UNIVERSITI TEKNOLOGI MARA

THERMODYNAMIC STUDIES ON ADSORPTION OF BOVINE SERUM ALBUMIN (BSA) PROTEIN ON NITROCELLULOSE (NC) MEMBRANE

NADHRATUL NUR AIN BINTI ABDUL RAHMAN

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ABSTRACT

Thermodynamic studies on adsorption of Bovine Serum Albumin (BSA) protein from aqueous solution by using nitrocellulose (NC) membrane was investigate in this study. Nitrocellulose membrane has been choose as adsorbent due to high tensile strength and hydrophilicity, excellent handling in ensuring that membrane will not rip and detergent free. In this study, characterization of NC membrane was studied by using Attenuated Total Reflected Fourier Transform Infrared Spectroscopy (ATR-FTIR) and porometer. Three most intense peaks for characterization NC membrane at 1713 cm^{-1} represent of –OH and $–NH_2$ groups, 1243 cm^{-1} represent of C=C groups and 847 cm^{-1} represent of C-H groups. For porosity, the mean porosity of NC membrane is 59.58% $\pm$0.8485. Moreover, thermodynamic studies on adsorption of BSA protein on NC membrane was investigated that this process was not spontaneous reaction and endothermic. The standard Gibbs free energy ($\Delta_r G^\theta$), the change in standard enthalpy ($\Delta_r H^\theta$) and standard entropy ($\Delta_r S^\theta$) was calculated. The result of $\Delta_r G^\theta$ value for 298K, 308K and 318K were 6491.24 J/mole, 3047.25 J/mole and 660.96 J/mole respectively. The results for $\Delta_r H^\theta$ was 64790.17 J/mole and $\Delta_r S^\theta$ shows that 198.24 J/mole. K.

Keywords: *Adsorption, BSA protein, Nitrocellulose membrane, Characterization, Thermodynamic*

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CHAPTER ONE
INTRODUCTION

1.1 BACKGROUND OF RESEARCH

Widespread urbanization, the application of membrane in the field of biomedical is widely spreading. Efficient processes are also needed to obtain high-grade products in the food and pharmaceutical industries to supply communities and industry with high quality water and to remove or recover toxic or valuable components from industrial effluents. For this task a multitude of separation techniques such as distillation, precipitation, crystallization, adsorption and ion exchange are used nowadays. Recently, these conventional separation methods have been supplemented by a family of processes that utilize semipermeable membranes as separation barriers.

There are several processes of protein purification which are physical, chemical and biological processes. Physical process is the alternative ways which employ the adsorption material to bind and isolate the protein to membrane in case of immunoassay, the protein isolate from solution onto membrane. Adsorption can be defined as a mass transfer operation in which substances present in a liquid phase are adsorbed or accumulated on solid phase and thus removed from liquid (Aksu and Dönmez, 2003). Recently, protein adsorption has been extensively investigated owing to its important role in biomedical applications. Adsorption of protein involving complex interactions like hydrophobic interaction, electrostatic interaction and hydrogen bonding (Bhakta *et al.*, 2015)**.** Moreover, protein adsorption to surfaces is a central concern for the rational design and application of materials. As it will be later specifically addressed, the rate and strengths of the initial physical interactions between proteins and surfaces dictate (to a large degree) the final conformation, stability and activity of such protein (Bhakta *et al.*, 2015).