CHAPTER I
INTRODUCTION

In recent years, the conventional crude oil resources are getting depleted and the oil industry has begun to explore and exploit abundant unconventional heavy oil reserves. Process like vapor extraction process (VAPEX) is being used to recover heavy oil. Heavy oil usually contains more than 10wt% of asphaltene content (Luo et al., 2009).

Asphaltenes are the heaviest and most complex fraction of crude oil. It is a brown and black powdery material, consists of condensed polynuclear aromatics and contains small amounts of heteroatoms (S, N, and O), and traces of nickel, vanadium and iron. Asphaltenes are also the fractions that precipitate upon the addition of n-alkanes at a solvent to oil ratio of 40:1 or ASTM D3279 method (Trejo et al., 2004).

Precipitation of asphaltenes induces the wettability of the reservoir matrix and consequently affects the flood performance. It can also cause formation damage and wellbore plugging, requiring expensive treatment and cleanup procedure (Ibrahim et al., 2004). One other problem asphaltenes can cause is in the process of catalytic hydrotreating of heavy oils. Asphaltenes are known to be coke precursors and deactivates the catalysts (Trejo et al., 2004).

Extensive works have been done on asphaltene precipitation and it has been proved that it is a time dependent process and is a function of precipitant (i.e. n-alkane) concentration (Maqbool et al., 2009). It is not known why asphaltenes from the same crude oil precipitate at different times. One possible hypothesis is that different fractions of asphaltenes have different physical and chemical properties that affect the aggregation-precipitation rate.

Investigating this hypothesis had led to extensive characterization of asphaltenes using different techniques. In general, properties of asphaltenes such as their nanoaggregate size, aromaticity, length of aliphatic side chains, polarity and their elemental composition have been focus of these studies (Spiecker et al., 2003).The most common characterization techniques used are Nuclear Magnetic Resonance (NMR), Fourier Transform Infrared (FTIR), Vapor Pressure Osmometry (VPO), Small-Angle X-ray Scattering (SAXS), Small-Angle Neutron Scattering (SANS), X-Ray Diffraction (XRD), Elemental Analysis (EA) and Inductively Coupled Plasma Mass Spectrometry (ICP-MS).

In this study, SAXS, NMR, EA and ICP-MS were used to characterize the time based fractionation of n-heptane derived asphaltenes from crude oil A1.Centrifugation based separation technique developed by Maqbool et al. (2009) will be used to quantify the amount of asphaltene precipitated at different times. Microscopy experiments were also used to achieve the aim of correlating the properties of time based asphaltene fractions to their aggregation behavior.