

## CHAPTER I

### INTRODUCTION

Mercury can be present in gas condensate in its metallic form and/or organometallic compounds with boiling points comparable to that of the range of the condensate (Shafawi *et al.*, 2000). In fact, mercury has been detected and reported in petroleum fluids from a number of locations around the world. Areas where are particularly affected are Netherlands and Germany, but also in Canada, USA, Malaysia, Brunei, and latterly in the North Sea (Edmonds *et al.*, 1996). In Thailand, mercury has been found and reported by Unocal (Thailand) with the range of mercury concentrations in the natural gas and condensate of 10-25 µg/m<sup>3</sup> and 500-800 µg/l, respectively (Chongprasith *et al.*, 2001).

The significance of removing the mercury content is not only driven by environmental concern, but also driven by plant security and economic reasons. Two important operational factors that incite mercury removal are catalysts poisoning and equipment corrosion. Mercury and its compounds react with aluminium process equipment, forming an amalgam, which can lead to failure. McIntire *et al.* (1989), for example, described the failure of the aluminum heat exchangers in the ethylene plant of Cain Chemicals to mercury attack by processing Algerian condensate containing 26-40 ppb of Hg. In addition, corrosion of steel, chromium, brass and other copper and/or zinc alloys is also possible (Edmonds *et al.*, 1996). To protect the equipment and environment, it is desirable to remove the mercury from hydrocarbon condensates and crude oils or reduce it to levels that are as low as possible. In fact, it is becoming an important issue in petrochemical industry to develop an effective technology to remove mercury from condensate because of the gradual shift of ethylene plant feed stocks from naphtha to condensate.

Mercury removal systems for both gas and liquid hydrocarbon streams are commercially available. For liquid removal process, iodide impregnated carbon, metal sulfide on carbon or alumina, silver (on zeolite), mol-sieve and a two-step process consisting of a hydrogenation catalyst followed by metal

sulfide have been tested and used for removing mercury. However, Shafawi *et al.* (2000) mentioned that the removal of mercury from natural gas condensate is quite different to that from natural gas because it is in the liquid phase during the operation and the main types of mercury presented in the condensate are organometallic (> 80%). Besides, removal systems for natural gas condensates have not been thoroughly tested under real plant conditions. Only a few units have been installed in real plants and most of these were on a trial basis. One plant that possessed a mercury removal facility still experienced mercury contamination in their process steams because only mercury metal vapor was targeted. This was due to little or no information of the mercury species present in the streams.

To date, little research has been published on the feasibilities of adsorbents to the efficiency of mercury removal. Thus, the central purpose of this work is to study several kinds of the adsorbents in order to understand the adsorption mechanisms such as pore size effect and adsorption isotherm and to focus on the main problem in removing mercury by using organomercury (diphenylmercury, DPM) as a contaminant in n-heptane as a substitute condensate. The DPM concentration was prepared into two ranges, at low mercury concentration (2.0 mg/l) and at high mercury concentration (5.0 mg/l) for the studies.