CHAPTER I
INTRODUCTION

Cassava is an important agricultural product in Thailand because it has the effect in agricultural sector and also linkage to manufactures. Cassava from farm could be produced for ethanol, power, and pellets (Poramacom *et al.*, 2013). During the manufacture processes, wastewater and residue which are nutrient-rich organic waste are generated. A high amount of organic waste causes environment problems, and also bad smell. The utilization of organic waste especially cassava wastewater and cassava residue to produce hydrogen and methane is attracting more and more interesting nowadays. One of the promising technologies to produce hydrogen and methane is dark fermentation with two-stage process (Lou *et al.*, 2011). The advantage of dark fermentation process is not only provides lower the hydrogen production cost (Cheng *et al.*, 2011) but also treats the wastewater and solid organic wastes (Sreethawong *et al.*, 2010).

The two stage fermentation process consists of hydrogen and methane reactors, respectively (Kim *et al.*, 2011). In the first stage, the acidogenic bacteria hydrolyzed organic compound and converted to hydrogen, carbon dioxide, and volatile fatty acid. The effluent product and produced organic acid from the first stage further converted to methane and carbon dioxide by methanogenic bacteria in the second stage burns (Pisutpaisal *et al.*, 2010). Compared to the one-stage fermentation process, the two-stage process promised higher process efficiency in term of overall energy productivity (Schievano *et al.*, 2012). Liu *et al.* (2006) reported that methane production activity of two-stage fermentation process is 21% higher than the one in one-stage process. This work is to investigate the maximum hydrogen and methane production by adding cassava residue concentration without pretreatment to cassava wastewater under thermophilic temperature using a two-stage upflow anaerobic sludge blanket (UASB) system. The removal of the cellulosic fraction of added cassava residue was also investigated. The UASB was fed at a COD loading rate of 12 kg/m^3d based on the methane bioreactor without added cassava residue. The system was operated at different cassava residue concentration

(ranging from 300 to 1,500 mg/l) in order to determine an optimum cassava residue concentration.