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METHOD FOR IMPROVING SYNTHETIC HYDROCARBON OILS

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This invention relates to a method for improving synthetic hydrocarbon oils by subjecting such oils to silent electric discharge. It relates more particularly to the refining of crude synthetic oils, especially those having the property of decreasing the pour point of waxy oils when added thereto in small amounts. Such oils are conveniently described as pour point depressants.

The treatment of petroleum oils by silent electric discharge, or "voltolization", to increase their viscosity, has already been suggested. Such treatment may be conducted in any suitable apparatus for bringing the oil in contact with a silent electric discharge. It is conveniently conducted in a Siemens ozonization tube or in a trommel type voltolizer, in which a thin film of oil is continuously passed between electrodes in a reaction chamber maintained under an absolute pressure of about 2 to 10 or 20 cm. of mercury, with an electric potential of about 1,000 to 10,000 volts or more at a frequency of about 500 to 10,000 cycles per second, the potential and pressure and space between electrodes being adjusted so as to obtain continuous silent electric discharge.

It has now been found that the synthetic hydrocarbon oil pour point depressants are greatly improved by submitting such oils, to treatment with the silent electric discharge. By this treatment highly refined synthetic oils may be obtained directly from the crude synthetic reaction products without the necessity of other refining methods now commonly used. Such products are also obtained in greater yields since the process of the present invention is attended by none of the losses to low quality or objectionable by-products such as accompany ordinary treating and refining methods.

When synthetic oils are subjected to relatively intensive treatment with silent electric discharge, the molecular weight and viscosity of the oils are increased several fold, and products of high molecular weight of the order of 1,000 to 2,000 more, and of high viscosities of the order of 500 to 1,000 or more seconds Saybolt at 210° F., are obtained. Such products are especially suited for use as blending agents with lubricating oils in order to produce blends of higher viscosity and viscosity index, and are suitably used in proportions of 5, 10, 20 to 50% or more with lubricating oils, such as ordinary petroleum lubricating oils. Small amounts of these voltolized synthetic oils of the order of ½, 1, 5 to 10% may also be used as oxidation inhibitors in lubricating oil blends, particularly with lubricating oils having high rates of oxidation, such as petroleum lubricating oils which have been extensively refined with fuming sulfuric acid or by other refining methods adapted to increase substantially the viscosity index of the oil.

This invention comprises subjecting the synthetic oils to a mild treatment with silent electric discharge whereby any increase in viscosity or molecular weight of the oils is relatively small and these are preferably not more than doubled. The increase in viscosity is generally not more than 10 to 50 or 100%. By this modification the objectionable qualities of the impurities normally present in such oils are greatly decreased or eliminated and many properties of the synthetic oils are greatly improved, such as color, cast, solubility and other special properties. For example, the effectiveness of synthetic pour inhibitors is increased by this treatment to an optimum extent when the increase in viscosity by the action of silent electric discharge is about 100% but less than 200% and preferably less than about 140%. Other and further objects of this invention will be apparent from the present description and the claims.

The property of certain types of condensation products of decreasing the pour point (or solidification point) of waxy lubricating oils when added thereto in small amounts is well known. Such condensation products are known as pour point depressants or "pour inhibitors". These products are usually viscous oils. They are described more fully in U. S. Patent No. 1,815,022 granted July 14, 1931, to G. H. B. Davis. Examples of such oils include alkyl-aryl condensation products which are preferably prepared by condensation of aliphatic reagents having a straight carbon chain of 10 to 30 or more carbon atoms with aromatic reagents containing condensed nuclei. An example of this type of condensation product is the viscous oil obtained by condensing chlorinated paraffin wax with naphthalenes by the Friedel-Crafts reaction, in the presence of a catalyst of the type of aluminum chloride.

It has now been discovered that the properties of such pour depressants are markedly improved by subjecting the condensation products to the action of a silent electric discharge. This treatment is preferably mild, as described above under the second modification of this invention. The resulting products are more effective pour point depressants, particularly in heavy lubricating oils, and they have a greatly improved color, being given a clear red color and a green cast, so that they may be blended with the highest quality lubricating oils without objection.

The following examples are presented to illustrate one method for conducting this modification of this invention, but are not to be construed as limiting the invention in any way.

Example I

Paraffin wax was chlorinated by passing chlorine through the molten wax at a temperature between 140 and 300° F. until the chlorinated wax contained about 10 to 12% of chlorine. 100 parts of this chlorinated paraffin were then condensed with 15 parts of naphthalene by stirring with the addition by anhydrous aluminum chloride to a solution of the reagents in kerosene at room temperature. The reaction mixture was then washed with aqueous caustic soda to neutralize any residual aluminum chloride, and the aqueous layer containing the aluminous sludge was settled and separately drawn off. The oil layer was then distilled to remove the kerosene and any unreacted paraffin as distillates, and there was obtained as residue a viscous synthetic hydrocarbon oil condensation product. This product, dissolved in kerosene, was agitated with a decolorizing clay, which was filtered off and the kerosene again removed by distillation. There was thus obtained as distillation residue an oil having a Saybolt viscosity of 297 seconds at 210° F. and a black, almost opaque color.

This condensation product was then subjected to the action of silent electric discharge in a Siemens ozonization tube at a pressure of 2 cm. of mercury absolute, using an electric potential of 2,000 to 2,500 volts at 10,000 cycles per second. The apparatus was a vertical annular glass tube with concentric electrodes on both outside walls. Hydrogen was bubbled through the oil to maintain it in a state of foam. The treatment was continued for about 5 hours in order to secure an increase in viscosity of about 100%.

The resulting product had a light clear red color with a green cast, and a viscosity of 599 seconds at 210° F.

