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LUBRICATING COMPOSITIONS

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ABSTRACT OF THE DISCLOSURE

Hydrocarbon lubricant compositions are provided containing a minor proportion of the reaction product of at least one member of the group consisting of alkyl and alkenylsuccinic anhydrides and at least one member of the group consisting of benzotriazole and substituted benzotriazoles in a mole ratio of 1:1 to 1:2.

CROSS-REFERENCE TO RELATED APPLICATIONS

Continuation-in-part of application Ser. No. 222,642, filed Feb. 1, 1972.

BACKGROUND OF THE INVENTION

1. Field of the invention

This invention relates to improved lubricant compositions and, in one of its aspects, relates more particularly to lubricant compositions that are normally susceptible of causing deterioration of metal surfaces with which they may come into contact or tend to undergo deterioration under conditions of use. Still more particularly, in this aspect, the invention relates to hydrocarbon lubricant compositions in the form of lubricating oils and greases which normally exhibit the aforementioned shortcomings in performing their intended functions.

2. Description of the prior art

It is well known that certain types of lubricants, including hydrocarbon lubricating oils and greases, are susceptible of causing deterioration, by oxidation or corrosion, when coming into contact with various metal surfaces, for example in causing copper-staining. In addition, such lubricants may also tend to undergo deterioration in performing their intended functions, for example in the impairment of load-carrying characteristics, thus clearly indicating the necessity for incorporating in such lubricants effective anti-oxidative, corrosion inhibiting and load-carrying improving agents.

SUMMARY OF THE INVENTION

It has now been found that the aforementioned oxidative and corrosion inhibiting properties and, also, load-carrying characteristics of hydrocarbon lubricants can be effectively improved by incorporating, in minor proportion, sufficient to inhibit such deterioration, the reaction product of at least one member of the group consisting of alkyl and alkenylsuccinic anhydrides and at least one member of the group consisting of benzotriazole and substituted benzotriazoles in a mole ratio of 1:1 to 1:2. For most applications, these reaction products are employed in an amount of from about .001 to about 5%, and preferably in an amount of from about .01 to about 1% by weight of the total lubricating composition.

Where the hydrocarbon lubricant comprises an oil of lubricating viscosity, the lubricant may comprise many mineral or synthetic oils of lubricating viscosity. In instances where high temperature stability is not a prime requirement, mineral oil at a viscosity of at least 40 SSU. at 100° F. and particularly those falling within the range from about 60 SSU. to about 6,000 SSU. at 100° F. is preferably employed. In instances where the lubricant comprises a synthetic hydrocarbon oil rather than a mineral oil, or in combination therewith, various compounds of this type may be successfully utilized. Typical synthetic vehicles include: polypropylene, polypropylene glycol, trimethylol propane esters, neopentyl and pentaerythritol esters, di-(2-ethyl hexyl) sebacate, di-(2-ethyl hexyl) adipate, dibutyl phthalate, fluorocarbons, silicate esters, silanes, esters of phosphorous-containing acids, liquid ureas, ferrocene derivatives, hydrogenated mineral oils, chain-type polyphenyls, siloxanes and silicones (polysiloxanes), alkyl-substituted diphenyl ethers typified by a butyl-substituted bis-(p-phenoxy phenyl) ether, phenoxy phenyl ethers, etc.

The aforementioned liquid hydrocarbon lubricants may also be employed in combination with a grease forming quantity of a thickening agent as vehicles in the production of greases containing the above-described reaction product. For this purpose, a wide variety of materials may be employed. These thickening or gelling agents may include any of the conventional metal salts or soaps, which are dispersed in the lubricating vehicle in grease-forming quantities, in such degree as to impart to the resulting grease composition, the desired consistency. Other thickening agents that may be employed in the grease formation may comprise the nonsoap thickeners, such as surface-modified clays and silicas, aryl ureas, calcium complexes and similar materials. In general, grease thickeners may be employed which do not melt and dissolve when used at the required temperature within a particular environment; however, in all other respects, any material which is normally employed for thickening or gelling hydrocarbon fluids for forming grease can be used in preparing the aforementioned improved grease in accordance with the present invention.

Any alkyl or alkenylsuccinic anhydride may be employed for reaction with benzotriazole or substituted benzotriazoles in producing the aforementioned reaction product and incorporation in the hydrocarbon lubricant composition. Typically representative of such alkyl and alkenylsuccinic anhydrides are octenylsuccinic anhydride, dodecenylsuccinic anhydride, polybutenylsuccinic anhydride, hexadecenylsuccinic anhydride, eicosenylsuccinic anhydride, triacontenylsuccinic anhydride and isooctadecylsuccinic anhydride. Typically representative of the substituted benzotriazoles is tolyl triazole.

