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PREPARATION AND CHARACTERIZATION OF PECTIN-STARCH HYDROGEL MODIFIED WITH CHOLINE CHLORIDE-BASED DEEP EUTECTIC SOLVENT FOR POTENTIAL APPLICATIONS IN THE AGRICULTURAL INDUSTRY

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This Final Year Project Report entitled **"Preparation and Characterization of Pectin-Starch Hydrogel Modified with Choline Chloride-Based Deep Eutectic Solvent for Potential Applications in the Agricultural Industry"** was submitted by Aniis Amira binti Mohd Yusoff in partial fulfilment of the requirements for the Degree of Bachelor of Science (Hons.) Applied Chemistry, in the Faculty of Applied Sciences, and was approved by

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ABSTRACT

PREPARATION AND CHARACTERIZATION OF PECTIN-STARCH HYDROGEL MODIFIED WITH CHOLINE CHLORIDE-BASED DEEP EUTECTIC SOLVENT FOR POTENTIAL APPLICATIONS IN THE AGRICULTURAL INDUSTRY

Hydrogels are 3D polymeric networks that can absorb and retain large amounts of water and are useful in various industries, such as agriculture, personal care, and pharmaceuticals. However, most hydrogels nowadays are synthetic, negatively affecting the environment and human health. In this study, two biodegradable hydrogels were prepared using natural polymers of pectin and starch with the addition of deep eutectic solvent (DES) of ChCl: urea and ChCl: LA to increase the water absorption through the casting method. The hydrogel has been optimized using different concentrations of crosslinking agent (0.5%, 1.0%, 1.5%, 2.0%) and different concentrations of DES (1.0%, 2.0%, 3.0%, 4.0%) to investigate their highest water sorption. The optimized hydrogels using the best crosslinking agent and DES concentration have been developed and characterized. The properties of hydrogels, such as swelling ratio, water retention, mechanical strength, biodegradability, and seed germination, have been investigated using standard methods. The results showed that the optimized pectin-starch-ChCl: urea, and pectin-starch-ChCl: LA successfully absorbed water up to 108.70% and 120.80% within one hour, respectively, compared to the control, pectin-starch hydrogel (97.86%). The hydrogels were found to be biodegradable with a rate of degradation of 100% for pectin-starch-ChCl: urea and 95.75% for pectin-starch-ChCl: LA, which was better than the control of 90.25% after 25 days in soil. The germination seed testing showed that hydrogel with ChCl: LA significantly promoted the growth of bean seeds and was able to maintain soil moisture for 20 days. In conclusion, it is proven that hydrogel with DES is better than hydrogel without DES, considering the higher water sorption of hydrogel and the ability to release water in dry areas. Hence, the hydrogel developed with DES showed high potential for agriculture by maintaining soil moisture, reducing irrigation water consumption, and increasing seed germination.