CHAPTER I
INTRODUCTION

The energy problem is one of the most important issues seeming endless and continually affects all human beings directly. The price of crude oil in the world market has been, however, increased from time to time, and the quantity of crude oil available is decreasing with the shortage of fuel oils in Thailand. Each year Thailand depends on imported energy from foreign sources. On the environmental perspective, the use of fossil fuel resources such as oil, gas, and coal shows adverse effects. They can cause emission of carbon dioxide that is one of main greenhouse gases causing the global climate change. Today, many people in Thailand are aware that the country has to be responsible for solving the global climate change. Therefore, we need to review the present energy policies in order to respond to this problem and our country involvement in the sustainable development of "Clean" renewable energy. Renewable energy includes various solar heat, wind energy, geothermal heat, and biomass energy. Especially, the energy stored in biomass can be released by burning the materials such as wood, manure, biological waste products, and other natural materials directly or by feeding it to microorganisms that use it to make biogas (Manginot, 2013).

Commonly, biogas is generated from organic matter decomposing under anaerobic conditions in the open, or in captive anaerobic digesters, or in the guts of large ruminant animals, or by termites and some other smaller organisms (Abbasi *et al.*, 2012). Nowadays, there are the numbers of research works considering the biogas production by anaerobic digestion of biodegradable materials such as manure, sewage, municipal waste, plant materials, and crops (www.nnfcc.co.uk).

Anaerobic digestion is presently outstanding and effective technology. It is a biological process, which helps to degrade organic matter in the absence of oxygen. The organic matter is degraded partially by the combined action of several types of microorganisms. The process stages of anaerobic digestion are hydrolysis, acidogenesis, acetogenesis, and methanogenesis (Rapport *et al.*, 2008). Generated biogas is a primary mixture of methane and carbon dioxide. However, biogas gathers a large variety of gases resulting from different sources of biogas production and

specific treatment processes. According to its compositions, biogas has interesting characteristics. Especially, biogas has a good calorific value similar to natural gas and propane (www.biogas-renewable-energy.info).

In this research, biogas was produced from the main materials that were cassava wastewater and cassava residue. The characteristics of the cassava wastewater indicate its use as feedstock for biogas production that is potentially strong in methane because it is acidic with high organic matter content (soluble carbohydrates and proteins) and suspended solids (lipids and non-soluble carbohydrates-starch or cellulose fibers). Besides, it also has very high chemical oxygen demand (COD) and biochemical oxygen demand (BOD) (www.fao.org). Although cassava residue can be used as feedstock, there is lignocellulose that is composed of carbohydrate polymers (cellulose, hemicellulose) and an aromatic polymer (lignin). These form structures called microfibrils that cause high structural stability in the plant cell wall (Robin, 2008). As a result, anaerobic microorganisms may not be able to digest cassava residue by anaerobic hydrolysis.

Therefore, this research work was conducted to investigate ways to enhance anaerobic digestion of this lignocellulose by studying likelihood of supplying microaeration to enhance the hydrolysis of cassava wastewater with added cassava residue. A continuous stirred tank reactor (CSTR) was used as the anaerobic digester. Investigated parameters included different characteristics of cassava wastewater, fiber content of cassava residue, and gas compositions to find the optimum conditions of experiment for hydrolysis.