UNIVERSITI TEKNOLOGI MARA

EFFECT OF FERMENTATION CONDITION AND ALKALI TREATMENT ON ACETOBACTER *XYLINUM* BACTERIAL CELLULOSE MEMBRANES PROPERTIES

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of the requirements for the degree of
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AUTHOR'S DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the results of my own work, unless otherwise indicated or acknowledged as referenced work. This thesis has not been submitted to any other academic institution or non-academic institution for any degree or qualification.

I, hereby, acknowledge that I have been supplied with the Academic Rules and Regulations for Post Graduate, Universiti Teknologi MARA, regulating the conduct of my study and research.

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ABSTRACT

A 3D matrix of cellulose synthesis from bacterial strain such as Acetobacter xylinum possess good mechanical strength, high crystallinity and biodegradable. Other than that, BC membrane properties such as water holding capacity and porosity also influenced the pore size, water absorption rate (WAR), water release rate (WRR) and water vapour permeability rate (WVPR) which is closely related with breathability behaviour. Previously stated that the characteristics of cellulose membrane are influenced by several parameters during production including culture media's pH level, carbon source and purification process-which will affect the potential use in advanced applications such as breathability behaviour for textile applications. At present, there is less work found on the breathability properties of cellulose membranes. In this study, Acetobacter xylinum was used to produce cellulose membrane through fermentation process for 7 days. The main objective of the study is to identify the breathability properties of the cellulose membrane by modifying the production parameters such as the carbon source and alkaline concentration. The results indicate that modification of production parameters had influenced the yield, thickness and porosity of cellulose membrane which also affected their breathability behaviour. High concentration of NaOH and sucrose (%) had increased dry weight (2.972%; 1.553%), thickness (0.09mm; 0.11mm) and cellulose formation. On the other hand, initial pH level and acidity increment in culture media also provide changes in cellulose formation, weight and thickness, where pH3.5 with 17% acidity increment obtained 1.65% weight with 0.03mm thickness. Moreover, the addition of pores on cellulose surface due to elimination of impurities (1.0% NaOH) and low cellulose formation (4.0% sucrose) had enhanced the porosity (99.96%, 99.782), WVPR (1045.55, 4242.23g/m2/day), WRR (94.83%, 99.236%) and WAR (182.73%, 180.543%). Yet, BC membranes produced in this study did not achieve a high value of WVP ($\geq$5000g/m^2/day) that requires for producing a breathable fabric, probably due to the hydrophilic nature of cellulose which may interrupt the penetration of water and water vapour through the BC membrane. Therefore, the end use or application of BC membranes based on the properties obtained need to be determined. Nevertheless, the cellulose membrane can be suggested for other applications such as in agriculture, due to its high-water holding capacity and porosity value.

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