



CHAPTER I INTRODUCTION

1.1 Energy Situation in Thailand

In order to secure sustainable development and energy security, the Thai government has declared a renewable energy development program by planned to increase the national renewable energy share up to 20% by the year 2022 (EPPO, 2009). The pyrolytic liquid from biomass pyrolysis can play an important role as renewable energy sources. Liquid from biomass so called “bio-oil” has been reported that it has considerably high potential not only for using as substituted fossil fuels, but also for refining and further using as fine chemicals (Bridgwater and Peacocke, 2000).

Among all renewables, biomass is the most widely used renewable energy sources (11.6% of the primary energy demand at the present). Besides biomass, waste materials exhibit a considerable potential for energy production. Recently, many research groups have paid attention on the studies of the conversion of waste materials into energy and commodity chemicals (Demirbas, 1998; Werther and Ogada, 1999; Bridgwater, 2003). Since, the conversion of wastes to energy/chemicals will benefit on environment. Even so, the knowledge of these technologies is still insufficient and hence, it is still challenges for all scientists and engineers to develop the knowledge for these important technologies.

1.2 Waste to Energy

Utilization of waste for energy production provides not only an advantage on a recovery of energy and valuable matters but also a sustainable waste stabilization . Several kinds of waste such as municipal solid waste (MSW), plastics, agricultural residues and sewage sludge are considered to potentially use for energy production. This can be achieved by several means. For example, biochemical conversion such as fermentation and thermal conversion processes such as liquefaction, gasification and pyrolysis.

In this contribution, the conversion of sewage sludge to liquid fuels and chemicals are emphasized. Sewage sludge is regarded as a residue produced by the wastewater/water treatment processes. Beside the energy production point of view, the idea of sewage sludge utilization by pyrolysis was the most efficient disposal way. Pyrolysis provides the advantages over conventional sewage sludge treatment methods such as incineration, landfill and use for agricultural purpose. Incineration system is the energy intensive process. Moreover, an extra off-gas treatment unit is required. Landfill requires a lot of space and probably causes new problems of the leaches and/or gas releases. For agricultural use, pathogenic organisms and heavy metals containing in sludge are released directly to surrounding. Therefore, pyrolysis process may be a promising solution. However, research and development for an advanced pyrolysis technology is still being in progress.

1.3 Objective

Pyrolysis processes are utilized in the commercial production of a wide range of fuels, solvents, chemicals, and other products. The sewage sludge pyrolysis can be described as the direct thermal decomposition of the organic components in sewage sludge in the absence of oxygen to yield an array of useful products. Improvements continue to be made today for efficient pyrolysis technology. To complete the efficient pyrolysis process, the fundamental understanding of the pyrolysis processes, the optimum process conditions, the typical products yield and their chemical compositions including the upgrading of pyrolysis products are required. Therefore, in this thesis, the basic chemistry of pyrolysis of sewage sludge is discussed. The pyrolysis liquid contains the significant amounts of oxygenated compounds. The proper upgrading via deoxygenation is to be accomplished. Therefore, the upgrading of pyrolysis liquid using the catalytic deoxygenation reaction is illustrated. Moreover, the solid derived from the pyrolysis is study for combustion reactivity. Apart from the energetic applications, the solid products can be used in environmental application as a cheap adsorbent. The information collected will useful to develop the pyrolysis of sewage sludge system in the near future.