CHAPTER I
INTRODUCTION

Sulphur compounds are the most common found in crude oil and natural gas (example mercaptans, sulfides, bensothiophene and dibenzothiophene). All sulphur compounds are removed and converted to hydrocarbon compound and hydrogen sulfide (H_2S) by using hydrodesulfurization unit before transferring crude to conversion unit. The hydrogensulfide was converted to liquid sulphur for preventing emission into the air, then cause of acid rain.

In Thailand, there are many large and complex refineries to produce petroleum products. In addition, with the advent of regulation in low sulphur diesel and gasoline, and ever-increasing amount of liquid sulphur can be easily forecasted, a high amount of liquid sulphur is obtained as residue from the process. From a previous study of liquid sulphur products and derivatives by PPC and Thaioil group, to enhance the value of liquid sulphur, four main applications of liquid sulphur derivative are dominant: sulphuric acid, sulphite, sulphur-based anionic surfactant, and sulphur bentonite. Sulphur bentonite is the most effective outlet of liquid sulphur based on the availability of technology providers, the highest expect margin, innovation perspective, and the largest percentage of liquid sulphur requirement.

Every year, crop is harvested, a portion of the available sulphur is depleted and a portion is returned to soil as residue and converted into organic matter. But in the cropping system, it tends to remove more sulphur than being replaced. So the sulphur fertilizers are required for soil supplement. There are various chemical and physical forms of sulphur fertilizer such as sulfate fertilizes (example ammonium sulfate and potassium sulfate) and another one is elemental sulphur in different physical forms. For the sulphate fertilizer, it provides an immediate source of sulfate to the plant, but sulfate is easy to leaching loss. The elemental sulphur fertilizer has high concentration of 70-100wt% sulphur and greatly physical characteristic. Element sulphur is oxidized to sulfate before it can be taken up by plant. Release of an available sulfate form sulphur prill depends on 2 processes; 1) physical dispersion of the pill and 2) oxidation to sulfate. The benefits of elemental sulphur are a continual releasing of sulfate during the growth season and minimal sulfate leaching

loses. However, the oxidation process depends on soil moisture, temperature, bacteria activity, time, and particle size. The particle size of sulphur is the most crucial factor, especially the small particle sizes are easily dispersed and oxidized.

For preparing sulphur bentonite, molten sulphur has been mixed with bentonite to form a safe and easy to apply product. The principle is that when the clay absorbs water and swell, it makes pill fracture and disperses to small particles of sulphur. From the previous work (Riley *et al.*, 2000), the yield of crops, total sulphur uptake, and extractable soil sulfate of sulpher bentonite were less than ammonium sulfate and micronized sulphur fertilizer, because the sulphur particles were not small enough and slow dispersion.

The purpose of this work aims to formulate a novel sulphur bentonite by using liquid sulphur that was provided by a local refinery plant and our modified bentonite clay. The methodology is divided into 2 parts. First, the sulphur particle size was reduced by modifying bentonite clay, porous clay heterostructure (PCH) and organomodified bentonite in order to control particle size of sulphur. Second, the optimized ratio of sulphur and bentonite clay was investigated in order to get the maximum sulfate available in soil, yield and symptoms of soybean.