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LUBRICATING OIL

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The present invention relates to the refining of lubricating oils. It is particularly concerned with the manufacture of high quality lubricating oils having relatively high viscosity indexes as determined by the Dean and Davis method as described in the October, 1929, edition, volume 36, of Chemical and Metallurgical Engineering. The process of the present invention prepares a high quality lubricating oil having a high viscosity index in an economical manner by first subjecting the lubricating oil to the effect of an oxygen-containing gas and then treating said oxidized lubricating oil with a selective solvent.

It is well known in the art to prepare lubricating oils of relatively high viscosity by means of various processes as, for example, by means of treating with selective solvents. In processes of this type solvents are used which have the ability to segregate the relatively more aromatic constituents from the desirable relatively more paraffinic constituents of a lubricating oil. Suitable solvents which have the ability to dissolve the relatively more aromatic compounds from the desirable paraffinic constituents of the lubricating oil are, for example, phenol, furfural, aniline, sulfur dioxide, dichlor diethyl ether, nitro benzene and the like. These solvents are used alone and are also used in various combinations, depending upon the material being treated and the type of product desired. Substances of the class of liquefied normally gaseous hydrocarbons are also used, particularly in combination with solvents of the above described classes.

I have now discovered a process of producing a high quality lubricating oil having a viscosity index of from 3 to 10 points above the viscosity index secured by the usual method of solvent treating. The product of my process also has a good color and is more stable. The process of my invention is also particularly desirable in that for a fixed viscosity index improvement it is possible to use from one-quarter to one-half of the solvent normally required when the lubricating oil has not been previously oxidized.

The process of the present invention supplements the usual solvent treating operation by adding a controlled prior oxidation step. The process of the present invention first treats the stock which is to be finished into a high quality lubricant with an oxygen-containing gas under controlled conditions and then solvent treats the oxidized oil with a suitable selective solvent or solvent mixture.

The process of the present invention may be utilized in the finishing of any lubricating oil distillate or residuum. The lubricating oil fraction being finished may be a waxy or dewaxed distillate or may have been previously acid or clay treated. It is preferred, however, to treat a dewaxed distillate which has not been previously subjected to acid, clay or similar treatment.

In carrying out the process of my invention it is necessary that during the oxidation treatment the temperature be maintained within the range of about 325° to 500° F. At an oxidizing temperature substantially below 300° F. no significant improvement is secured and if the oxidation is carried out at a temperature substantially above 500° F., undesirable carbonization and other side reactions occur.

The oxidation treatment may be performed by blowing air into any part of the oil body, although it is preferred to blow the air into the bottom portion. The time of reaction when blowing with air is preferably from two to eight hours, although this may be modified, depending upon the particular lubricating oil being treated. It is preferred to use from 800 to 1200 cubic feet of air per barrel of oil. In order to facilitate the oxidation treatment oxidation catalysts, as for example, manganese naphthenate in the concentration of from 0.05 to 0.5% may be employed. If it is desirable, the oxidation step may be carried out in the absence of oxidation catalysts. Satisfactory results may be obtained by either method.

After the oxidation reaction is completed, the oxidized oil is allowed to cool and is then subjected to the effect of a selective solvent or solvent mixture which will remove the undesirable constituents. Preferred solvents are, for example, sulfur dioxide, phenol, furfural, dichlor diethyl ether, aniline, nitro benzene and the like. Solvent mixtures of these solvents are also desirable as well as solvents whose selectivity and solvency power have been modified by the use of substances of the class of water, alcohols and glycols. Solvent mixtures comprising a solvent of the class having a preferential solvency power for the aromatic type compounds as compared to the paraffinic type compounds and a liquefied normally gaseous hydrocarbon are also desirable.

The quantity of solvent used per volume of oil may vary widely and will depend upon the particular oil being treated, the temperature of treatment, as well as upon the particular solvent or solvent mixture employed.

In general it is preferred to use from one to four volumes of solvent per volume of oil being

treated. The solvent and oil may be intimately mixed in any manner desirable, as for example, in a single or multi batch operation. It is, however, preferred to contact the oxidized oil and the solvent in a continuous treatment in which intimate contact between the oil and the solvent are secured by suitable contacting and distributing means.

The temperature of the solvent extraction treatment may vary widely. It is, however, preferred to keep the temperature below the complete miscibility temperature of the solvent and the oil.

