CHAPTER I
INTRODUCTION

Crude oil is a mixture of hydrocarbons and organic compounds and it can be divided into four major groups: saturates, aromatics, resins, and asphaltenes (SARA) (Hammami *et al.*, 2007). Asphaltenes are a fraction of crude oil with a high polarity and high molecular weight. Their structures are composed of complex combination of aromatic rings, trace amount of heteroatoms (S, N, and O) and metals, such as nickel and vanadium (Ancheyta *et al.*, 2002).

Asphaltenes are defined as a fraction of oil soluble in aromatics, such as toluene or benzene, and insoluble in light alkanes, such as n-heptane or n-pentane. They are a brown and black solid with no definite melting point (Nalwaya *et al.*, 1999) (Speight, 2001). Asphaltenes can destabilize during oil production by change in temperature, pressure or composition. The destabilized asphaltenes tend to aggregate into clusters, precipitate and block pore-spaces in pipelines, causing possible damage to the petroleum reservoirs. Furthermore, asphaltenes cause equipment fouling and catalyst deactivation (Wattana, 2004). These problems lead to loss in productivity of crude oil during transportation, production and processing (Maqbool *et al.*, 2011).

In order to solve these problems, many researchers had attempted to understand the precipitation of asphaltenes from crude oils. The method that is widely used in the oil industry is an ASTM standard procedure. These experimental measurements based on ASTM standard were run either instantaneously or on short time scales which lead to the effect of time on precipitation being negligible.

Recently, Angel *et al.* (2006) and Maqbool *et al.* (2009) have discovered that kinetics plays a role in asphaltene precipitation. Their results showed that at low precipitant concentrations, it can take long periods of time (days to weeks and even months) for asphaltenes to precipitate and become detectable under the microscope. These results challenge the assumption proposed by earlier studies of asphaltene precipitation being instantaneous. The physical properties of asphaltenes and solution such as solubility parameter and viscosity were used to explain the physical properties that control aggregation rates of asphaltenes in this study. The characterization experiments were also used in this study to identify the differences in properties of asphaltenes precipitated at different times and precipitant concentrations. Different characterization techniques were used to measure asphaltene properties such as solubility, nanoaggregate size, aromaticity and heteroatom and metal contents. Other cut except cut 1, the asphaltenes that precipitated earlier have larger nanoaggregate sizes, heteroatoms and metal contents.