CHAPTER 1

INTRODUCTION

General

Lubricants is one of the most important parts of industries . Thousant types of lubricant are used to lubricate all industrial machines, the engine in your cars, trucks, marine vessel engine and aircraft. Without lubricants you can imagine how difficult your life would be. Turbine oils are a type of lubricants which are used for lubricating turbine system. There are three main categories of turbines.

1. Gas turbines
2. Steam turbines
3. Water turbines

Gas turbines are mostly used in aircraft, though some aircarft-derived gas turbines are used for propulsion of naval vessels or for industrial purposes, e.g. stand-by generation of electricity. Industrial gas turbine are usually robust. The same is true of steam turbines. Turbine oils must provide satisfactory lubrication, low air release value, good demulsibility, good oxidation stability, low foam tendency , low foam stability, high viscosity index, low pour point and etc. Mineral oil based turbine oils are manafactured from turbine quality base oils and additives. Air release value is the important property of turbine oils. Good turbine oil must provide low air release value. Normally, turbine quality base oils have air release value between 4 to 10 minute whilst general quality base oils have air release value between 10 to 20 minute. High air release value base oils will cause high air release value of finished products.

The following problems may occur if high air release value oil is used in turbine system.

1. Lose suction of centrifugal pump.
2. Pump pressure failling.
3. Undue wear of high speed thrust pads.
4. Filter blocking.
5. Accelerate oxidation reaction.
6. Blackening of oil.

In the past adsorbents were used in the finishing stage of base oil production to improve color, odor and Stability of products. Two commom adsorbents are activated clay and bauxite. Activated clay in used in contact

process which base oil is brought into intimate contact with fine particle of activated clay by vigorous mixing after that used activated clay is separated from oil by filtration. In the used percolation process the oil percolates downwards through the coarse grain bauxite. Eeven these processes are old fashion method but they are still used for other purposed such as recondition or regeneration of used lubricating oils. Castrol india used to use percolation process to improve air release value of base oil many years ago. However, there was no record or evidence to show theirsult or detail of their process. Early this year this study became interesting to Castrol again due to price and supply problem of Turbine Quality base oil. Research studies were carried out at Castrol Technology centre in UK and Castrol in Thailand.

Rationale

It is necessary to use turbine quality base oils to make Turbine oils which provide low air release value. There is no additive which can improve this property of oil. However, there are some problem which lubricant manufacturers are facing, for example ;

1. High price of turbine quality base oils makes finished product cost not competitive.
2. Turbine Engine Manufactures recommend their customer to use only low air release value turbine oil.
3. Low consumption of this kind of base oils when compare with general quality base oils causes the problem of sourcing, price and storage.
4. High price of imported finished turbine oils.
5. There are only few refineries which can supply turbine quality base oils.

Purposes of Study

1. To investigate the possibility of using percolation process in reducing air release value of base oils.
2. To find suitable contact time between oil and bauxite which give acceptable reduction of air release value whilst other properties still remain within the acceptant limits.
3. To study the effect of temperature of oil on the effectiveness of process.
4. To compare physical properties of base oils before and after processing.

Scope of Study

After the proposal had been presented to the committe of Chemical

Engineering Department, air release value of base oils to be used for study were carried out. The results are below.

Base oil	Air release Value. minute
150 SN	3.0
450 SN	8.0
500 SN	6.3
600 SN	6.8

From the results above only 450 SN has high air release value and can not be used for manufacturing turbine oil. Normally, air release value of turbine oil is limited between 4-5 minute. However, in case of 500 SN and 600 SN, air release value will be decrease when blended with 150SN. Anyway,the study was carried out with the following condition.

1. Base oils used for study were 150 SN, 450 SN, 500 SN and 600 SN.
2. Study were carried out at 60 C. and 100 C.(temperature of feed oil)
3. Bauxite was used as adsorbent.
4. Contact time between base oil and bauxite was varied from 0, 20,40, 60, 80, 100 and 120 minute. Contact time is caculated from the equation ;

$$\text{contact time (min.)} = \frac{\text{Packed Volume of bauxite (litre)}}{\text{Volume flow rate of oil (litre/min.)}}$$

5. Samples taken from the column were tested for the following items.
   - 5.1 Air release value at 50 C (IP 313)
   - 5.2 Colour (ASTM D1500)
   - 5.3 Sulphur content (ICP)
   - 5.4 Kinematic viscosity at 40 C
   - 5.5 Kinematic viscosity at 100 C
   - 5.6 Viscosity Index
   - 5.7 Aromatic content
   - 5.8 Paraffinic content
   - 5.9 Naphthenic content