UNIVERSITI TEKNOLOGI MARA

CARBOXYLMETHYL CELLULOSE (CMC)-BANANA FLOUR FILM: PRODUCTION & CHARACTERIZATION

ARINA IZZATI BT AB RAHMAN
(2015238552)

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ABSTRACT

A study has been conducted to produce edible films from banana flour and carboxylmethyl cellulose (CMC) with addition of glycerol as plasticizer. The CMC-banana flour films were synthesized by casting method with different CMC concentrations (0, 5, 10 and 15% w/w). The characterization of the film is made based on mechanical strength, solubility, water vapor permeability (WVP), color and Fourier Transform Infrared Spectroscopy (FTIR). The thicknesses of the films range between 0.133±0.05 to 0.165±0.09 mm. As CMC is added into banana film from 0 to 10% w/w, the increase in tensile strength (TS) were found with the range of 1.86±0.08MPa to 1.99±0.26MPa and reduced upon the addition of 15%CMC and this trend was similar to the elongation at break (EAB) of the film. The CMC-banana films have the solubility range from 41.39±0.19 to 50.55±6.16% and this study found that the solubility of the film reduced in addition of CMC between 5% to 15% and increase in solubility with temperature (25, 37 and 90°C). WVP in the CMC-banana films is reduced in 5%CMC addition (3.7±0.16 $x10^{-9}$ g.mm/(h.cm^2.Pa) and keep increasing until 5.24±0.08 $x10^{-9}$ g.mm/(h.cm^2.Pa). Overall, the films form brownish color due to natural content of banana flour used in the film production with slightly different opacity due to the difference in CMC concentrations. All the parameters of films were compared with other natural sources of edible film and it is believed that CMC-banana flour film applicable to certain type of food packaging applications.

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CHAPTER ONE:

INTRODUCTION

1.1 Research Background

Non-biodegradable polymers packaging can cause environmental problems in many ways due to their difficulties to degrade which lead to land pollution (Taghizadeh *et al*., 2013). The impending petroleum shortage on the other hand, has driven the change from synthetic plastic packaging to biodegradable packaging (Dewi *et al*., 2017). However, the evolution and innovation of food packaging techniques have become challenging due to the current lifestyle trend (Majid *et al*., 2016). The concern of researchers to fulfill the customer demand for higher quality and longer shelf life of foods and at the same time increase sustainability has led to major interest in edible film research (Bastida *et al*., 2005).

Edible film is a thin layer of material made up from any edible components which is usually used as food wrap without changing the food's original ingredients and its processing method (A. Pascall, 2012). In food industry, the edible film is used to extend the shelf life by protect the product and reduce the solid disposal as it may be eaten together with food (Kramer, 2009). Most of the biodegradable films exhibit excellent properties that are comparable with synthetic plastic however their applications are limited by certain poor properties. Thus, many researches have been conducted to reveal the potential of edible film by modifying and enhancing the properties of film (Tabari, 2018). Recently, the extensive attention has been given to composite edible film (Bourtoom, 2008). Composite films created to have improved properties such as strength as compared to the conventional plastic (A. Pascall, 2012)

Composite film produced from the combination of various starch and carboxylmethyl cellulose (CMC), have been studied by many researchers. CMC is the most common cellulose derivative used in the production of edible film as CMC possess a good film forming characteristics such as flexible, transparent, dissolve in water, fat and oil-resistance and have tolerable transmission to moisture and oxygen (Bourtoom, 2008). For instance, Tongdeesoontorn