UNIVERSITI TEKNOLOGI MARA

THE EFFECTS OF CLAY NANOPARTICLES AS REINFORCEMENT AGENT ON THE PROPERTIES OF STARCH-PROTEIN EDIBLE FILM

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ABSTRACT

In order to minimize the environmental effect, edible film made from starch-protein was introduced which may replace the non-degradable material likes plastic that is commonly used today. As to improve the properties of film, addition of clay is made to the starch-protein film with objective to study the mechanical and physical properties of the starch-protein film. Montmorillonite (MMT) clay was used in this research. For evaluation, the water-vapour permeability (WVP), water solubility and mechanical test (tensile strength and elongation at break) were conducted. From results, the presence of MMT in the film had decreased the value of WVP (3.377×10^{-9} g/m.s.Pa to 1.0918×10^{-9} g/m.s.Pa) and percentage of water solubility (98.72% to about 50%). Investigation was conducted for different amount of clay at 5%, 10%, 15% and 20% from weight of starch-protein where some of the results were found inconsistent. Results for mechanical properties showed the decreased in tensile strength with the addition of clay to the starch-protein film. On the other hand, elongation at break improved with clay addition but showed decreasing trend when more clay was added. From analysis, it can be concluded that 5% MMT clay film was the best composition because of the highest elongation at break at 121.5%; significantly higher than others. For tensile strength, WVP and water solubility properties, the 5% MMT clay performances were comparable to others.

Keywords: starch-protein film, edible film, clay nanoparticle, montmorillonite, mechanical properties.

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CHAPTER 1

INTRODUCTION

1.1 Research Background

Edible film is a thin layer, which can be consumed, coated on a food or placed which function to act as barrier between the food and the surrounding environment (Skurtys et al., 2010). Films is purposely used to protect foods mechanically, prevent the contamination from microorganism and protect foods against quality loss due to mass transfer such as moisture. Previously, non-degradable synthetic materials was used for food packaging. The increasing usage of non-degradable materials cause the increasing of environmental pollution which driven to do research on the uses of edible film. Then, the research on the edible film was continued and the demand of edible film increase due to the advantages of using it as food packaging. Edible film able to longer the shelf-life and enhance the quality of fresh foods as well as environmentally friendly food packaging. Sausage meat in casing is the one of the example of edible packaging where the casing is not removed and can be cooked and consumed. The biomaterial film may also be used to enhance the quality and stability of pharmaceutical solid. (Talja, 2007)

The edible films were classified into three categories taking into account the nature of their components: hydrocolloids (containing proteins, polysaccharides or alginates), lipids (constituted by fatty acids, acylglycerols or waxes) and composites (made by combining substances from the two categories) (Skurtys et al., 2010). Biopolymers used to prepare edible films are proteins from fish gelatin and polysaccharides including starch like cassava starch, corn starch and potato starch. The materials used for biopolymer film have advantages over the synthetic polymer in term of environment. However, biopolymer film have poor mechanical properties and high permeability to water vapor. The improvement is made by adding plasticizer such as glycerol to obtain good properties of edible film.

For film made from starch, the mechanical strength can be improved with the addition of glycerol. However, barrier properties of starch films like protein films