

# Lecture - 13

# LUBRICATING OIL



# LUBRICANTS

The substances which are used to decrease the force of friction between the moving parts of machine in contact are known as **Lubricants** and the process of decreasing the force of friction between the moving parts of machine in contact is known as **Lubrication**.

# LUBRICATING OILS

- Lubricating oil fractions extracted from **crude oil** are a widely varying mixture of straight and branched chain paraffinic, naphthenic aromatic hydrocarbons having boiling points ranging from about **302°C** to **593°C**.
- Some specialty lubricants may have boiling point extremes of 777 and 815°C. The choice of grade of lubricating oil base is determined by the expected use.

# ORIGIN OF LUBRICATION OILS

- In the past , vegetable and animal oils were used (e.g. Castor oil and Olive oil)
- Nowadays, they are replaced by the heavy paraffinic compounds resulting from oil refineries.

# MINERAL OIL-BASED LUBRICANTS

- **Naphthenic crudes** were the first crudes to be used in the manufacture of lube oils.
- As the demand for higher viscosity index increased, paraffinic crudes became the main sources for base oil production.
- Naphthenic crudes were amply used for special applications which did not require excellent viscosity index.

## **Generally, process sequence involves the following-**

1. Vacuum distillation
2. Deasphalting of vacuum residue
3. Solvent extraction
4. De-waxing
5. Finishing

# 1. Vacuum Distillation

It is conducted at temperatures between  $300^{\circ}\text{C}$  to  $350^{\circ}\text{C}$ , and at pressures ranging from  $30$  to  $50$  mmHg

# 2. De – Asphaltting

De-Asphaltting is done to remove **Asphalt** and **naphthenic** compounds from the oil because Asphalt increases the viscosity of the oil in a harmful matter, and naphthenic compounds are oxidizable causing formation of water and acidic compounds which have harmful effects on oil viscosity.



### 3. De-Waxing

De-waxing is done to remove **wax** from raw oil because wax has harmful effects on viscosity.

This is done by cooling oil to low temperature ( **$-10^{\circ}\text{C}$** ), the wax solidifies and can be filtered easily using rotary filters

## 4. Finishing

### A. Hydrogen Treatment

Hydrogen treatment is done to remove **unsaturated compounds** by converting them into **saturated compounds** to prevent the formation of heavy polymers causing oil blockage.

Also, hydrogen eliminates **sulfur** compounds in the oil and converts them into hydrogen sulfide.

### B. Activated Clay

Activated clay is used to remove colors , residual waxes and naphthenic.

