CHARPTER I
INTRODUCTION

The most important energy source for economic development in Thailand is petroleum. In 2012, Thailand consumed crude oil about 48,560 kilo ton of oil equivalent (ktoe). Crude oil 7,411 ktoe out of the total consumption is from domestic production and over 40,000 ktoe from an import (Ministry of energy, 2012). Crude oil production from a reservoir can be divided into three phases, i.e. primary recovery, secondary recovery and tertiary recovery. For a primary phase, oil is recovered by natural pressure of the reservoir or gravity drive, and artificial lift techniques. It can bring oil to the surface about 10 percent of the original oil in place (OOIP) in the reservoir. A secondary phase is used when oil can't be produced with its own pressure. These techniques include injecting fluid into the reservoir to displace oil which result in recovery about 20 to 40 percent of OOIP. A tertiary phase or enhanced oil recovery (EOR) can recover oil up to 60 percent of OOIP. There are three major categories of EOR, such as thermal recovery, gas injection and chemical injection.

EOR, such as thermal process and chemical injection are seem to use a higher operating cost than gas injection technique, which it can be applied for light to heavy oil. The gas injection considers the miscibility between oil and gas and thus, there is no phase boundary between the two phases. Without the phase boundary, gas will have a good mobility in oil that is most effective to recover oil from the reservoir. The injection gases used are nitrogen (N_2), carbon dioxide (CO_2) and light hydrocarbon. N_2 is the lowest cost of gas supply, but the miscibility between N_2 and oil requires high pressure. Sometimes the miscibility pressure can be higher than 3000 psi, which can fracture the reservoir. The most widely injection gas used is CO_2, however CO_2 is the greenhouse gas that leads to the global warming. Thus, the use of CO_2 injection gains two benefits, EOR and CO_2 storage in the reservoir. Capture and storage of CO_2 become a significant and important process to reduce the CO_2 emission into the atmosphere. The CO_2 injection process requires miscibility between oil and CO_2 gas. Minimum pressure required to achieve the miscibility is called minimum miscibility pressure (MMP).

CO_2-oil MMP is mostly used to screen and select reservoir for a gas injection technique. MMP depends on reservoir temperature, purity of gas injected and oil composition. There are several methods to measure MMP, slim-tube apparatus (Elsharkawy *et al.*, 1996), rising bubble apparatus or RBA (Christiansen and Haines, 1987), vanishing interfacial tension or VIT (Rao, 1997), swelling/extraction method (Tsau, 2010) and extraction method (Siagian and Grigg, 1998), however, the slim-tube apparatus and the RBA method are most frequently used. RBA is considered as more accuracy method than the slim-tube method (Dong *et al.*, 2001). . VIT and the extraction methods are time-consuming and expensive, especially the costs of equipment for measurement are very expensive and not widely use in a small company and university. In addition to the MMP measurement, there are many correlations which are used to calculate MMP, such as Alston correlation, Li *et al.* correlation etc. (Li *et al.*, 2012).

In this work, MMP was measured by using the pressure decay technique with high purity CO_2 in a Parr reactor. Petroleum samples were liquid hydrocarbon and PTTEP Lan Krabue crude. Effect of pressure and temperature were studied.