIC PARTNER: UiTM Global

IN COLLABORATION WITH: UTM

I-CReST 2025:129-095 – Antimicrobial Study of Synthesized Cetyl Palmitate for Application in the Cosmetic Industry

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ABSTRACT

Cetyl palmitate is a waxy ester commonly derived from palm or coconut oil and widely used in personal care products for its conditioning and smoothing properties. In this study, cetyl palmitate was synthesized via an enzymatic esterification reaction between cetyl alcohol and palmitic acid using Lipozyme as a biocatalyst in hexane. The reaction was conducted at 50°C with agitation at 150 rpm for 5 hours. The synthesized product was characterized using Fourier Transform Infrared (FTIR) spectroscopy and Gas Chromatography-Mass Spectrometry (GC-MS). FTIR analysis revealed a prominent ester carbonyl absorption peak at 1732.67 cm^{-1}, confirming ester bond formation. GC-MS analysis showed a retention time of 30.029 minutes, corresponding to the molecular weight of cetyl palmitate (480.3 g/mol), further validating the synthesis. The antimicrobial activity of the synthesized ester was evaluated against both Gram-positive and Gram-negative bacteria using the agar diffusion method. The Minimum Inhibitory Concentration (MIC) was determined via the microdilution method, while the Minimum Bactericidal Concentration (MBC) was used to distinguish between bacteriostatic and bactericidal effects. The results indicated a bacteriostatic effect against Gram-positive bacteria (Bacillus subtilis and Staphylococcus aureus) at a concentration of 1:60 v/v, and a bactericidal effect at 1:40 v/v. Furthermore, the physicochemical properties of the wax ester were analyzed. The synthesized cetyl palmitate exhibited an SPF value of 7.13, a peroxide value of 6.00, a saponification value of 106.59, and an iodine value of 0.00. These values are within acceptable ranges for cosmetic formulations. In conclusion, the synthesized cetyl palmitate shows promising antimicrobial activity and favorable physicochemical properties, supporting its potential as a functional ingredient in cosmetic and personal care products.

Keywords: Enzymatic synthesis; Cetyl palmitate; Antimicrobial; Long chain ester; Cosmetic