CHAPTER I

INTRODUCTION

1.1 Background

The automobile has become an indispensable means of transportation for many households throughout the world. As a result, more than 330 million waste tires are discarded each year. Such tires have become the serious waste disposal problem and environmental pollution. Several attempts have been made to relieve these problems, for example, disposal in landfill sites, design longer-life tires, recycling into new tires, or using as dock bumpers, playground equipment, *etc.* However, from environmental and economical points of view, a much better solution is to convert such waste tires to valuable products.

Activated carbon has been widely used as adsorbents in both gas-phase and liquid-phase separation processes and can be produced from various carbonaceous materials, for instance, coal, coconut shell, wood, and polymer scrap. It has been reported that activated carbons can also be obtained from municipal and industrial wastes such as PET waste and refuse derived fuel (RDF). Waste tires represent another interesting source for activated carbons because of thier high carbon content. As the production of activated carbon from waste tires changes hard-to-dispose waste to pollution-cleaning adsorbents, it is considered to be a doubly effective solution for environmental pollution.

Generally, activated carbon is used for treating wastewater in many industries, for example, food, textile, chemical and pharmaceutical. However, in some applications, especially that involve large molecules or macromolecules

which can not be adsorbed into micropores (< 2 nm), the activated carbons should possess not only micropores but also mesopores (2-50 nm).

Practically, the feasibility of the carbon adsorption process depends greatly on the cost of regeneration. Thermal regeneration is the most common method, but 5-10% of carbon is lost by attrition and burning during each cycle, and the cost of fuel can not be neglected. Therefore, solvent regeneration in which no carbon attrition occurs is the other interesting alternative.

1.2 Objectives of Study

1.2.1 To produce high-performance activated carbon from waste tires

1.2.2 To investigate the effect of chemical pre-treatment on properties of activated carbon

1.2.3 To investigate the potential application of the obtained activated carbon in wastewater treatment

1.3 Scope of Study

1.3.1 Preparation of activated carbon from two types of raw materials (vulcanized and decrosslinked waste tires) by a series of experiments:

1.3.1.1 Carbonization at temperatures in the range of 500-850^{O}C

1.3.1.2 Activation with steam at temperatures between 750-950^{O}C

1.3.1.3 Acid treatment by HCl and HNO_3 at room temperature prior to steam activation

1.3.1.4 Chemical pretreatment by mixing metal compounds such as $Ca(OH)_2$, ZnO, Fe_2O_3, and KNO_3 to waste tires before carbonization

1.3.2 Characterization of the prepared activated carbon:

1.3.2.1 Micropore and mesopore volumes

1.3.2.2 BET surface area

1.3.2.3 Pore size distribution

1.3.2.4 Adsorption test, for instance, Iodine Number and Methylene Blue Number

1.3.2.5 Physico-chemical properties such as volatile matter, ash content, moisture content, and bulk density

1.3.3 Potential application of the obtained activated carbon in batch liquid-phase adsorption of wastewater from, for example, phenol and dyes by determining adsorption-desorption characteristics including solvent regeneration

1.4 Obtained Benefits

1.4.1 Problems in the management of waste tires will be reduced.

1.4.2 Understanding in the effect of chemical pre-treatment on porous properties of activated carbon will be obtained.

1.4.3 High-performance activated carbon used in wastewater treatment will be obtained.