CHAPTER I

INTRODUCTION

Palm oil mill is one of the major agro-industries in southern part of Thailand. Palm fresh fruit bunches are unloaded on a ramp and put into containers for stabilization. The containers with the sterilized bunches are emptied into a rotary drum threshers where the fruits are separated from the bunch stalk. The separated fruits are discharged into vertical steam-jacketed drums (digesters). Hot water is added to the digester to facilitate homogenization. Extraction of palm oil is done by means of a continuous screw press system. The screw press produces raw crude oil which contains high concentration of suspended matter, resulting in difficulties in oil water separation and high organic loading in the wastewater discharged from the palm oil mill. The conventional procedure for separation of oil from water and suspended solids is the "settling tank" method. This procedure, however, has low separation efficiency. To improve overall oil yield of the process, some mills switched from the settling tank procedure to a more efficient oil clarification system using a 3-phase centrifugal separator (decanter). Separated oil floating on top of the settling tank is collected by a funnel system and sent to the oil purification system. The settling tank underflow is collected in the sludge tank and subsequently treated to recover remaining oil. Bottom sludge from the settling tank has high oil content, high concentration of organic substances (both in the dissolved form and as suspended solids) and water soluble substances. Liquid effluent from palm oil mill usually contains 1 wt% of crude palm oil in the form of oil-in-water emulsion. The effluent is sent to waste water treatment facility before discharging.

Separation of palm oil from the emulsion is difficult because the emulsion is quite stable. Three major demulsification phenomena affecting the homogeneity of dispersions are creaming, flocculation and coalescence. Creaming is a tendency of the oil phase to concentrate at the top of the emulsion. Flocculation is defined as a process by which two or

more droplets aggregate without losing their individual identity. Coalescence is the process when two or more droplets collide with each other and results in the formation of one larger droplet. In order for the droplets to be collided, a coalescing medium is normally used. The medium is packed inside a column vessel and the emulsion is allowed to flow through the packed medium. Droplets in emulsion flow approaching the coalescing medium and attach on the surface of the medium. The droplets are the collided and form large droplets. Larger droplets are later detached form the surface of the medium. The medium can be either fibrous on particulate types. Both types have been found to be effective in certain cases.

The action of coalescence has been the subject of many studies. Madia et. al. (1976) studied the influence of wettability of packing materials on coalescence of navy distillate oil in distilled water. Packing materials used are anthracite coal, Ottawa sand, powdered polypropylene. They found that an oil-wet packed bed is effective in coalescing oil-in-water dispersions. Li and Gu (2003) studied coalescence of oil droplets in oil-in-water emulsions through fibrous and granular beds. They found that the coalescence efficiency was higher at some intermediate velocities and the coalescence performance was better for a fibrous bed packed with smaller fibers. Instow crude oil, mineral oil and tap water were used in the experiments. Magiera and Blass (1997) studied the separation of liquid-liquid dispersions by flow through glass fiber, stainless steel fiber and teflon fiber bed. Toluene, Butyl acetate and Octanol in water are used in the experiments. They found that separation efficiency declines with an increasing in fluid velocity, but this effect becomes clearer with increasing fibre diameter. Eventhough several researches have been conducted on separation of oil-in-water emulsion using coalescence technique, most of the work are concentrated in petroleum industry. The application of coalescence technique has not yet been used for separation of vegetable oil from waste water.

In this research, coalescence of palm oil in oil-in-water emulsions through a fibrous and granular bed

packed-column was examined under several of conditions. The emulsion used in this study is 1wt% palm oil in deionized water. The coalescing media are palm fiber, synthetic fiber and pumice stone. These media are packed in a column having a diameter of 10 mm and at bed depth of 100 mm. The packing densities are 0.29, 0.40 and 0.11 gm/cm^3 for palm fiber, synthetic fiber and pumice stone, respectively. Temperatures used in this experiment at 60°C, 70°C, and 80°C. Flow velocities used at 0.12mm/sec, 0.25mm/sec, 0.40mm/sec, and 0.50mm/sec.

Effect of coalescing media Types, flow velocities and temperatures on demulsification of palm oil are the objectives of this research, The results of study are used to develop the more efficiency of extraction process in the palm oil mills.