CHAPTER I
INTRODUCTION

I.1 Background

Energy is the main component of our daily life. Currently the main source of energy is fossil fuel, which has a limited amount reserved in nature. With increasing the number of people who uses energy, the consumption of fuel increases significantly. This creates another problem the shortage of fossil fuel, to prevent that to happen scientists are trying to develop alternative fuels to replace fossil fuels.

One of the most promising alternative fuel is bio-ethanol. Bio-ethanol is an alternative fuel commonly made from the fermentation of glucose. Using fermentation to make bio-ethanol takes a lot of time and energy, but the main problem is the source of glucose. Most of raw glucose can be taken from anything that contains some sort of carbohydrates. The problem is most of them are food items. An alternative method to earn glucose is by breaking cellulose, which is contained by anything with plant fiber. There are two reasons to justify the use of cellulose for glucose production as raw material for bio-ethanol compared to other carbohydrates: abundant source and low cost.

Various methods can be used to break cellulose. The most efficient way is to use cellulase enzyme. Using cellulase enzyme can produce high amount of glucose, reduced waste production and its environment friendly. Yes, it has also limitation: due to its small size and expensive cost.

One of the methods to improve enzyme stability is to immobilize the enzyme inside a solid carrier. Previous research indicates that porous silica material can give benefits in enzyme immobilization. Yet, further

improvement still very much required. For this reason, continuous study in this field is urgently required.

The main purpose of this research is to study the synthesis and modification of mesoporous silica material with channel-like (2D) mesostructure and to study the use of these nanomaterials to increase the stability, activity, and reusability of cellulase enzyme by modifying the surface of nanoporous silica and its size.

I.2 Objective

1. To synthesis mesoporous silica at different particle size with a hexagonal mesostructure (channel-like).
2. To study the synthesis and functionalization of mesoporous silica material.
3. To determine the loading amount or adsorption amount of mesoporous silica material against cellulose enzymes.
4. To study the effect of mesoporous material to cellulase enzyme activity.
5. To determine the optimum conditions of mesoporous material in stability, activity, and reusability aspects.