# CHAPTER I
# INTRODUCTION

Crude oils are complex mixtures of hydrocarbons and are commonly divided into several classes according to their polarity property. The classes are: Saturates, Aromatics, Resins, and Asphaltenes (SARA analysis) (Yarranton *et al.*, 1996). Asphaltenes are the heaviest fraction in crude oils and defined as the fraction that is insoluble in light normal alkanes (n-heptane or n-pentane) and soluble in toluene (Speight, 1991 and Tojima *et al.*, 1998). The other definition of asphaltene is the heaviest and most polar component of crude oils. This fraction contains aliphatic (or naphtenic) and aromatic structures (Yen *et al.*, 1961), as well as small amounts of heteroatoms: sulfur (S), oxygen (O), nitrogen (N) (Moschopdis *et al.*, 1976), and some of metals, such as iron, vanadium and nickel (Speight, 1991). Because asphaltenes contain a variety of heteroatoms and polar functional groups, for examples aldehyde, carbonyl, carboxylic acid, amine, and amide, they may perform acid-base interaction with each other and associate into micellar-like aggregates in a solution (Chang and Fogler, 1996 and Schechter, 1992). Hence, asphaltenes can be dissolved in crude oils by this micelle aggregation or colloids that are dispersed by the adsorption of resins on the surface of small particle (Socrates *et al.*, 1995). Resins are known to have a lower molecular weight than asphaltenes that including in maltene part of crude oil. Resins perform as a peptizing agent of colloid stabilizer by neutralization mechanism. Because of dissolution of resins in alkane solvents, this tends to be desorbed or re-peptized from the asphaltene surface, which can be the cause of insoluble of asphaltenes in crude oil. Then the asphaltene particles begin flocculating to form larger entities (Altgelt and Boduszynski, 1944).

Because of their definition, asphaltenes are generally incompatible with light petroleum fractions leading to undesirable effects in many stages of petroleum industry. Asphaltenes tend to precipitate from variation of temperature, pressure and composition under production conditions, and plug reservoir pore space as well as deposition in downstream equipment leading to serious problems (i.e. explosion or corrosion) in the petroleum refinery (Theophylaktos *et al.*, 2001). Moreover, they sometimes can stabilize water-in-oil emulsions which influence the efficiency of oil

recovery (Altgelt and Boduszynski, 1944). Thus, most of the researchers have focused on asphaltene and particular heavy portions in order to solve the problem.

In attempting to describe behavior of asphaltenes in many processes such as solubility and precipitation, various approaches have been tried to characterize asphaltene properties (Yarranton *et al.*, 1996). The numerous of experimental data and models have been used. Due to lacking of clarified knowledge of asphaltene, several models, which have been developed for predicting asphaltene behaviors, were not successful. Hence, the urgent research topic of asphaltene is to figure out the properties of asphaltene and try to understand more complicated asphaltene reactions. Molecular weight is one of the most important properties which can be used as the connector to reach the other properties.

This research proposed was to predict the molecular weight of asphaltenes using experimental solubility data. The molecular weight in turn can be used to construct possible asphaltene structures. The molecular weight and structure are the general properties, which lead to a better understanding of the complex properties of asphaltenes.