CHAPTER I
INTRODUCTION

Crude oil is a mixture, which can be separated by fractionation distillation into a variety of commercially known fractions. They are beginning with napthas followed by gasoline, kerosene, gas oils, and ending with residuum. Under normal reservoir conditions, the crude oil is a single phase liquid. When crude oil is produced, it can undergo phase changes as a result of changing in temperature and/or pressure, asphaltic sludge during acidization treatments, and the use of enhanced oil recovery techniques such as water floods and carbon dioxide floods. Asphaltene precipitates in crude have been normally found in the near wellbore regions of the formation (Izquierdo and Rivas, 1997).

Asphaltene may be defined as the heaviest and most polar component of crude oil that is insoluble in a light normal alkane but soluble in an aromatic solvent. Asphaltene consists of polyaromatics nuclei carrying aliphatic chains or rings, variety of functional groups and heteroatoms such as sulfur, oxygen, nitrogen, vanadium and nickel (Speight, 1997).

Based on the concept embodied in the physical model, asphaltenes exist in the oil in colloidal suspension, and are stabilized by resins (see Figure 1.1). The short-range steric intermolecular repulsive force between resin molecules adsorbed on different asphaltene kernel keeps them from flocculating. There is also another weaker and no longer range repulsive force present between the asphaltene particles because of their same electrical charge. These repulsive forces can be overcome or neutralized by mechanical (large repulsive drop, agitation) or electrical (opposing streaming potential) means (Leontaritis, 1989).

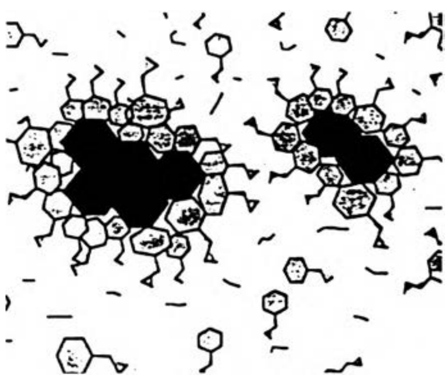

Figure 1.1 Peptization of asphaltene with resins

Asphaltene deposition is an important phenomenon in the petroleum industry, which causes serious problem in production, transportation, and processing. Asphaltene is well recognized around the world as manifested by the extensive economic damage. It can block the pore throats, which cause a reduction in permeability. The formation can become more oil-wet and change the relative-permeability relationships. Asphaltenes can promote water-in-oil emulsions leading to much higher viscosities. In the wellbore and surface facilities, asphaltene deposits will gradually reduce the area for flow, resulting in the need of higher pressure to maintain the oil production. Deposition in downhole safety valves may interfere with their proper operation. Buildup in tubing may damage wireline tools or require different running procedure (Jamaluddin, 1996).

Chemical treatment method was commonly employed to clean up deposits and to prevent their formation. The most frequently used solvents for clean up are toluene and xylene. Attempts of replacement of these chemicals have been tried because of their environmental unacceptance and their high costs. Mechanical scraping is the most common procedure for cleaning facilities and downhole tubing but this is apparently inappropriate for formation rejuvenation (Jamaluddin, 1996).

Special chemicals based on alkyl-benzene-derived amphiphiles have been designed to treat formation plugging caused by asphaltene precipitation. Amphiphiles with strong polar head groups such as sulfonic acid, and moderate to long alkyl tail groups have been recommended as strong solvents for dissolving asphaltenes. Dodecylbenzene sulfonic acid (DBSA) was found quite effective in redissolving asphaltene deposited in a porous reservoir core (Jamaluddin, 1996).

It is very interesting to point out that the properties of asphaltenes can be changed significantly due to the elapse time during oil production. Therefore, in this study, aged asphaltenes were studied to demonstrate this problem.