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LUBRICANTS

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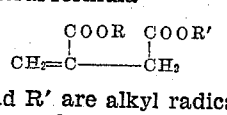
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This invention pertains to improvements in lubricant compositions, and more particularly is directed to improving the temperature-viscosity characteristics of hydrocarbon oil lubricants.

It is known that the viscosity of certain types of hydrocarbon oils is greatly affected by temperature changes, thus it is known that the viscosity of highly paraffinic oils does not change as greatly and as rapidly as do naphthenic oils with changes in temperature. This viscosity-temperature relationship is measured by the viscosity index (V. I.) of the oil. Oils which change little in viscosity with increase in temperature have a greater viscosity index than do oils whose viscosity is materially affected by increase in temperature. Thus, paraffinic oils have, in general, higher viscosity indices than do naphthenic oils. Where wide variations in operating temperature are encountered, for example, in automobile and aircraft engine lubrication, the viscosity-temperature coefficient (V. I.) of the lubricant is of great importance, and hence hydrocarbon oils which exhibit a minimum change in viscosity under such operating conditions, i. e., have a high viscosity index (V. I.), are highly desirable.

It is an object of the present invention to provide a hydrocarbon oil lubricant having improved viscosity-temperature characteristics. Another object of the invention is to provide a lubricating oil composition whose viscosity changes little with increase in temperature. Still a further object of the invention is to provide a hydrocarbon oil lubricant composition having improved viscosity-temperature coefficient. Other objects and advantages of the invention will become apparent from the following description thereof.

In accordance with the present invention the viscosity-temperature coefficient of hydrocarbon oils, especially of the lubricating oil range, is greatly improved by the addition thereto of a small amount of an oil-soluble polymer having a molecular weight of at least about 1000, and preferably in the range of from about 5000 to about 50,000 of an ester of an olefin dicarboxylic acid having the general formula



in which R and R' are alkyl radicals of at least 4 carbon atoms and preferably of from about 8 to about 30 carbon atoms. The alkyl radicals may be the same or different radicals. These esters are the alkyl esters of itaconic acid in which the alkyl substituents have at least 8 carbon atoms, and preferably from about 8 to about 30 carbon atoms. The polymer may be a polymer of the individual esters of one or more alcohols or copolymers of the esters with an alkyl aconitate and/or with an alkyl methacrylate. Such polymers or copolymers are used in hydrocarbon oil

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compositions in amounts sufficient to impart to the oil the desired viscosity-temperature characteristics; amounts in the range of from about 0.1% to about 20%, and preferably from about 0.5% to about 10%, by weight, are usually sufficient to obtain the desired result.

The esters of itaconic acid can be prepared by direct esterification of the itaconic acid with the selected saturated alcohol in the presence of esterification catalysts, such as para-toluene sulfonic acid, metallic sodium, potassium carbonate, sulfonic acid, sodium acid sulfate, etc. The alcohol used for the esterification is preferably one having at least 4 carbon atoms, and preferably at least 8 carbon atoms, for example, butyl alcohol, amyl alcohol, octyl alcohol, nonyl alcohol, decyl alcohol, dodecyl alcohol, cetyl alcohol, octadecyl alcohol, stearyl alcohol, myricyl alcohol, etc. The mixed esters may be prepared by effecting the reaction between an itaconic monoester acid chloride and the selected alcohol in the presence or absence of an inhibiting agent, such as phenolic bodies, copper, etc. Other methods of preparing mixed esters are, (1) from an itaconic mono-acid chloride and one of the select saturated alcohols, followed by direct esterification of the other acid radical by another selected saturated alcohol of the desired carbon chain length, and (2) by the esterification of the acid with mixtures of alcohols.

The alkyl esters of aconitic acid can be prepared by the acetylation of the corresponding ester of citric acid with acetic anhydride followed by dehydration to form the corresponding aconitate and acetic acid. For example, tributyl aconitate is prepared by heating tributyl citrate with acetic anhydride for one hour at about 310° F. in the presence of phosphoric acid as the catalyst, and heating the resultant product at a temperature of about 795° F.

Polymers of the herein described esters of olefin polycarboxylic acids can be prepared by polymerizing the pure ester at a temperature of from about 100° F. to about 350° F. in the presence of a catalyst, such as for example, oxygen, ozone, hydrogen peroxide, sulfuric acid, aluminum chloride, boron fluoride, aliphatic acyl peroxides, such as acetyl peroxide, stearyl peroxide and the peroxides of the aromatic acids, such as for example, benzoyl peroxide; the preferred catalyst being the benzoyl peroxide.

The method of polymerizing the dialkyl itaconate is illustrated by the following example:

EXAMPLE I

A flask containing about 100 g. of di-2 ethylhexyl itaconate in which is dissolved 0.1% benzoyl peroxide is flushed for one hour with purified nitrogen, sealed under this atmosphere and warmed for 72 hours at 60–80° C. The product is

a colorless to pale yellow oil-soluble semi-solid having a molecular weight in the range of about 10,000.

