CHAPTER I
INTRODUCTION

Natural gas, the cleanest fossil fuel, consists methane as a main component, is currently used in transportation sector in Thailand. Consumption of the natural gas as a fuel for vehicle is rapidly increased. Using natural gas as a fuel, storage method must be safe and effective. There are three different storage methods including Compressed Natural Gas (CNG), Liquefied Natural Gas (LNG), and Adsorbed Natural Gas (ANG). In Thailand, CNG is widely used for the natural gas storage by compressing and storing under high pressure over 3,600 psi.

However, energy density of compressed natural gas is low comparing to other liquid fuels. Energy density of CNG is approximately only one-third of gasoline (11 MJ/L for compressed natural gas at 3,600 psi compared with 32 MJ/L for gasoline) (Burchell *et al.*, 2000).

Due to a low energy density in CNG system, a vehicle requires re-filling more often at service station. CNG requires high pressure condition thus the investment for both tank storage and refilling station are high. To increase the travel distance per one fill up, the storage capacity needs to be improved. It has been suggested that a porous material such as activated carbon can adsorb natural gas due to high surface areas and high porosity, activated carbon can increase the capacity of natural gas storage.

Several techniques have been developed for methane storage in porous materials such as activated carbons. Ozone treatment is one of the interesting surface modification methods. Numerous studies of chemisorption of ozone on activated carbon (Kingsley and Davidson, 2006; Metts and Batterman, 2006; Park and Jin, 2005) have shown that ozone can react with carbon on the surface. With a strong oxidation power, this gaseous treatment causes severe degradation and excessive pitting of carbon surface which directly effect to the surface area, pore volume and pore size diameter of activated carbon. These properties play an important role in methane adsorption (Salehi *et al.*, 2007). The measurement of pure methane gas adsorption was carried out by both gravimetric (Dreisbach *et al.*, 1999) and volumetric method (Salehi *et al.*, 2007). In addition, increasing in pressure and decreasing in temperature can increase the amount of methane uptake (Delaver *et al.*, 2010).

The purpose of this work is to explore the possibility to use ozone to treat activated carbon. Methane adsorption will be measured by volumetric apparatus under the pressure up to 900 psia and the temperature at 35°C in various treatment times. The effect of treatment time will be investigated. In addition, the physical properties of the activated carbons are characterized by Fourier Transform Infrared Spectrophotometer (FTIR) and Brunauer, Emmett and Teller (BET) surface analysis.