

## CHAPTER I

### INTRODUCTION

Mercury in natural gas condensate could present under various chemical states : elementary, organometallic and inorganic salt generally in the ranges of 10 to 3000 ppb depending on the origin of the condensates (Didillon *et al.*, 2000). Mercury in most forms is highly toxic and particularly when present as the organomercury species, is a cause for environmental concern, the damage caused to industrial plants, particularly petrochemical plants (Shafawi *et al.*, 1999). Mercury presenting in the feed stream corrodes aluminum constructions and poisons catalyts and these effects have serious implications for the petroleum industry. 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 feedstocks from naphtha to condensate. In the past, the world has encountered many serious disasters involving mercury. For example, the aluminum heat exchanger in the Skikda facility, Algeria, was completely destroyed due to small amounts (1 ng to 100  $\mu\text{g}/\text{m}^3$ ) of mercury in natural gas. Similar problems have been reported from Groningen, Holland, and from fields in North Sea. Therefore, the significance of removing the mercury contents as low as possible is absolutely critical . It is not only driven by environmental toxicity, but also driven by plant security and financial crippling especially when unscheduled shut-downs are forced.

The technology for removal involves sorbents that are specifically reactive to certain mercury species. Several commercial processes are available for removing mercury and mercury compounds from hydrocarbons. Some commercial mercury removal systems are focused on the gas phase and some on liquid phase. Gas phase systems primarily involve sulfur-impregnated carbon, metal sulfide on carbon or alumina, and silver-impregnated zeolite. Mercury removal processes for liquid phase involve iodide-impregnated carbon, metal sulfide on carbon or alumina, a molecular sieve amalgam system and a two-step process consisting of a conversion catalyst (convert all species of mercury to metallic mercury in the first stage) followed by metal sulfide reaction with elemental mercury. Most mercury removal systems for liquids are chemically specific to one form of mercury, usually elemental. If the

feeds contain substantial amounts of ionic, dialkyl or complexed mercury, then the removal system may not be efficient. One mercury removal system for liquids employs process steps that are designed to hydrogenate dialkylmercury and subsequently treating to remove  $Hg^0$ . Dialkylmercury compounds do not amalgamate rapidly, hence, the molecular sieve amalgamation sorbents do not operate at high efficiencies if organic forms of mercury are present. Unfortunately, the main types of mercury present in the gas condensate are organometallic (>80%) (Shafawi *et al.*, 2000). In addition, 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 many of these are on a trial basis. One particular plant that operates a mercury removal facility is still experiencing mercury contamination in their process streams because only mercury metal vapor was targeted. This was due to little or no information of the mercury species present in the streams.

Although researches are performed to study the adsorption of mercury from gas condensates by activated carbon but they are mainly designed to focus to particular metallic mercury. In fact, there is also organomercury existing in liquid condensate.

In this research work, adsorption of diphenylmercury (DPM) in n-heptane on the commercial zeolite molecular sieves, NaX and NaY were carried out in batch system. The effects of temperature, water content in the adsorbents and other hydrocarbons normally presented in condensates on adsorption selectivity were studied. The selected hydrocarbons were cyclohexane, toluene, ethylbenzene and o-xylene were introduced one by one into n-heptane substituted condensates. The adsorption of DPM spiked in industrial heavy naphtha and real condensate were also carried out in continuous system.