CHAPTER I
INTRODUCTION

Crude palm oils are generally refined prior to use for food application and even biofuel production, in a series of stage; degumming, neutralizing, bleaching and deodorizing. Spent bleaching earth (SBE) is a generated waste after utilization as adsorbent which involves removing a variety of impurities by adsorption such as color pigment, phosphotide, fatty acids, gums, metals trace and oxidizing compounds. A large quantity of spent bleaching earth (SBE) was estimated at about 1.5 to 2 million tons worldwide based on the world edible oil production of 128.2 million metric tons in 2007 (Soystats, 2007). SBE normally contains about 20 to 40% oil by weight. The disposal of SBE is directly disposed in landfills without additional treatment causing possibilities of spontaneous combustion, severe water pollution and loss cost of adsorbed oil, which are becoming a serious problem. Therefore, an increasing interest in recovery of waste palm oil retained in SBE has been led to facilitate production cost reduction as well as environmental restrictions.

A residual oil in SBE from palm oil refining industry is commonly recovered by solvent extraction technique using hexane as a solvent, which is broadly used in extracting oil due to high oil extraction efficiency and good quality of extracted oil. However, hexane extraction requires expensive equipment to handle and to ensure worker safety due to its highly volatile solvent and hazard air pollutant. Other methods of extracting oil from SBE include supercritical fluid extraction (SC-CO_2). Although, the extracted oil from the both methods gives high efficiency and the same as quality of extracted oil from hexane, operating condition at high temperature and pressure is necessarily required. Hence, this study focuses on an alternative extraction, which provides both environment friendly and economic sound technology.

In this work, microemulsion based extraction was evaluated as an alternative method for residual palm oil extraction from SBE due to the replacement of toxic solvent by non-toxic surfactants. The most important criterion of this method is the ability of lowering interfacial tension (IFT) between oil and aqueous surfactant

solution in order to liberate oil from SBE surfaces and separate oil from aqueous phase. However, conventional surfactants have been not able to achieve low interfacial tension in several studies, extended surfactants is an option to produce ultralow IFT at the lowest concentration, which is known as the critical microemulsion concentration (CμC). Extended surfactants have groups of intermediate polarity, such as polypropylene oxides and/or polyethylene oxides which are inserted between hydrocarbon tail and hydrophilic head group. Due to their unique structure, they can spread into both the oil and water phase with avoiding water soluble, providing a smoother transition between two regions at the interface.

Several research studies have evaluated the possibility of microemulsion to extract vegetable oil from oil seed using various extended surfactants. Naksuk and co-workers (2009) studied microemulsion formation by mixture anionic extended and nonionic surfactants to extract palm kernel oil, and the extraction efficiency of two surfactant systems achieved 93.99 and 94.13%. Do and Sabatini (2010) was able to extract peanut and canola oil using anionic extended surfactant at the CμC point. The corn germ oil extraction efficiency using anionic extended surfactant concentration near CμC in which the IFT reached a minimum was reported by Kadioglu *et al.* (2011). From the background mentioned above, this work particularly takes an interested in concept of vegetable oil extraction in order to develop these systems to extract oil from SBE.

The main objective of research study is to investigate the possibility of using microemulsion based extraction as an alternative method to replace hexane for extracting oil from SBE. SBE typically has net negatively charged surface, the surfactants used are anionic extended surfactant and nonionic surfactant because this system can reduce losses from surfactant adsorption. The effect of extraction parameters such as salt concentration, surfactant concentration, extraction time and solid-to-liquid ratio are studied based on oil extraction efficiency. In addition, the quality of extracted oils of this proposed method and conventional method (hexane extraction) is compared.