UNIVERSITI TEKNOLOGI MARA

MODIFIED MODELLING OF SORPTION ISOTHERMS OF CASSAVA STARCH – KAFFIR LIME OIL FILM

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ABSTRACT

Bioplastic or edible film is a thin layer made of polymeric material that can be consumed and degrade readily. Cassava starch is a promising material to be developed as films as they have good film forming and gas barrier properties. Bioplastic film is seen as an alternative for packaging of food. As a good food packaging, the film should be able to retain moisture when exposed to a wide range of relative humidity. Moisture sorption isotherm (MSI) studies the relationship between moisture content and water activity (a_w) of food or film at a given temperature. In this study, the MSI properties of cassava starch incorporated with kaffir lime oil (KEO) were determined in order to study the effect of KEO to the MSI properties of the film. KEO was added as an antimicrobial agent. The MSI properties of film made from cassava starch incorporated with KEO were studied at 30 and 40°C. The thickness of the films was kept constant and measured using a micrometre. The sorption data was used to determine the net isosteric heat of sorption (q_{st}) which gives an approximation of the minimum energy required to remove water from solid. Results showed that q_{st} decreases exponentially with increase in moisture content with and without incorporation of KEO. The incorporation of KEO does not affect the barrier of the film whereby the moisture content and q_{st} of the control and KEO films were relatively similar. The sorption data was fitted into three models which are Guggenheim – Anderson – de Boer model (GAB), Brunauer – Emmett – Teller (BET) and Oswin model. Oswin was found to be the best model to describe the MSI of the film with R^2 of 0.93 to 0.97. The BET and GAB models were found to be unsuitable to fit the sorption data. The RMSE and MRE (%) for Oswin model was found to be less than 1 and below 5%, respectively. The Modified Oswin model was then compared with the original Oswin model to determine the effect of temperature parameter to the accuracy of the model. The Modified Oswin had lesser RMSE and MRE (%) value than the original Oswin model while the R^2 was nearer to 1. The Modified Oswin and the original Oswin model was validated with sorption data at a_w0.4 and 0.75. The Modified Oswin gave the best fit for both a_w*'s*. Next, the Modified Oswin was successfully validated with MSI data obtained at 4°C. The final model for the MSI of KEO incorporated film was given by: $M_w=(0.1879+(0.00004T))[\frac{a_w}{1-a_w}]^{\frac{1}{2.0182}}$

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