EFFECT OF CONCENTRATION CALCIUM CHLORIDE CROSSLINKER TO PECTIN BASED DEEP EUTECTIC BIOFILM

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ABSTRACT

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Biofilm is a flexible film made of biological materials such as polysaccharides that act as a barrier against external elements. The aim of this study is to prepare and characterise biofilm using deep eutectic solvent (DES) as a plasticizer and calcium chloride as a crosslinker. The effect of using different crosslinker concentrations towards the physical and structural properties of pectin-based DES biofilm were investigated. The film manufacturing process was divided into two stages: preparation of deep eutectic solvents and preparation of biofilm. The first stage involved dissolving malonic acid and choline chloride (ChCl:MA) in a mole ratio of 1:1 at 60°C until complete dissolution. The films were prepared using a casting method with pectin and crosslinked by immersing them in $CaCl_2$ solution with varying concentrations (3,5 and 7%). Physical and structural properties include moisture absorption, water solubility and biodegradable test were used to assess the effect of the crosslinking agent. Meanwhile, the interaction of material within films were determined using FTIR-ATR. Results found that, film moisture absorption ranges from 40 to 57.96%, water solubility ranges from 47.23 to 59.04%, and degradation ranges from 1.1 to 9%. This means that the 7% $CaCl_2$ will cause the biofilms to become organized in matrix and resistant to absorption, dissolution, and degradation. As a result, the highest concentration is better suited for biofilm preparation.

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CHAPTER 1

INTRODUCTION

1.1 Background of study

Plastic is known to be used limitedly only a few times before being discarded. The plastic waste produced was manageable in the 1950s and 1970s due to the small amount of plastic produced. Beginning in the 1990s, the production of plastic increased due to the increased demand from consumers, resulting in increased plastic waste. By the 2000s, the production of plastic waste had increased more in a single decade than it had been in the previous 40 years. With the increase in plastic users each year, plastic waste has become a global environmental problem in recent years. Every year, approximately 300 million tons of plastic waste are produced. About 79% of plastic waste was discarded in landfills or the natural environment. About 9% and 12% of plastic waste were recycled or incinerated, respectively (Kasavan et al., 2021).

Green technology for producing bioplastics has been discovered. It is a biodegradable material composed of natural materials that can be recycled. Microorganisms break down biodegradable substances in the environment over time. The temperature and level of aeration affect the microorganisms' ability to convert natural materials to natural substances such as water, carbon dioxide, and biomass. Pectin can be used in biofilm production to create a biodegradable film due to its gelling capabilities and thermally stable. Biofilms made from high methoxyl pectin exhibit a significant loss of brittleness (Munthoub et al., 2017). It is soluble in pure water but insoluble in organic solvents, and