CHAPTER I

INTRODUCTION

Thailand had imported essentially lubricating oil from other countries about 350 to 400 million litres every years. After used in various processes, only about 50 million litres were kept into recycle processes (Wiwat Tanthapanichakoon,1993). It was obviously seen that in each year a lot of used lubricating oil had remained in environment. There were unfavorable contaminants in used lubricating oil such as (1) water, (2) solid abrasive particles of dirt, dust, grit, and metallic fragments, (3) sludge which was a combination of water, dirt, and oil deterioration, (4) liquid contamination such as unburned fuel from engine (Johnson,1980). Metal contaminants found in concentration of about 1 to 2% wt/wt in the oil must be decontaminated in recycle units. These metals included in used oil were occurred from wearing such as iron, silver, aluminium, chromium, tin, nickel, lead, titanium, molybdenum, antimony, and manganese, from contamination such as silicon, sodium, boron, from additives added in production process of commercial lubricating oil such as magnesium, calcium, barium, silicon, phosphorus, and zinc. Since zinc was a metal found in relatively large quantity in used oil compared with other metals. It was chosen as a representation of cationic metals in this experiment. In addition, zinc complex ions such as zinc dialkyl dithiophosphate (ZDDP) was a form of zinc that presented as additive in general lubricating oil. For this reason, ZDDP was chosen for this experiment.

Many researchers reported treating procedures used to remove metal contaminants. The previous processes, e.g. a process which used oil was treated with acid to coagulate as an acid sludge and a process which used oil was contacted with aqueous solution of chemical treatment to precipitate the metals, etc. A liquid-liquid extraction process was a simple way to achieve this purpose, due to simple operating procedure. Since a limitation of this process was using a large amount of extracting solution. This induced problems such as high material cost and cost for treatment of used extracting solution. To solve these problems and improve the extraction, surfactants found in widely industries were used in separation process. At sufficiently high concentration of surfactant, molecules of surfactant would aggregate into a cluster called micelle. Micelle of anionic surfactants having negative charges of hydrophilic portion turning into aqueous solution were predicted to increase percentage of metal extraction from used oil by liquid-liquid extraction processes.

The objectives of this study

In this study, zinc added in a form of zinc complex ions, ZDDP, was removed from lubricating oil by liquid-liquid extraction. The experiments were performed with the following purposes.

1. To study the effects of surfactant on extraction of zinc complex ion from lubricating oil by liquid-liquid extraction process.
2. To determine the optimum condition for operating in batch and continuous processes obtained on the equipment and system used.

The scope of this study

In this experiment, the liquid-liquid extraction process was used in batch and continuous processes.

1. To study the extraction process of zinc complex ions from lubricating oil by liquid-liquid extraction.

2. To study the influence of four parameters on the extraction

2.1 Agitator speed

Agitator speed was varied from 400 to 800 rpm and 100 to 400 rpm for batch and continuous processes, respectively.

2.2 Surfactant concentration in extracting solution

Surfactant concentration was varied from 1 to 8% wt/wt and from 0.1 to 1% wt/wt for batch and continuous processes, respectively.

2.3 Phase ratio (volume fraction of extracting solution:volume fraction of feed)

Phase ratio was varied from 1:1 to 1:5 in both processes.

2.4 Initial zinc concentration

The initial zinc concentration was varied from 100 to 1500 ppm in both processes.