CHAPTER I
INTRODUCTION

Many studies about wetting of various solids have been conducted that contributed wide applications such in coating, flow, flotation, printing, lubrication, drying, oil recovery from porous rocks, detergency, and other chemical processes. The process of wetting can be modified by adding surfactants to reduce the high surface tension which will help spreading the solution on solid surfaces. In most industrial processes, a single surface-active agent is not commonly applied, but rather a mixture of different surfactants and co-surfactants. Wetting is characterized qualitatively in terms of contact angle. The smaller the contact angle, the better wetting on the solid surface will be achieved, thus, 0^o contact angle shows complete wetting, 180^o non-wetting, and in between 0^0 to 180^0 implies partial wetting (Marmur, 1996). Alteration of wetting by liquids is often complicated to attain, in order to advance the contact angle, it requires series of experiments for which small amount of surfactants are added.

Surfactants can be used as wetting agents and recognized as important substance in spreading aqueous solutions on surfaces that composed of hydrophobic and hydrophilic portion. When added to a solution, surfactants adsorb to both the liquid–solid and liquid–vapor interfaces, which causes in lower interfacial tension (γ). The spreading of solution even into hydrophobic surface can be characterized by spread coefficient (S), which is given by (Rosen, 2004):

$$(S_{l/v}) = \gamma_{SV} - \gamma_{LV} - \gamma_{SL} \qquad (1)$$

where γ_{SV} is the solid-vapor surface tension, γ_{SL} is the solid-liquid surface tension, and γ_{LV} is the liquid-vapor surface tension. The common problem of wetting agent is changing the solution in undesired manner. In practice, concentration of wetting agent needs thorough preparation.

Reduction of interfacial tension entails better wetting which can be quantified by measuring the contact angle (θ) using different methods, but theoretically most precise and commonly used technique for obtaining the contact angle is the sessile drop (Hernainz and Caro, 2001). This technique uses software like Drop Shape

Analysis (DSA) with the precision of 5 degree error that carries the measurement of contact angle from a drop of liquid resting on a smooth surface of the solid with a goniometric scale from a photograph of the drop profile as done in the previous work (Luangpirom et al., 2001 and Balasuwatthi et al., 2003). The contact angle is formed on the liquid side of the tangential line drawn through the three phase boundary where a liquid, gas and solid intersect as shown in Figure 1.1 (Mittal, 1999). Young equation which is given by (Rosen, 2004, Kwok et al., 1998, and Marmur, 1996):

$$\gamma_{SV} - \gamma_{SL} = \gamma_{LV} \cos\theta \qquad (2)$$

is widely used to calculate the value of contact angle provided that the solid surface is smooth, chemically homogeneous, rigid/nonporous, and non-reactive.

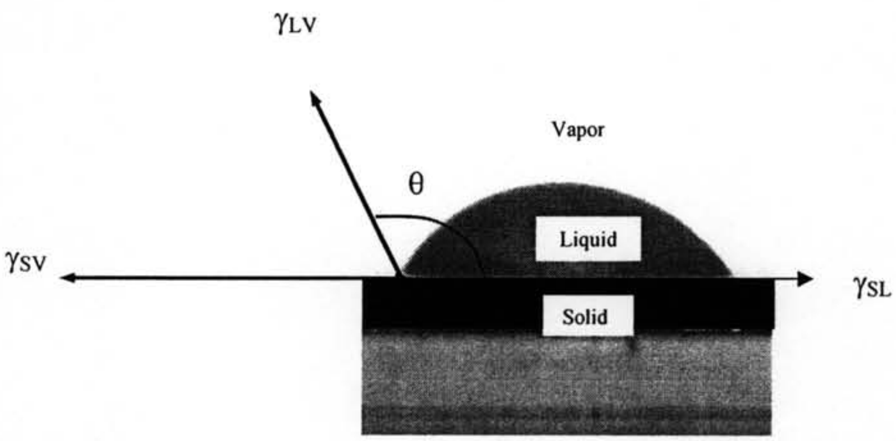

Figure 1.1 Schematic diagrams for Young's equation

Series of studies have been conducted for contact angle of surfactant solutions on precipitated surfactant surface since 2000. In part I, contact angle of various precipitated surfactants was measured using its corresponding saturated solution (Dechabumphen et al., 2001). In Part II, effects on contact angle of sodium and calcium salts of alkyl sulfates on the surface of precipitated surfactant with saturated surfactant in the solution was dealt including subsaturated sodium dodecyl sulfate (SDS) solution onto precipitated calcium dodecanoate (CaC_{12}) as soap scum and found out that subsaturated surfactant helped effectively in improving wettability (Balasuwatthi et al.,2003). In Part III, the wetting on CaC_{12} precipitate was investigated by dropping its saturated solution with subsaturated surfactants solutions including the effect of added NaCl with NaDS, of a nonionic surfactant, and of a low molecular weight fatty acid which was found out that n-octanoic acid sodium salt (NaC_8) was the most effective wetting agent followed by SDS, and nonylphenol ethoxylate (NPE) (Luepakdeesakoon et al., 2004). NaDS has wide applications in chemical processes, but once exposed with calcium ions it forms calcium dodecyl sulfate (CDS) precipitate. This paper further investigates the effect of the anionic surfactants (NaC_8 and SDeS) and non ionic surfactant (NPE (EO9)) as wetting agents, on the CDS system.