The process of the present invention may be readily understood by reference to the following examples which are given for purposes of illustration only and are not to be construed as limiting the invention in any manner whatsoever.

EXAMPLE 1

A dewaxed overhead cylinder stock was oxidized by blowing with air for about three hours at about 330° F. in the presence of 0.1% manganese naphthenate catalyst. The inspections of the oil before and after oxidation were as follows:

Table 1

	Original oil	Oxidized oil
Yield	100	----------
Gravity, °A. P. I.	20	19.1
Vis. Saybolt at 100° F.	5850	7920
Vis. Saybolt at 210°F.	207	251
Viscosity index	73	74
Precipitation No. mg. sludge/10 g. oil	----------	119

Portions of the above original oil and of the oxidized oil were diluted, acid treated and were then clay percolated. The yields and inspections of the acid treated, clay percolated original and oxidized oil were as follows:

Table 2

	Original oil	Oxidized oil
Yield, percent	87	75
Vis. at 210° F.	175.1	164.8
Viscosity index	79	82
Gravity, °A. P. I.	21.7	22.4
Color, R	4½	1¼
Cast	Good	Poor

The above data clearly show that the conventional methods of finishing by acid treating and clay percolation are not suitable for an oxidized oil. The yield is very low and the color is poor.

Portions of the original oil and of the oxidized oil were given several batch extractions with 100% phenol at about 300° F. The solvent treated original oil and oxidized oil had the following inspections:

Table 3

	Original oil 3×100% phenol at 150° F.	Oxidized oil 1×100% phenol at 150° F.	Oxidized oil 3×100% phenol at 150° F.
Yield (overall)	73.0	76.7	62.7
Gravity, °A. P. I.	25.1	23.4	25.8
Vis. at 210° F.	135.8	153.7	128
Viscosity index	86	85	89
Color, R	1¾	----------	2½

From the above data it may be seen that approximately 25% greater viscosity index improvement was secured by a pre-oxidation treatment. The data also indicate that the oxidized oil can be improved to almost the same extent in quality with one phenol extraction as compared to the unoxidized oil with three phenol extractions with approximately the same yields.

EXAMPLE 2

A hydrogenated lube oil distillate having a Saybolt viscosity of 120 seconds at 210° F. was oxidized at a temperature of 475° F. to a viscosity of 219 seconds Saybolt at 210° F. The oil was then diluted with three parts of naphtha boiling in the range from about 350° to 500° F. and was then acid treated. It proved impossible to separate all the acid sludge and the oil remained a dark color, even after an acid treat of 140 lbs. per barrel and a clay treat of 200 lbs. per barrel. The inspections of the oil were as follows:

Table 4

Gravity, °A. P. I.	27.1
Vis. Saybolt at 100° F.	2095
Vis. Saybolt at 210° F.	145
Viscosity index	103
Color	Black

The hydrogenated lube oil described above was oxidized as described and then was given two successive extractions with two parts of beta beta dichlor diethyl ether. The oil was then contacted with 100 lbs. per barrel of fine Attapulgus clay. Inspections of the finished oil were as follows:

Table 5

Vis. Saybolt at 100° F.	1870
Vis. Saybolt at 210° F.	140
Viscosity index	106
Color, R	2½

The above invention is not to be limited by any theory or mode of operation.

I claim:

1. Process for refining and improving the quality of a lubricating oil comprising subjecting the same to the action of more than 800 cu. ft. of air per barrel of oil at a temperature between 300° and 500° F. in the presence of 0.1% of manganese naphthenate, said air being passed through the oil at the rate of about 4½ cu. ft. of air per barrel of oil per minute, treating the oxidized oil with a solvent mixture to remove the undesirable constituents, said solvent mixture comprising a solvent of the type having a preferential selectivity for aromatic type compounds.

2. Process in accordance with claim 1 in which said solvent mixture comprises a solvent of the type having a preferential selectivity for aromatic compounds and a liquefied normally gaseous hydrocarbon.

3. The process of improving the viscosity index of a lubricating oil comprising subjecting the same to the effect of an oxygen-containing gas at the rate of between 160 cu. ft. and 240 cu. ft. of oxygen per barrel of oil at a temperature between 300° and 500° F. in the presence of 0.1% manganese naphthenate, said oxygen-containing gas being passed through the oil at the rate of between ½ and 10 cu. ft. of oxygen per barrel of oil per minute, then treating the oxidized oil before cooling with a solvent of the class having a preferential selectivity for aromatic type compounds.

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