

# CHAPTER I

## INTRODUCTION

### I.1 Background

Fuel becomes an inseparable main component in every human's activities. Fuel also takes an important role for advancing industries and economic of a country. The demand of gasoline increases continuously, but the amount in nature are decreasing because fuel isn't a renewable material. Research of alternative fuel such as bioethanol and biodiesel become main research target in many countries. In particular, Brazil produces bioethanol from sugar cane in a big quantity successfully. Besides, biodiesel research also grows up with raw material from soy beans.

Bioethanol can be produced from materials which contain glucose, meanwhile glucose can be obtained from cellulose. Cellulose can be obtained easily because it is the biggest most abundant organic material on earth. Cellulose can be found in agriculture residues. There are two processes to produce bioethanol from cellulosic materials: chemical and enzymatic.

The limitations of the chemical process are the production of hazardous waste which cause adverse effects on the environment. Yet the production cost is lower than enzymatic process. Enzymatic process is environmentally friendly and produces bioethanol with higher conversion than chemical process. However, the usage of enzymatic processes is still limited due to a high production cost and fragile protein chain. Increasing efficiency from enzymatic process can be done by reusability of enzyme by taking advantages of porous materials.

This research has a purpose to study the utilization of nanotechnology to produces nanomaterial for increasing activity, stability, and reusability of

enzymatic process. Various nanoporous material character will be studied such as chemical characteristics of the surface and particle size. Both of these variables have a great influence in determining enzyme activities. This research is expected to find an optimum condition from nanoporous material which can increasing feasibility from enzymatic process, so in the future, it is possible to commercialize enzymatic process to produces bioethanol from glucose which is made from cellulosic materials.

## **I.2 Objective**

- Studying the synthesis of nanomaterials with cubic mesostructured with different particle size.
- Studying the surface modification of nanoporous materials by using vinyltrimethoxysilane (VTMS) at various concentrations.
- Determine the loading capacity of nanoporous materials against cellulase enzyme immobilization
- Studying the effect of a nanoporous material on enzyme activity, stability and reusability.
- Determine the optimum condition of nanoporous material to maintain activity, stability and reusability.