

## CHAPTER I

### INTRODUCTION

One of the global problems is the rising price of fossil fuels, the major global energy resource, results from an increasing consumption. Moreover, the excess use of fossil fuels also causes environment problems which come from by-products when they are burned to generate energy. Those by-products are carbon dioxide, nitrous oxide and greenhouse gases that cause to global warming (Sreethawong et al., 2010). Thus, many researchers have been working on finding alternative energy sources that are eco-friendly and sustainable fuels. More than a dozen of alternative fuels are in the production and usage or under development. Hydrogen is considered as a promising and clean fuel with no carbon dioxide emission. It will be an energy carrier for a future because it has a high energy content (122 kJ/g) which is 2.75 times greater than hydrocarbon fuels (Yung Chang and Yue Lin, 2003). Hydrogen can be produced from various processes. Biological process is great interesting for hydrogen production due to operation is at ambient temperature and pressure (Sreethawong et al., 2010). Two main biological hydrogen productions include anaerobic (dark fermentation) and photosynthetic (photo-fermentation). The anaerobic fermentation is superior to the photo-fermentation since it does not rely on the availability of light sources (Argun et al., 2008). Under the anaerobic fermentation, the first step, large molecules are hydrolyzed to simple organic molecules. The second step, simple organic compounds are broken down by acidogenic bacteria to organic acids (volatile fatty acid, VFA), carbon dioxide and hydrogen (Searmsirimongkol et al., 2011). The last step, the methanogenesis step, hydrogen, the produced carbon dioxide, volatile fatty acids and alcohols are further consumed by methanogenic bacteria to yield methane and carbon dioxide. The main problem is low substrate conversion efficiency to hydrogen in the fermentation process and most of organic fraction remains as soluble fermentation products and what a type of material for hydrogen production that is an important factor is. There are several materials for hydrogen production; corn and cassava as a carbohydrate source are used in previous studies. But they are still not economically feasible to use due to their high cost. Wastewaters containing high starch are considered to be a potential source for hydrogen production. Under

biological production, 60-70% of volatile fatty acid such as acetic, propionic, butyric acid and ethanol remain in wastewater. Therefore, one way to use of remaining organic in wastewater is to recover it to methane as additional gas beside hydrogen (Mohan et al., 2010). Methane gas is widely used as a fuel in homes, commercial areas, and factories. Additionally, methane is an important source of hydrogen and some organic chemicals.

The purpose of this work is to study the production of hydrogen and methane from alcohol wastewater using two-stage upflow anaerobic sludge blanket reactors (UASB) under mesophilic operation.