UNIVERSITI TEKNOLOGI MARA

MOISTURE SORPTION ISOTHERMS CASSAVA STARCH KAFFIR LIME BIOPLASTIC FILMS

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ABSTRACT

Cassava starch can be used in the formation of biodegradable films and containers, as an alternative for polymer derived from petrol. Kaffir lime oil act as antimicrobial agent that can inhibit the growth of bacteria in the food packaging. Bioplastic films from cassava starch with 35 w/w glycerol were produced by casting method. The concentration of glycerol which is 35 w/w as a plasticizer. Equilibrium moisture content at temperature 25°C and the water activity at range 0.05 to 0.9 by using static gravimetric method was determined. Moisture sorption isotherms were measured through a standard saturated salt slurry method. Five saturated salt solutions which are KOH, NaCI, $BaCI_2$, KCI, $NaNO_3$ were prepared corresponding to wide range of water activities. The result of monolayer moisture contents of bioplastic films was evaluated using Brunauer Emmett and Telle (BET) sorption equation. The isotherms exhibited Type III behaviour. Type III behaviour, in which a small amount of water was adsorbed in low water activity and the amount absorbed in larger water activity. The moisture sorption data were fitted to BET models and a non-linear regression method was used to evaluate the value constant of the sorption equations. The highest R^2 values ranging between 0.9439 to 0.9850 and the value of MRPD values ranging between 9.1882 to 18.3558. The monolayer, Mo value in this study was determined by using the BET equation and was obtained between range 0.0429-0.0469 gram water per gram dry matter following adsorption at 25°C. The bioplastic film is suitable as packaging because the microorganism unable to grow below water activity of 0.91. There is no significant effect in moisture content with an increase of concentration of kaffir lime.

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CHAPTER ONE:

INTRODUCTION

1.1 Background of Research

Bioplastic film is a thin layer material to cover food products, which can be produced from biopolymers. Biopolymers have been studied extensively regarding their film-forming properties to produce bioplastic films and coatings intended as food packaging. Different biopolymers have been used in the development of bioplastic film and coatings, such as proteins, lipids, and polysaccharides. Bioplastic films can improve mechanical barrier properties and can also prolong shelf life of food (Kooltheat et al., 2016).

Starch is one of the polysaccharides used to develop bioplastic film. It can be obtained from several raw materials of tropical origin such as corn, sweet potato and cassava (Luchese, Spada, & Tessaro, 2017). Starch is the second most abundant natural compound, which produce about five million tons each year in Europe after cellulose. It is low cost, abundantly available, eco-friendly, biodegradable and renewable. Cassava presents a high potential to be utilized as raw material for fabricating biodegradable plastics. Souza et al. (2012) found that cassava starch has been significantly used to produce biodegradable film with properties comparable to those prepared using other starches. Moreover, the adding up of cassava starch in pectin bioplastic film production can affected properties of the product (Rosida, Sudaryati, & Yahya, 2018).

The utilize of plasticizer is often needed to produce a bioplastic film. Normally used is glycerol because might be considered to be non-toxic and compatible to be used in the food industry (Basiak, Lenart, & Debeaufort, 2018). Bioplastic film with glycerol addition as plasticizer was proven to produce good plasticity properties and can increase elasticity of the film. After adding up the glycerol, this film was not too brittle and rigid. The addition of plasticizing agents to bioplastic films is to overcome film brittleness caused by extensive intermolecular forces (Iamareerat, Singh, Sadiq, & Anal, 2018).