CHAPTER I
INTRODUCTION

Mercury is one of the most frequently found contaminants in the geological hydrocarbons i.e. natural gas, crude oil, and gas condensates. Its presence can be in various forms such as metallic mercury, ionic compounds, organometallic compounds, and suspended mercury. As a matter of fact, mercury has been detected and reported in petroleum fluids from a number of locations around the world. The areas particularly affected are not only the Netherlands and Germany, but also Canada, USA, Malaysia, Brunei, and latterly in the North Sea (Edmonds *et al*., 1996). The mercury concentration in crude oil and natural gas is highly influenced by geological location and varies approximately between 0.01 ppb and 10,000 ppb (wt) (Wilhelm and Bloom, 2000). In the Gulf of Thailand, the range of mercury concentration found in natural gas and condensates are 10-25 and 0.5-0.8 $\mu g/m^3$, respectively (Chongprasith *et al.*, 2000). Not only suspended mercury compounds such as mercury sulfide usually present in crude oil and unprocessed gas condensates in a significant amount, dissolved species like elemental mercury and ionic halide are also substantial in petroleum fluids. This ionic mercury species is not yet verified whether it is naturally abundant or it exists due to post-collection conversion of other mercury species over a period of time (Wilhelm and Bloom, 2000). Additionally, organometallic compounds can be discovered in petroleum hydrocarbons but in a low concentration level.

Since mercury is widely known as a toxic and harmful substance, in Thailand, its concentration in water, sediments, and marine organisms has been monitored by the Division of Pollution Control Department (PCD) under the Ministry of Science, Technology and Environment (Chongprasith *et al.*, 2000). Apart from environmental pollution concern, mercury contaminated in oil and gas also has direct impacts on petroleum processing. Mercury in feeds is capable of poisoning the catalysts during downstream processes and degrading associated equipments. Mercury and its compounds are able to react with aluminium equipment, forming an amalgam, which can lead to failure. Moreover, corrosion of equipments made of steel, chromium, brass, and other copper and/or zinc alloys due to mercury effects are possible (Edmonds *et al.*, 1996). Mercury also has a significant effect on increasing both toxic waste generation and risk to the health and safety of workers during operation and maintenance processes (Wilhelm and Bloom, 2000). In order to avoid the negative effects from mercury, it is important to include the mercury removal system into the petroleum operation so that mercury will be reduced to the lowest possible level.

To initiate the mercury removal process, understanding of the solubility of mercury and speciation of mercury compounds in liquid hydrocarbons has become the critical issue. Temperature and pressure are the most important parameters affecting the solubility of mercury and its existing forms while being brought up from high temperature of down hole to ambient. Information regarding mercury solubility, existing forms, and transformation of mercury species in hydrocarbons will enhance the quality of treatment in both petroleum processing and environmental aspects. They shall influence the selection of mercury removal system and waste disposal processing.

In this research, solubility of metallic mercury in a series of aliphatic hydrocarbons and simulated condensate were studied at a range of increasing temperature from 5°C to 40°C, and also decreasing temperature in the same range so as to observe hysteresis. The employed analytical method followed the test procedure for analyzing total mercury and mercury species in liquid hydrocarbons by mercury analyzer NIC SP-3D (UOP 938-00). By this mean, the detection limit at ppb level could be achieved.