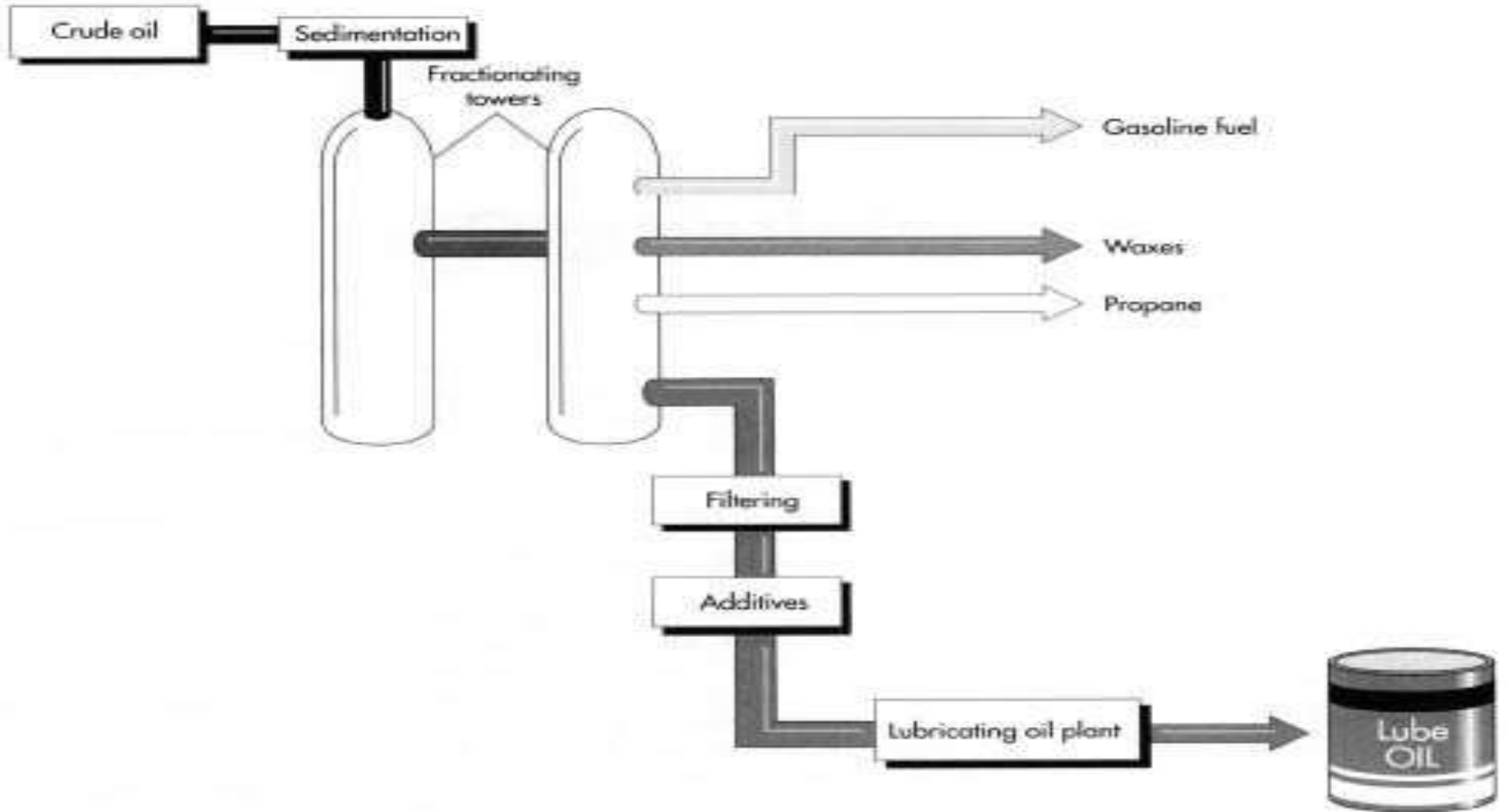
## 5. Introduction of oil Additives

Additives are used to expand the lifetime of the oil to improve its efficiency, and its viscosity index.

Functions of additives:

- To prevent oil oxidation
- To prevent oil erosion
- To compensate for the decrease in oil viscosity resulting from high temperature.
- To prevent solidification by oil.

# Flow diagram



# **Lube oil base stocks are classified as following-**

- 1. Low Viscosity Index (  $VI < 30$  )**
- 2. Medium Viscosity Index ( VI varies from 30-85 )**
- 3. High Viscosity Index (  $VI > 85$  )**

# SYNTHETIC LUBRICANTS

- Synthetic lubricants consists of chemical compounds that are artificially made.
- Synthetic lubricants can be manufactured using chemically modified petroleum components rather than whole crude oil.
- Synthetic lubricants withstand high temperature better, reduce oil consumption, provide better cold starting, save fuel, reduce engine wear, keep engine clean and provide long drain period.

# BASIC FUNCTIONS OF LUBRICANTS

- The basic functions of lube oils are to reduce friction and wear, remove heat and prevent corrosion.
- Lube oils should possess and maintain proper viscosity, flow as liquid at the handling and operating temperature and have good thermal and oxidation stability.
- The following additional factors also call for upgradation of lubricant quality- energy conservation, environmental protection, increased equipment life etc.

# AUTOMOTIVE ENGINE OILS

## Engine Lubrication-

lubricants for modern internal combustion engines must:

- Lubricate the engine-form a fluid film between moving parts to prevent metal to metal contact
- Reduce friction
- Seal combustion pressures
- Minimize rust and corrosive wear
- Minimize sludge and varnish deposits



# ELECTRICAL INSULATING OILS

Oil to be used as an insulating agent in electrical equipments has to fulfill one or more of the following requirements-

- It should have high electrical resistance.
- It should not give rise to substantial dielectric losses in an alternating field.
- It should not readily suffer breakdown with the passage of a spark.
- It should not readily undergo chemical changes in the presence of atmospheric oxygen during its use.
- It should have a low pour points.

# JUTE BATCHING OIL

- During twisting and weaving of jute threads, oil is invariably used as lubricant for easy segregation of the jute fibers.
- During the processing of gunny bags, the finished jute goods usually contain 2 to 7 wt % of the oil which is an essential material for the batching of jute.

# WHITE OILS

- White oil may be produced from any of the three types of crude, i.e. paraffinic, intermediate and naphthenic.
- White oils are made by sulphuric acid treatment of petroleum distillates. Petroleum sulphonic acids are the main by-products from the manufacture of white oils.
- Due to the inert character of white oil and its resistance to oxidation, the major volume of white oil is consumed in **technical applications** and in the **process industries**.

 **THANK YOU**

