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**ENHANCING WATER RESISTANCE OF PECTIN FILMS
USING DEEP EUTECTIC SOLVENTS (DES) OF THYMOL WITH
DECANOIC ACID**

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**ENHANCING WATER RESISTANCE OF PECTIN FILMS
USING DEEP EUTECTIC SOLVENTS (DES) OF THYMOL WITH
DECANOIC ACID**

AINA FATIHAH BINTI MD SHAHNON

**Final Year Project Report Submitted in
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This Final Year Project Report entitled “**Enhancing Water Resistance of Pectin Films using Deep Eutectic Solvents (DES) of Thymol with Decanoic acid**” was submitted by Aina Fatihah binti Md Shahnnon in partial fulfilment of the requirement for the Degree of Bachelor Sciences (Hons.) Chemistry with Management, in the Faculty of Applied Sciences, and was approved by

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ABSTRACT

Pure pectin films inherently exhibit high hydrophilicity and poor water barrier properties, which allow external moisture to rapidly infiltrate the matrix (Xu et al., 2025). This limitation renders them ineffective for applications requiring water resistance, necessitating the incorporation of hydrophobic additives. The main objectives are to improve hydrophobicity and enhance mechanical properties. This study focuses on the development and characterization of pectin-gelatine-glycerol composite films incorporated with Thymol-Decanoic Acid (TDA) as a Deep Eutectic Solvent (DES) via the solvent casting method. The primary objective was to evaluate the effect of varying TDA concentrations (0%, 5%, 8%, and 15%) on the physicochemical, mechanical, and barrier properties of the films. Fourier Transform Infrared Spectroscopy (FTIR) analysis confirmed that the interaction between the DES and the biopolymer matrix was via hydrogen bonding, driven by the entrapment of TDA within the polymer network. A significant finding of this research is the concentration-dependent dual functionality of the TDA. At low concentrations (5%), the DES acted primarily as a plasticizer, significantly enhancing flexibility by increasing the Elongation at Break (EAB) while reducing tensile strength. Conversely, at higher concentrations (15%), the mechanism shifted towards hydrophobic shielding. The lipid-rich TDA phase successfully formed a barrier that drastically reduced the Water Vapor Transmission Rate (WVTR), water solubility, and swelling ratio. In conclusion, the TDA serves as a versatile additive: the 5% formulation is optimal for applications requiring high flexibility, while the 15% formulation is superior for moisture-sensitive packaging, demonstrating the potential of hydrophobic DES in tailoring bioplastic functionality.

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