

CHAPTER I

INTRODUCTION



Lubricating oil is one of the most lubricant of today's use. It is used in industrial machines, automobiles and all mechanical equipment, in order to operate them for a longer period and be done efficiently. After lubricating oil was used, it was deteriorated by several 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 drained into ground and channels or distribute 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 oil were usually disposed in three ways:

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

Almost all of base oil was imported from several countries such as Taiwan, China, Singapore, England, Korea, Hongkong, Malaysia, Australia, Kuwait, etc.,. Thus to minimize the trade deficit and to reduce the environment pollution, used lubricating oils are the one of the choices to be considered [1].

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

In 1972, Brownawell, Darrell W., Renard, Remi H., (Esso Research and Engineering Co.,) [2], had reclaimed and refined used lubricating oils by preliminary treated used lubricating oils with C4-C5 alcohols, separated and brought the desludged oils to refining step such as treatment with fuming sulfuric acid followed by neutralizing, washing, clay treating step and hydrogenation treatment step.

In 1972, Biswas, A., et al., (Reg.Res.Lab.,Jorhat,India), [3], had regenerated used lubricating oils by settling and decantation used motor oils at 60-70 °C, dehydration at 120-150 °C followed by acid treatment, clay treatment and blending with additives.

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

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

In 1979, Salusinszky, A.L.,(Burwood, 3125 Australia),[5], had recycled used lubricating oils by mixed used oils with aqueous treating solution then passed through a self-cleaning centrifuge, separated and stripped of light hydrocarbons and brought the pretreated oils charged to refinery stream.

In 1981, Tirtaatmadja, V., Agnew, J.B., (Dep.Chem.Eng.Monash Univ., Clayton, 3186 Australia),[6], had refined used lubricating oils by treated used oils with MEK followed by acid treating and separation.

In 1981, Marvin M., Johnson, et al.,[7], they reclaimed used motor oil by reacted with aq.ammonium salt followed by separation and filtration step.

In 1982, Flether, Laird C., Beard, Harold j.,(Delta Central Refining, Inc.),[8], had refined used lubricating oil by distillation to remove a volatile forecut and distillation to obtain the lubricating oil fractions.

In 1983, Fletcher, Laird C., et al.,[9], had refined used lubricating oils by distillation into light and heavy fractions followed by extraction with tetrahydrofurfuryl alcohol and separation.

In 1983, Wood, William E., et al.,(Phillips Petroleum Co.),[10], had reclaimed used lubricating oils by treated used oils with aqueous ammonium salt followed by dehydration, filtration and vacuum distillation.

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

In 1985, Tabler, Donald C.,(Phillips Petroleum Co.),[12], had reclaimed used lubricating oils by filtration, acid treatment and clay treatment.

In 1986, Strahorn, David A.; Forester, Allen R.,[13], had purified used lubricating by distillation and mixing with NH_4OH followed by settling and separation.

In 1989, Langhoff, Josef, et al.,[14], had improved used oil by solid content separation and hydrogenation.

In 1994, Edward C. Shurtleff, R.R.,[15], had reclaimed wasted oil by evaporation and condensation.

In 1994, Charles W. Harrison; Arthur G. Gorneau; Robert M. Steinberg, Bruce R. Bond, [16], had reclaimed zinc dithiophosphate from used lubricating oil by vacuum distillation.

In 1995, Kanit rongsawad,[50], had reclaimed used industrial lubricating oil by acid/clay treatment and hydrogenation.

So to improved used oil quality, this work comprises only one process to recycle used oil by catalytic treatment.

Catalytic treatment process has the important objectives to:

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

The objectives of this study are:

1. To improve the quality of used lubricating oil.
2. To determine the physical and chemical properties of hydrogenated oil compared with used and unused lubricating oils.
3. To reduce the steps of treatment.
4. To find the condition which use least reaction time and concentration of catalyst that gave oil having desirable properties.

Scope of this study

For the recycle of used lubricating oil by catalytic hydrogenation, by using three types of hydrotreating catalyst, the appropriate conditions such as reaction time and concentration of catalyst were studied. The optimum condition of each type of catalyst was found. The necessary procedure may be as follows ;

1. Literature survey and in-depth study of this research work.
2. Studying the use of Nickel oxide/tungsten oxide/alumina ($\text{NiO}/\text{WO}_3/\text{Al}_2\text{O}_3$) catalyst on hydrogenation of used lubricating oil by changing the following parameters so as to attain the appropriate reaction condition :
 - a) The effect of reaction time.
 - b) The effect of concentration of catalyst.
3. Studying the use of Nickel oxide/molybdenum oxide/alumina ($\text{NiO}/\text{MoO}_3/\text{Al}_2\text{O}_3$) catalyst on hydrogenation of used lubricating oil by changing the following parameters so as to attain the appropriate reaction condition :
 - a) The effect of reaction time.
 - b) The effect of concentration of catalyst.
4. Studying the use of Raney nickel catalyst on hydrogenation of used lubricating oil by changing the following parameters so as to attain the appropriate reaction condition :
 - a) The effect of reaction time.
 - b) The effect of concentration of catalyst.
5. Summarizing the results.