UNIVERSITI TEKNOLOGI MARA
CARBON DIOXIDE SEQUESTRATION VIA IMMOBILIZED CARBONIC ANHYDRASE

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ABSTRACT

Carbonic Anhydrase (CA) was immobilized within amberlite XAD 7 and characterized for carbon dioxide sequestration purposes. The catalytic activities for free and immobilized CA were estimated by using para-Nitrophenyl Acetate (p-NPA) as the substrate. The activities were estimated by using tris-buffer containing 10% of Acetonitrile. Lineweaver-Burk plot was employed to estimate the Michaelis-Menten kinetic parameters for both free and immobilized enzyme. The value of kinetic constants (K_m and V_{max}) of free and immobilized CA were 2.92 mM and 5.7 mM respectively. Meanwhile the value of V_{max} and K_m of free and immobilized CA were 5.95 μmoles/min/ml and 2.67 μmoles/min/ml respectively. The optimum pH for free enzyme was found to be at pH 9 while immobilized CA found to be at pH 10. The optimum temperature on the other hand, for free was at 25°C while immobilized work effectively at temperature 50°C. Then, both free and immobilized CA was employed in $CaCO_3$ precipitation reaction in a different temperature. It was observed that carbonation reaction for free enzyme work optimum at 50°C, 70°C and 85°C. For immobilized CA, the carbonation reaction work optimum at temperature 70°C and 85°C. It was concluded that immobilized CA can be used in carbon dioxide sequestration for the purpose of converting the CO_2 into valuable calcium carbonate that can be used in many processes industries.

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TABLE OF CONTENT

CHAPTER ONE

INTRODUCTION

1.1 BACKGROUND OF STUDY

Carbon dioxide is the major contributor to the cause of global warming due to the increase of anthropogenic CO_2 concentration in the atmosphere. There are many sources of carbon dioxide emissions into the atmosphere come from industrial processes such as ammonia production, natural gas processing or cement manufacturer and many others. However, according to some resources, carbon dioxide emissions from fossil fuels plants are the main contributor to the problems arises [1]. The UN Intergovernmental Panel on Climate Change (IPCC) 2007 has already established that CO_2 capture and storage (CCS) would be an option portfolio of actions for stabilization of greenhouse gas concentrations while allowing for continued use of fossil fuels [2]. CCS is a technology based on the reduction of CO_2 emissions into the atmosphere mostly from fossil fuel power plants and industrial processes. If CCS is fully implemented, approximately 236 billion tons of CO_2 could be in the total capture and storage by 2050 [3]

In the past decade, anthropic carbon dioxide and its storage have become the major task to achieve in order to control the increasing of earth's atmospheric temperature. Recently scientist discovered that the possibility of using carbonic anhydrase enzymes which have been known as enzyme that aid the hydration of neutral CO_2 into bicarbonate HCO_3^-. In this research, the study of mechanism of the enzymes is summarized. Their main characteristics, including their structure and catalysis kinetics are investigated and analysed. In this paper also some of the possible application of carbonic anhydrases is