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RHEOLOGICAL PROPERTIES OF CASSAVA STARCH-KAFFIR LIME ESSENTIAL OIL FILM SOLUTION FOR FOOD PACKAGING APPLICATION

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ABSTRACT

Food packaging from synthetic polymers are not easily degraded which later can cause environmental issues. On the other hand, food products still need protection as these products are easily deteriorated by oxidation and microbial growth. As an alternative to the conventional food packaging, antimicrobial edible film will extend the shelf-life of food and minimize the use of synthetic plastic. The incorporation of kaffir lime essential oil as antimicrobial agent in edible film formulation has not been studied yet. The rheology of the formulation and the thermal properties of the produced film are important in determining the final characteristics of the film. The rheological properties of cassava film solution with different kaffir lime essential oil of 0.0% v/v, 0.2% v/v, 0.6% v/v, 1.0% v/v and 1.4% v/v were studied at temperature range from 45°C to 85°C using Anton Paar MCR 300. The analysis of the data concluded that all flow behaviour index of cassava film solution incorporated with kaffir lime essential oil are less than 1.0. Therefore, all the solutions behave as a pseudo plastic or shear thinning polymer. Meanwhile, the effect of the temperature on the viscosity can be deduce as the increase in temperature result in lower viscosity value. Also, from the Arrhenius equation calculation, lowest activation energy was at 662.84 kJ/mol for 1.4% v/v concentration of sample. This imply this sample is the most temperature stable solution among the other four of samples as the lower the activation energy possessed a more stable temperature behaviour.

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CHAPTER ONE
INTRODUCTION

1.1 BACKGROUND OF STUDY

Food packaging technology have been evolved each day by introducing a new type of packaging from the past 200 years and have becoming a part of important element in product design. For an example, edible coating is used to coat fruits and vegetables to increase its shelf-life and edible film is used as a bioplastic to hold crushed peanuts and cheese. Food packaging is a part of food preservation by acting as a barrier between the food and the surrounding.

Edible films are categorized based on their structural material which are proteins, polysaccharides, lipids or composite (Galus *et al.*, 2015). The formulation of edible film involved chemical additives that will act as antimicrobial and antioxidant agent, but recently the use of natural additives has risen as it did not give any negative effects on the human health (Alves *et al.*, 2013). According to Aider (2010) and Elsabee *et al.* (2013), edible film with incorporation of essential oil as an antimicrobial agent can improved the usefulness of the films in terms of protection of the food from microbial spoilage hence extending their shelf life.

Starch is among polysaccharides used to produce edible film. It has absolute characteristics which happen naturally in plant; having a form of granules (<1-100μm) which composed of alternating shapeless and semicrystalline shells (growth rings) (100-400 nm) which is stacked by crystalline and formless lamellae (periodicity, 9-10 nm); consists of two major biomacromolecules called amylose which mainly linear and amylopectine with hyper-branched (Fu *et al.*, 2011). Independently, starch cannot form a film that satisfied the mechanical properties such as high elongation at break and tensile strength, but with the addition of plasticizer and other materials the mechanical properties of the starch film can gratified with support of chemical modification or combination of treatments (Liu & Han, 2005).