DESCRIPTION OF SPECIFIC EMBODIMENTS

The following data and examples will serve to illustrate the preparation of the aforementioned reaction product of an alkenylsuccinic anhydride and benzotriazole of the present invention, and to demonstrate the effectiveness of these reaction products in hydrocarbon lubricant compositions which are normally susceptible of causing oxidative and corrosive deterioration of metal surfaces with which they may come into contact or tend to undergo deterioration under conditions of use, and particularly with respect to the use of these reaction products in hydrocarbon lubricating oils and greases. It will be understood, of course, that it is not intended the invention be limited to the particular composition disclosed or to the operations or manipulations involved. Various modifications thereof can be employed and will be readily apparent to those skilled in the art.

Example 1

A mixture of 266 grams (1 mole) of distilled dodecenylsuccinic anhydride and 119 grams (1 mole) of benzotriazole was stirred at a temperature of about 125° C. for a period of about 3 hours to form a viscous fluid.

Example 2

A mixture of 250 grams (0.93 mole) of undistilled dodecenylsuccinic anhydride and 110 grams (0.93 mole) of benzotriazole was stirred at a temperature of about

125° C. for a period of about 7 hours to form the final product.

Example 3

A mixture of 133 grams (0.5 mole) distilled dodecenylsuccinic anhydride and 119 grams (1.0 mole) of benzotriazole was stirred at a temperature of about 135° C. for a period of about 10 hours to form the final product.

Example 4

A mixture of 300 grams (0.3 mole) of a polybutenylsuccinic anhydride and 35 grams (0.3 mole) of benzotriazole was stirred at a temperature of about 135° C. for a period of about 12 hours and then at about 145° C. for a period of about 4 hours to form the final product.

Example 5

A mixture of 352 grams (1.0 mole) of isooctadecylsuccinic anhydride and 119 grams (1.0 mole) of benzotriazole was stirred at a temperature of about 135–140° C. for a period of about 6 hours to form the final product.

Example 6

A mixture of 133 grams (0.5 mole) of dodecenylsuccinic anhydride and 66.5 grams (0.5 mole) of tolyl triazole was stirred at a temperature of about 135–140° C. for a period of about 4 hours to form the final product.

A base oil having been incorporated therein, in separate blends, the reaction products of Examples 1 through 6 was subjected to the standard A.S.L.E.–64–9 Wet Corrosion Test. This base oil comprised a S.A.E. 30 grade mineral oil having an SUV at 210° F. of 69.1.

The A.S.L.E.–64–9 Corrosion Test is described as follows:

ASLE–64–9 CORROSION TEST

ASLE Slideway Lubricant Accelerated Breakdown Test

I. Test procedure for normal test conditions.—Place clean polished pieces [1] of copper and carbon steel rods (approximately 0.25 inch diameter by 3.0 inches long) in a 100 cc. griffin beaker containing 35 to 40 grams of oil sample. Put beaker and contents into an electric drying oven for 24 hours, maintaining a temperature at 210±2° F. (99±1° C.). Test period may be extended 72 hours if necessary.

Test results.—Condition of steel rod, condition of copper rod, precipitate of sludge, evaporation loss percent wt.

II. Wet ASLE–64–9.—Place 50 grams of oil sample in a 4 g. bottle, add 0.5 ml. of distilled water and stir vigorously for about 1 minute. Place clean polished pieces [1] of copper and carbon steel rods in the beaker. Stopper with a cork and place into an electric drying oven for 72 hours, maintaining a temperature of 210±2° F. (99±1° C.).

Test results.—Condition of steel rod, condition of copper rod, precipitation of sludge.

[1] Test specimen pieces must be freshly polished and placed in pentane for >30 minutes *before* using. These polished specimens must then be used within 30 minutes after the original 30 minute pentane deactivation period.

NOTE 1: For polishing the rods, medium emery cloth is used.

NOTE 2: Specimens should be rated "as is" when removed from the oil (*No* washing).

NOTE 3: Steel rods should be rated "No Stain," "Trace Stain," "Medium Stain," "Heavy Stain." Copper rods should be given an ASTM D–130 rating plus a verbal description such as "No Stain," "Light Brown Stain," "Medium Brown Stain," "Dark Brown Stain," "Black Stain" or "Black Coating," etc.

The results obtained employing the above-described ASLE–64–9 Corrosion Test are set forth in the following table:

ASLE-64-9 CORROSION TEST

	Conc., percent	Steel	Copper	Sludge
Base oil	0	Lt. stain	4A	Light.
Base oil plus Example:				
1	0.1	Pass	1B	Nil.
2	0.1	do	1B	Nil.
3	0.1	do	1A	Nil.
4	0.1	do	1B	Nil.
5	0.1	do	1B	Nil.
6	0.1	do	1A	Nil.

As will be seen from the comparative data of the foregoing table, the presence of the reaction products of alkyl and alkenylsuccinic anhydrides and benzotriazole and substituted benzotriazole additives results in a marked improvement in corrosion inhibiting characteristics of the treated base oil.

