CHAPTER I
INTRODUCTION

Detergency, or removal of soil, is a complex kinetic process that includes contributions from many factors such as physical properties of the wash system, time, and temperature of wash, hydrodynamic force exerted during the wash process, the substrates, additives (builders, enzymes, antideposition agents), water hardness, and electrolyte level (Verma *et al.,* 1998; Azemar, 1997; Whang *et al.,* 2001). The soil present may be classified as particulates (solid, usually inorganic), oily (usually organic and liquid), and strains (unwanted dyestuffs) (Carroll, 1996). Due to the great variability of substrates and soils, there is no one single mechanism of detergency but a number of different mechanisms depending on the nature of the substrate and soil (Rosen, 1988).

Many research works attend to study the oily soil removal due to its widespread applications in efficacy of soaps, detergents, shampoos, delivery of emollients through skin creams, and enhanced tertiary oil recovery. However, the current level of understanding of oily soil removal mechanisms is only qualitatively adequate (Verma *et al.,* 1998). Therefore, the mechanisms of oily soil removal is necessary to study for better understanding of detergency on fabric surfaces and approving the detergency to high efficiency to soil removal.

The rolling-up process is primarily the most important mechanism for oily soil removal, which is facilitated by an increase in contact angle exhibited by the oil droplet on the substrates in the presence of a wash system (Verma *et al.,* 1998). Although the roll-up has been accepted as the predominant mechanism in oily soil removal, other mechanisms such as solubilization-emulsification are believed to play an important role in detergency process as well (Othmer, 1980; Kissa, 1987; Rosen, 1988). Many systems having high solubilization are resulted from microemulsion formation. Since microemulsions exhibit an ultralow interfacial tension at their own oil-water interface and process high limits for oil solubilization that is favorable for soil removal, most recent literatures have emphasized on the correlation of microemulsion and detergency (Raney *et al.,* 1987).

It has been known that the maximum detergency corresponds to the optimum condition in the middle phase. Surfactant formulation system is the one important factor in forming a middle phase. In a nonionic surfactant system, the point at the optimum is known as phase inversion temperature (PIT). For a system with ionic surfactant, salt concentration at the optimum point in the middle phase is known as the optimum condition, which has the lowest interfacial tension (Broze, 1994). Moreover, the detergency performance is dependent on several operating parameters such as salt concentration, surfactant concentration, temperature, washing time, rinsing time, and agitation speed (Linfield *et al.,* 1962; Germain, 2002).

Most of detergent formulation and performance research works studied the removal of human sebum, fatty acid, oleic acid, triolein and squalene. It seems to be a little particular investigation on the unsaturated oily soil. However, the studies of saturated oily soil removal is interesting since some parts of task associated with the saturated oily soil. Especially, motor oil stains found on work clothes worn in garages are known to be one of the most difficulty in removing from fabrics (Chi *et al.,* 1999). Therefore, mechanism, and the kinetics of saturated oily soil removal by detergency should be studied.

From the previous work, the formulation of microemulsion by mixed surfactant system of sodium dioctyl sulfosuccinate (AOT), alkyldiphenyloxide disulfonate (ADPODS), and sorbitan monooleate (Span 80) with motor oil was studied (Tongcumpou, 2002). In this work, it was reported that a very high salinity (16%w/v) was needed for this formulation to obtain the middle phase which is not practical for the real application. Therefore, the objective of the present study was to develop a formulation with a low salinity for microemulsion formation with motor oil for detergency application. Detergency experiment of oily soil removal from pure cotton, polyester/cotton (65/35) blend and pure polyester was carried out. In addition, the dynamic interfacial tension in wash and rinse steps were investigated in order to obtain a better understanding about the detergency mechanism of oily soil removal. In addition, the effect of rinse method (quantity of rinsing water and number of rinsing) on detergency performance was also studied.