INTRODUCTION

Lubricating oils:-

Lubricating oils are produced from two general types of these stocks, neutral oils and bright stocks. The neutral oils are produced from the waxy distillate fractions boiling in the range of 300 - 350°C go to the 500°C, while the bright stocks from the vacuum residue.

Composition of lubricating oils:-

Lubricating oils[1,2] are homogeneous mixtures of hydrocarbons and other constituents like (sulphur, nitrogen and oxygen compounds) which are miscible in all proportions with the exception of solid paraffins.

1- Hydrocarbons:-

Hydrocarbons present in lubricating oils are of paraffinic, naphthenic and aromatic types[3,4]. The emperical formula generally lies between C_nH_{2n} and C_nH_{2n-8}, the ratio C/H being least in the paraffinic oils[5].

The paraffins, widely distributed in oils, are characterized by saturated noncyclic chain structures. The cycloparaffins or naphthenes present in oils belong to the saturated five and six-carbon-atom ring hydrocarbons. The cycloparaffins are monocyclic in low - boiling petroleum fractions and polycyclic in high boiling

fractions[6].

In contrast to the saturated structure of paraffins and cycloparaffins, the aromatic hydrocarbons have resonating double bonds imparting the aromatic properties.

The ring structure of lubricating oils are first reported by Bossini and his associates[7,8]. The distribution of polycyclic cycloparaffins in fractions of lubricating oils has been studied[9].

2- Non-Hydrocarbons:-

Sulphur compounds present in petroleum belong to various classes, including hydrogen sulphide, mercaptans, aliphatic sulphides, cyclic sulphides and thiophenes.

The relative contents of these compounds depends upon the source of the fraction[5].

Nitrogen compounds in crude oils are entirely obscure. The nitrogen bases in distillates appear to result from decomposition of some neutral complex nitrogen compounds at distillation temperatures. Some of the nitrogen is combined in resinous compounds extracted by solvents from high-boiling fractions.

The presence of nitrogen compounds reduces the activity of cracking catalyst and also contributes to the

formation of gum and colour on storage of petroleum products[10,11].

Nitrogen compounds in petroleum may be grouped arbitrarily as basic and non-basic. The basic group includes pyridine, quinoline, and some of their higher homologous. Non-basic group includes pyrrole, indole, carbazole and their higher homologous. In lubricating oil fractions the nitrogen compounds are generally heterocyclic and its atom being incorporated in either a five or six membered rings. The five membered rings are frequently non-basic with hexahydrocarbazole and indoline as notable exception while the six membered ring compounds are generally basic[12].

The oxygen compounds in petroleum generally consists of fatty acids, naphthenic acids and phenols which are generally called "petroleum acids".

Müller and Pilot[13] have studied the high molecular weight naphthenic acids extracted from a Polish lubricating distillate, the formulae of which correspond to $C_{20.4}H_{36}O_2$-$C_{26.9}H_{45.3}O_2$.

3- Asphaltenes, Resins and Oils:-

The composition of asphalts is so complex. Some techniques have been developed for their fractionation,

evaluation and analysis of the resulting fractions[14,15].

The molecular weight of resin fractions is lower than those of asphaltenes. To obtain these fractions according to molecular weight and hydrocarbon types, a molecular distillation is made first on the crude resin in maltene fraction.

This is followed by a fractional precipitation procedure using a mixture of ethyl and butyl alcohols. The oxygen containing hydrocarbons have been considered by Marcusson [16] to be mostly in the form of asphaltogenic acids which can be removed from the asphalt by extraction with alcoholic alkalies.

Structurally, however, the oxygen has been found in the bridge linkage between heterocyclic nuclei, rather than in the form of carboxylic or hydroxyl material.

4- Trace Elements:-

Practically all metals[17] have been found in the ashes of petroleums, the most important being nickel, vanadium, iron, and copper, which have been found very useful in petroleum geochemicals studied[18].

The elements as vanadium, nickel, iron, copper, phosphorus and arsenic have poisoning effects upon the

catalysts used in processing. Also vanadium and sodium, have a corrosive effect on gas turbines working with residual oil.