CHAPTER I
INTRODUCTION

Asphaltenes are a polydisperse mixture of the heaviest and most polarizable fraction of the crude oil. Asphaltenes are defined as the solubility class of petroleum which are insoluble in normal alkanes such as n-pentane or n-heptane but soluble aromatics, like benzene or toluene. It is generally believed that asphaltenes are composed of peri-condensed aromatic rings with a variety of alkyl groups. Asphaltenes also contain heteroatoms, i.e. nitrogen, sulfur and oxygen (N, S and O) and some trace metals such as iron, nickel and vanadium (Fe, Ni and V) and have a wide range of molecular weights (Xie *et al.*, 2005). Separation of asphaltenes from crude oil can occur due to variations in temperature, pressure and composition (Mullin, 2007). Once asphaltenes are destabilized there is a potential for them to deposit or flocculate and plug production equipment.

Flow assurance is a major consideration for planning and operation of petroleum extraction and processing. During production and transportation, asphaltenes tend to aggregate and deposit in porous rock, wellbores, pipelines and production equipment. The damage from deposition causes a serious problems resulting in reduced production and large cost to remove the deposit (Abdallah *et al.*, 2007). It is necessary to understand the mechanism of asphaltene deposition to improve the prediction and prevention of deposits.

Many researchers have studied asphaltene stability, which is the first step of the deposition process. Two types of models, solubility and colloidal, have been developed to explain the stability (Nabzar *et al.*, 2008; Vargas *et al.*, 2010). Experimentally, the deposition process has been measured using core samples (Papadimitriou *et al.*, 2007), capillaries of various materials (Boek *et al.*, 2008) and with a quartz crystal microbalance (QCM) but these experiments have not been able to explain the asphaltene deposition mechanism.

The primary purpose of this work is to validate and standardize capillary deposition experiments by improving the current apparatus. Reproducibility is needed to before conclusions can be made on the asphaltene deposition process.