As mentioned above, instead of using a polymer and/or copolymer of the alkyl esters of itaconic acid, copolymers of such esters with alkyl aconitates and/or alkyl methacrylates can also be employed. The alkyl aconitate and alkyl methacrylate are preferably those having at least 4 carbon atoms in the alkyl group and preferably from about 4 to about 18 carbon atoms in the alkyl group. Examples of suitable methacrylates are butyl methacrylates, heptyl methacrylate, octyl methacrylate, 2-ethylhexyl methacrylate, nonyl methacrylate, decyl methacrylate, dodecyl (lauryl) methacrylate, cetyl methacrylate, octadecyl methacrylate, etc. Examples of suitable alkyl aconitates are tributyl aconitate, trihexyl aconitate, trinonyl aconitate, tridodecyl aconitate, trioctadecyl aconitate, etc.

The copolymerization of the herein described alkyl esters of itaconic acid with alkyl aconitates and/or alkyl methacrylates can be carried out by heating a mixture of the olefin dicarboxylic acid ester with the alkyl methacrylate and/or alkyl aconitate in the ratio of from about 1:1 to 2:1, at a temperature of from about 10° F. to about 200° F., and preferably from about 80° F. to about 160° F., in the presence of a catalyst, for example, a peroxide of the organic acid series, such as benzoyl peroxide. The polymerization is continued until a product having the desired molecular weight, namely at least 1000, and preferably from about 5000 to about 50,000, is obtained. The copolymerization of an alkyl methacrylate and a dialkyl ester of itaconic acid is illustrated by the following example:

EXAMPLE II

A flask containing 100 g. of the mixed monomers dioctyl itaconate and octyl methacrylates in the mole ratio of 1:1 together with .05% benzoyl peroxide was flashed with purified nitrogen for one hour, sealed under this atmosphere and heated 48 hours at 60° C. The product was a pale yellow oil-soluble solid.

The effectiveness of the copolymers of dialkyl esters of itaconic acid and alkyl esters of methacrylic acid having an average molecular weight of about 7,000 is illustrated by the following data which were obtained by determining the amount of the copolymer of dinonyl itaconic and various alkyl methacrylates were required to obtain a 140 viscosity index using as a base oil a petroleum oil having a Saybolt Universal viscosity at 100° F. of about 105 seconds and a viscosity index of about 70.

Copolymers of dinonyl itaconate and methacrylates

Methacrylate	Concentration Required For 140 V. I. (Percent)	Viscosity Increase at 140 V. I. (Sec. at 100° F.)
Butyl	4.8	85
Do [1]	2.2	145
Heptyl	2.0	30
Do [1]	5.8	130
Nonyl	4.4	155
Do [1]	8.2	155
Lauryl	2.8	75

[1] Two moles of itaconate/one mole of methacrylate otherwise 1:1. Dinonyl itaconate polymers in concentration of 0.5% in the above base oil increased the viscosity index from 70 to 125.

The herein described polymers and copolymers can be used in normally liquid lubricant compositions comprising a major proportion of a hydrocarbon oil, for example petroleum oils, synthetic hydrocarbon oils, etc., as well as in normally semi-solid and solid lubricants, such as greases. The composition can contain in addition other additives such as pourpoint depressants, antioxidants, metal deactivators, E. P. agents, etc.

While we have described our invention by reference to certain examples thereof the invention is not limited by the same, but includes within its scope such modifications as come within the spirit of the appended claims.

We claim:

1. A normally liquid lubricant composition comprising a major proportion of a hydrocarbon oil and from about 0.1% to about 20%, by weight, of a copolymer of a dialkyl itaconate in which the alkyl groups contain from about 4 to about 30 carbon atoms, said dialkyl itaconate being an ester of a saturated alcohol and itaconate acid, and an alkyl methacrylate in which the alkyl group contains from about 4 to about 18 carbon atoms, said copolymer having a molecular weight of from about 1000 to about 50,000.

2. A normally liquid lubricant composition as described in claim 1 in which the alkyl ester of the itaconic acid and the alkyl methacrylate are employed in the ratio of from about 2:1 to about 1:1.

3. A normally liquid lubricant composition comprising a major proportion of a hydrocarbon oil and from about 0.1% to about 20% by weight of a copolymer of a dialkyl itaconate having from about 8 to about 30 carbon atoms in the alkyl groups, said dialkyl itaconate being an ester of a saturated alcohol and itaconic acid, and an alkyl methacrylate having from about 4 to about 18 carbon atoms in the alkyl group, said copolymer having a molecular weight within the range of from about 5000 to about 50,000.

4. A normally liquid lubricant composition described in claim 3 in which the dialkyl itaconate is dinonyl itaconate and the alkyl methacrylate is heptyl methacrylate.

5. A normally liquid lubricant composition described in claim 3 in which the dialkyl itaconate is dioctyl itaconate and the alkyl methacrylate is octyl methacrylate.

6. A lubricating oil composition consisting essentially of a hydrocarbon oil and from about 0.1% to about 20% by weight, of a copolymer of a dialkyl itaconate in which the alkyl groups contain about 10 carbon atoms and an alkyl methacrylate in which the alkyl group contains about 10 carbon atoms.

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