Another series of runs were conducted in accordance with standard ASTM Copper Strip Test D130–6 for determining corrosion inhibiting effect of the aforementioned reaction products of alkyl and alkenylsuccinic anhydrides and benzotriazole and substituted benzotriazole additives, employing the aforementioned base oil. The results obtained are set forth in the following table:

ASTM Copper Strip Test D130–6 3 Hr. at 250° F.

	Rating
Base Oil	4A
Base Oil+Example 1	1B
Base Oil + Example 2	1B
Base Oil + Example 3	1B
Base Oil + Example 4	1B
Base Oil + Example 5	1B
Base Oil + Example 6	1B

As will be seen from the foregoinng table, the presence of the reaction product of alkyl and alkenylsuccinic anhydrides and benzotriazole and substituted benzotriazoles result in a marked improvement in inhibiting copper staining.

Another test was conducted in accordance with Federal Standard No. 791B, Method 5308.6, for determining oxidation and corrosion resistance of liquid hydrocarbon fluids treated with the reaction product of alkenylsuccinic anhydrides and benzotriazole additives of the present invention. The base oil comprised a mixture of C_5 to C_9 esters of pentaerythritol plus, by weight, 2.5% alkylated aromatic amines antioxidant, 2.0% tricresyl phosphate, 0.25% di(nonylphenyl)phosphonate, and 0.02% quinizarin. The results obtained, with respect to copper loss are set forth in the following table:

OXIDATION AND CORROSION TEST

Federal Test Standard No. 791B
Method 5308.6
Test run for 72 hours at 400° F.

	Conc., percent	Copper loss in mg.
Base oil	0	2.2
Base oil plus Example 1	0.1	0.8

As will be seen from the comparative data of foregoing table, the presence of the reaction product of the alkenylsuccinic anhydride and benzotriazole results in a marked improvement in reducing copper loss by oxidation and corrosion.

Another test was conducted in accordance with the standard Timken O.K. Load Test, for determining the effect of the reaction product of alkenylsuccinic anhydrides and benzotriazole with regard to load-carrying characteristics of a base oil. In this test the base oil was comprised of an SAE 30 grade mineral oil having an SUV at 210° F. of approximately 69.1. The results obtained are shown in the following table:

TIMKEN O.K. LOAD TEST

	Conc., percent	Load, pounds/sq. in.
Base oil	0	50
Base oil plus Example 1	0.1	70

As will be seen from the comparative data of the foregoing table the presence of the reaction product of the alkenylsuccinic anhydride and benzotriazole resulted in a marked improvement in the load-carrying characteristics of the base oil.

From the foregoing examples and comparative data, it will be noted that the presence of the aforementioned

reaction product of the reaction product of alkyl and alkenylsuccinic anhydrides and benzotriazole or substituted benzotriazoles are markedly effective in improving lubricant compositions which are normally susceptible of causing oxidative and corrosive deterioration of metals with which they may come into contact and tend to undergo deterioration under conditions of use. These liquid hydrocarbon lubricants thus treated, as hereinbefore indicated may be employed as the lubricant vehicle in combination with known thickening agents for providing improved greases, incorporating the benefits of the improved base lubricant oil vehicle.

It will be understood that although the present invention has been described with preferred embodiments, various modifications and adaptations may be resorted to without departing from the spirit of the invention as those skilled in the art will readily understand.

I claim:

1. A hydrocarbon lubricant composition containing, in minor proportion, the reaction product of at least one member of the group consisting of alkyl and alkenylsuccinic anhydrides, wherein the alkyl and alkenyl groups contain from 8 to 30 carbon atoms, and at least one member of the group consisting of benzotriazole and tolyl benzotriazoles in a mole ratio of from 1:1 to 1:2.

2. A composition in accordance with claim **1** wherein said lubricant comprises an oil of lubricating viscosity.

3. A composition in accordance with claim **1** wherein said lubricant comprises a grease.

4. A composition in accordance with claim **1** wherein said reaction product is present in an amount from about .001 to about 5%, by weight.

5. A composition in accordance with claim **1** wherein said reaction product is present in an amount from about .01 to about 1%, by weight.

6. A composition in accordance with claim **1** wherein the alkenylsuccinic anhydride is octenylsuccinic anhydride.

7. A composition in accordance with claim **1** wherein the alkenylsuccinic anhydride is a polybutenylsuccinic anhydride.

8. A composition in accordance with claim **1** wherein the alkenylsuccinic anhydride is triacontenylsuccinic anhydride.

9. A composition in accordance with claim **1** wherein the alkylsuccinic anhydride is isooctadecylsuccinic anhydride.

10. A composition in accordance with claim **1** wherein the substituted benzotriazole is tolyl triazole.

References Cited

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