CHAPTER I

INTRODUCTION

Nowadays, oil palm plantation and palm oil industry in Thailand grow up rapidly. More than 1,530,000 tons of fresh fruit bunches (FFB) and 405,000 tons of crude oil, are produced annually due to the dramatically rising in their demands for cooking and using as alternative fuel, which is biodiesel. Recently, at least 49 palm oil mills are operating especially in the southern part. Therefore, a lot of oily wastewater is generated from these mills and affects the environment because of its high organic contents.

In the environmental approach, it is necessary to reduce the organic contents, pH and temperature before purging out with the effectively treatments. And a requirement in the economical approach is to operate with feasible treatments and get high value by products. Many techniques are applied, such as oil and grease trap method (gravity separation of floatable grease and oil) is the first and simplest technique, chemical hydrolysis technique with NaOH and biological digestion or biodegradation process. After pretreatment processes with oil content around 2–10%, it is not economical feasible for physical and chemical process. The biodegradation is a nature process, which microorganisms have ability to utilize organic compounds. This one is a clean and cost effective process. And due to the nutrient in palm oil mill effluent is too low for aerobic treatment process, but sufficient for anaerobic treatment process. Under normal operation of anaerobic system, mainly biogases produced are 60% of methane and 30% of carbon dioxide.

During the last decade, hydrogen gas received wide attention as clean energy source with no carbon emissions that will replace fossil fuels in the energy and chemical industries. Hydrogen can be also produced by the anaerobic treatment process in the conditions of low pH and high loading which is called biohydrogen. Surfactant is an amphipathic agent which can solubilize oil in the system. The addition of surfactant can increase biodegradation and biogas production.

In this research, an upflow anaerobic sludge blanket (UASB) reactor, with a 16-liter working volume, was constructed from borosilicate glass for treat-

ing an oily wastewater simulated from distilled palm oil and water, with chemical oxygen demand (COD) of 22,000 mg COD/l, and for producing biohydrogen. A mixed bacterial culture was used as degrading microorganisms at an optimum temperature of 37°C and uncontrolled pH. Moreover, polyethylene sorbitan monoleate or Tween 80, a nonionic surfactant, was used to enhance oil solubilization, and thus the biodegradation, as well as the hydrogen production. Consequently, the effect of oil loading was investigated by varying COD loading rate from 10–80 kg COD/m^3d. The percent oil removal (measured as COD and oil content in % v/v), specific biogas production rate, and hydrogen content in the produced gas were the main parameters observed in this study.