

## CHAPTER I

### INTRODUCTION



Lubricating oil is one of the most important lubricant of today use. It is used in industrial machines, automobiles and all mechanical equipments, in order to operate them for a longer period and be done efficiently. After lubricating oil was used for a cycle, it was deteriorated by serveral causes especially by the changes of original base oil, additives and contaminants. Then used oil was managed in many ways to dispose it properly.

Generally, the used lubricating oil was drianed into ground and channels or distributed cheaply to customers. These are causes of many problems, especially in the considerations of environmental and low-grade lubricating oil distribution.

In order to perform properly, used lubricating oils were usually disposed in three ways: [1]

- 1) Disposal as toxic/hazardous waste
- 2) Re-refining to produce base oils
- 3) Use as fuel

Due to the rapid growth in Thailand's industrial sector, lubricating oils are in great demand. Nevertheless, Thailand has to import the oils from several countries such as Taiwan, China, Singapore, England, Korea, Hong Kong, Malaysia, Australia, Kuwait, etc.,. These economic data were shown in the latter section. Thus, to minimize the trade deficit, recycling of used lubricating oils is one of the choices to be considered.

There are many researches which have the same objective to improve or to recycle the used oils. In following contents, the recycling processes were described.

In 1972, Brownawell, Darrell W., Renard, Remi H., (Esso Research and Engineering Co., had reclaimed and refined used lubricating oils by: [2]

used oils → treated with C4-C5 alcohols → separation → acid treatment → caustic wash → clay treatment → hydrogenation

In 1972, Biswas, A., et al., (Reg.Res.Lab.,Jorhat,India), had regenerated used lubricating oils by: [3]

used motor oils → settling and decantation at 60-70 °C → dehydration at 120-150 °C → acid treatment → clay treatment → blending with additives

In 1974, M.L.,Whisman, et al., worked in improving the used oil quality by the following processes: [4]

- acid/clay treatment
- caustic treatment
- aliphatic alcohol-acid treatment
- caustic/peroxide /aluminium chloride treatment

In 1979, Salusinszky, A.L., (Burwood,3125 Australia), had recycled used lubricating oils by: [5]

used oils → mixed with aqueous treating solution → passed through a self-cleaning centrifuge → separation → stripped off light hydrocarbons → charged to refinery stream

In 1981, Tirtaatmadja, V., Agnew, J.B., (Dep.Chem.Eng.Monash Univ., Clayton, 3168 Australia), had refined used lubricating oils by: [6]

used oils → MEK treating → acid treating → separation

In 1981, Marvin M., Johnson, et al., they reclaimed used motor oil by:  
[7]

used oil → reacted with aq. ammonium salt → separation →  
filtration

In 1982, Fletcher, Laird C., Beard, Harold J., (Delta Central Refining,  
Inc.), had refined used lubricating oils by: [8]

used oils → distillation to remove a volatile forecut → distillation  
to obtain the lubricating oil fractions

In 1983, Fletcher Laird C., et al., had refined used lubricating oils by:  
[9]

used oils → distillation into light and heavy fractions →  
extraction with tetrahydrofurfuryl alcohol → separation

In 1983, Wood, William E., et al., (Philips Petroleum Co.), had  
reclaimed used lubricating oils by: [10]

used oils → treated with aqueous ammonium salt → dehydration  
→ filtration → vacuum distillation

In 1984, Mead, Theodore C., et al., (Texaco Inc.), had reclaimed used  
lubricating oils by: [11]

used oils → vacuum distillation

In 1985, Tabler, Donald C., (Philips Petroleum Co.), had reclaimed  
used lubricating oils by: [12]

used oils → filtration → acid treatment → clay treatment



In 1986, Strahorn, David A.; Forester, Allen R., had purified used lubricating oil by: [13]

used oil → distillation → mixing with  $\text{NH}_4\text{OH}$  → settling and separation

In 1989, Langhoff, Josef, et al., improved used oil by : [14]

used oil → solid content separation → hydrogenation

Therefore, to improve used oil quality, there are many treatments. This work, then comprises of two main processes to recycle used oil as follow:

- A) Physical and chemical treatment
- B) Catalytic hydrogenation

Physical and chemical treatment process has the important objectives :

- to improve an oil color
- to eradicate some undesired components in oil
- to increase viscosity index and oxidation stability
- to reduce some unstable compounds in oil

Catalytic hydrogenation process has two main objectives :

- the attainment of an increased viscosity index
- the stability improvement of oil

Thus, the objectives of this study are:

- 1) To improve the used lubricating oil quality
- 2) To determine the physical and chemical properties of treated oil compared with untreated oil and commercial industrial lubricating oils.