Portions of the original condensation product, and of the product after subjection to the silent electric discharge were each added to light and heavy waxy oils. The characteristics of the original oil and the resulting blends are shown in the following table:

	Light oil	Heavy oil
Waxy oils:		
Viscosity, seconds Saybolt@210° F.	44	70
Viscosity index	100	100
Pour point, ° F.	30	30
+0.4% condensation product:		
Pour point, ° F.	−10	−10
+0.4% voltolized condensation product:		
Pour point, ° F.	−20	−15

The crude condensation product, prepared as described in the above example, may be subjected after the separation of aluminum chloride sludge and without further finishing, directly to voltolization to produce similar pour depressants of improved color and increased effectiveness. In this manner ordinary treating and refining losses, which are substantial and may amount to as high as 25% or more, are avoided.

While the treatment with silent electric discharge in the above example produced an increase of about 100% in the viscosity of the synthetic oil, much milder treatments at lower voltages, lower frequencies and/or for shorter periods of time, which produce an increase of not over 10 to 50% in the viscosity of the synthetic oil, also serve to refine the oil and to produce substantial improvements in its appearance and blending characteristics with petroleum lubricants. The color of the oil is substantially improved even by such mild treatment with silent electric discharge that the viscosity of the oil is increased only 1 or 2%. More intensive treatments at higher voltages, frequencies and/or for longer periods of time may also be used, but these are not generally desirable when an improved pour point depressant adaptable for use in all waxy oils is desired. It has been observed that the effectiveness of the voltolized pour point depressant in waxy oils of low viscosity is impaired if the voltolization treatment is made too intensive. For example, when the voltolization of the synthetic oil described in Example I is continued until the voltolized product has a viscosity of 711 seconds Saybolt at 210° F., (corresponding to an increase of about 140% in the viscosity of the synthetic oil), a 0.4% of this product produces a blend having a pour point of −10° F. with the light oil shown in Example I and a pour point of −20° F. with the heavy oil shown in Example I. It is thus apparent that too intensive voltolization results in a pour depressant which is less effective in certain lubricating oils.

The voltolization of the synthetic oil shown in the above example may also be continued so as to produce an improved product having a viscosity several times greater than that of the original oil. For example, the voltolization treatment described in Example I may be continued until a voltolized synthetic product having a viscosity above 1,000 to 2,000 seconds Saybolt at 210° F. is produced. This highly viscous product is also of superior color and is suitable for use as a blending agent with other lubricating oils, particularly those derived from petroleum, in order to increase the viscosity and viscosity index of such oils and/or as an oxidation inhibitor.

The apparatus used in the present process may be of the usual type of tube or trommel design. The tube type of apparatus comprises a vertical tube preferably constructed of a dielectric material such as glass coated on the outside with a conductor electrode, a central electrode disposed in the center of this tube, provision being made for a high tension silent discharge between the electrodes. The trommel type of apparatus comprises a series of insulated plates placed a few millimeters apart and mounted on a rotatable shaft, the entire shaft with its plates being disposed within a horizontal drum maintained approximately half full of the material to be voltolized. The bottom portions of the plates dip into the material to be voltolized and as the shaft rotates, the material drips down over the surface of the plates forming a thin film thereon. The high tension silent discharge occurs between the plates. In apparatus of this type it is generally preferred to operate at a pressure below about 20 cm. of mercury and preferably about 2 to 10 cm. and at an electrode potential of about 1,000 to 10,000 volts or more at a frequency of about 500 to 10,000 cycles or more per second.

The treatment with silent electric discharge may be conducted in the presence of hydrogen or other preferably reducing gases, such as carbon monoxide, natural gas or other hydrocarbon gases or vapors, water gas, coke oven gases and the like.

The present invention is applicable to the improvement of synthetic hydrocarbon pour point depressants generally, including those prepared

by the Friedel-Crafts, Fittig, Wurtz and other types of syntheses. For example, the synthetic pour point depressants described in U. S. Patent No. 1,815,022 granted July 14, 1931, to G. H. B. Davis, and in British Patent No. 349,071 accepted May 11, 1931, may be improved by treatment with silent electric discharge according to the present invention.

This invention is not to be limited to any examples or explanations, all of which are presented herein solely for purpose of illustration, but is limited only by the following claims, in which it is desired to claim all novelty insofar as the prior art permits.

We claim:

1. Process for improving an unrefined synthetic hydrocarbon pour point depressant prepared by chemical condensation from an aliphatic reactant having about 10 to 30 carbon atoms in a straight chain to give the pour point depressant improved color and potency marked by increased effectiveness in lowering the pour point of a wax-containing oil having a Saybolt viscosity of 70 seconds at 210° F. which comprises voltolizing the crude pour point depressant product by the action of silent electric discharges until the viscosity of the resulting voltolized product is about 100% higher but less than about 140% higher than the viscosity of said crude pour point depressant product.

2. Process for refining a crude black alkylaryl hydrocarbon condensation product prepared by chemical condensation of an aromatic reactant with an aliphatic reactant having a straight chain of 10 to 30 carbon atoms which comprises subjecting said crude condensation product to the action of silent electric discharges until the thus treated condensation product is given a clear red color and a green cast with an increase of its viscosity limited to about 100%.

3. Process for refining a crude black pour point depressant synthesized by the condensation of chlorinated paraffin wax with an aromatic hydrocarbon to make an improvement in the color of the pour point depressant and in its effectiveness for lowering the pour point of a heavy wax-containing oil having a Saybolt viscosity of about 70 seconds at 210° F., which comprises voltolizing said crude pour point depressant by the action of silent electric discharges, and discontinuing the voltolizing when the increase in viscosity of the voltolized product is about 100% but less than 140% above that of the crude pour point depressant.

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