CHAPTER I
INTRODUCTION

Studies of detergency of oily soil removal are of great interest because it can be applied to use in the detergency process for routine life. From our previous work, the detergency of oily soil was studied in terms of several effects on detergency performance, such as effect of surfactant types, surfactant concentration, salinity concentration, temperature, different fabrics, and amount of rinsing water in order to gain a better understanding.

In 2003, Tongcumpou and coworkers studied the formulation of microemulsions by a mixed surfactant system of 3 wt.% sodium dioctyl sulfosuccinate (AOT, a surfactant with an intermediate HLB), 2 wt.% alkyldiphenyloxide disulfonate (ADPODS, a very hydrophilic surfactant), and 2 wt.% sorbitan monooleate (Span 80, a very hydrophobic surfactant) with motor oil and hexadecane. They found that the microemulsions formed by these mixed surfactants were temperature-insensitive. In this work, the interfacial tension (IFT) in the supersolubilization (SPS) region was almost as low as that under the optimal condition in a Winsor type III system (middle phase). In other words, a quite low IFT can be attained without the formation of a middle phase supported by the results of Wu *et al.* (2000). In addition, the supersolubilization region was found to give oil removal almost as high as that in the middle phase region. However, they reported that these mixed surfactants could form microemulsions with motor oil at a fairly high salinity (16 wt.%) and this high salinity is not practical for real applications.

In 2005, Tongcumpou *et al.* found that, under microemulsion conditions, the oil removal in the rinse step was almost as high as that in the wash step for both supersolubilization and the Winsor type III regions, because during the wash step, the spreading effect can occur, which was also proposed by other results (Thompson, 1994; Healy *et al.*, 1976).

In addition, Korphol *et al.* (2004) found that the use of a mixed surfactant system of 1.5 wt.% ADPODS, 5 wt.% AOT, and 5 wt.% Span 80 exhibited a Winsor type III microemulsion at a low salinity of 2.83 wt.%. With this selected formulation, detergency performance increased with increasing active surfactant concentration.

Two rinses were found to be sufficient to obtain maximum oil removal. These results agree with that of Ratchatawetchakul *et al.* (2005).

Besides this, Ratchatawetchakul *et al.* (2005) found that, in considering the total oil removal with two rinse steps at different amounts of rinsing water, the amount of rinsing water did not significantly affect the total oil removal. From these results, two rinsing steps with the lowest volume of rinsing water were recommended for operating any washing machine units.

In 2006, Rattanavoravipa (2006) found that a mixed surfactant system of 0.1 wt.% Alfoterra 145-3PO and 5 wt.% Tergitol 15S5 exhibited a Winsor type III microemulsion with motor oil at salinity of 5 wt.%. From the detergency results, optimum temperature was in the range of 30-50°C. Above 50°C the performance slightly decreased. Moreover, she found that pre-treating before the washing resulted in improving the detergency efficiency.

In this research work, the effects of hardness and builder on the detergency of oily soil removal were investigated. They concluded that in hard water or water that contains divalent cations (Ca^{2+} and Mg^{2+}), the detergency efficiency is low because divalent cations cause the precipitation of anionic surfactant. Consequently, the surfactant is insufficient in removing oily soil from the fabric surface. The best way to solve this problem is adding a builder to the hard water because it can remove the divalent cations from the water or solution bath. For this research work, a mixed surfactant system of 0.1 wt.% Alfoterra 145-3PO and 5 wt.% Tergitol 15S5 at 5 wt.% NaCl was used because this system provided the best detergency of motor oil removal that was developed by Rattanavoravipa (2006). Two types of builders, sodium triphosphate (STPP) and Ethylenediaminetetraacetic acid (EDTA) were studied to improve the detergency efficiency under the presence and absence of hardness.