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RUST INHIBITING COMPOSITION

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This invention relates to rust preventing oil compositions and more particularly to mineral lubricating oil compositions which tend to inhibit rusting and corrosion of metal parts which are exposed to moisture.

A primary object of the present invention is the preparation of compositions which may be employed as internal combustion engine lubricants and which will also serve for protection of exposed surfaces of such engines when the same are not in use. When operating engines in climates having a high humidity, rusting begins within a very short period of time after the engine is shut down. The compositions of the present invention are particularly valuable in preventing such rusting and they are useful not only in the lubrication of internal combustion engines, but with oil bases of suitable viscosity they will be employed as turbine oils or as lubricants for fire arms, ordnance equipment, industrial machinery, etc., and for any lubricating purposes where metal surfaces are exposed to humid air. The compounds may also be added to other mineral oil bases and employed in motor fuels, emulsions, hydrocarbon polymers, polishes, paints, sprays, and the like.

It is known that partial esters of polyhydroxy alcohols are effective rust inhibitors when employed as lubricating oil additives or as the principal components in slushing oils. In accordance with the present invention a specific class of such partial esters may be sulfurized to produce additives of unusual effectiveness in inhibiting rust and corrosion of metal surfaces. The additives of the present invention may be broadly defined as the sulfurized C₁₂ to C₂₄ unsaturated aliphatic monocarboxylic acid monoesters of polyhydroxy aliphatic compounds containing 5 to 6 carbon atoms per molecule and having 4 to 6 hydroxyl groups attached to carbon atoms which are separated from each other by not more than one carbon atom containing no hydroxyl group. The acid portion of the molecule, before sulfurization, may contain one to two double bonds. The polyhydroxy aliphatic compound may contain various substituent groups in addition to the hydroxyl groups such as aldehyde groups, ketone groups, ether groups, etc.

The polyhydroxy compounds thus defined include the hexitols, typified by sorbitol, mannitol, dulcitol, and the like, also the aldohexoses, such as glucose, mannose, fructose, galactose, and the like, as well as the dehydrated products of such compounds, such as sorbitan and other hexitans. The polyhydroxy compounds also include com-

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pounds containing a neo carbon atom, typified by pentaerythritol.

Examples of suitable unsaturated acids to be employed in preparing the esters of the present invention include the monoolefinic acids such as oleic acid, elaidic acid, erucic acid and the like, as well as the diolefinic acids, such as linoleic acid, and substituted unsaturated acids, such as ricinoleic acid.

The esters are formed by reacting the acids and the polyhydroxy compounds under well known esterification conditions, employing only enough acid to form the monoester. The sulfurization reaction may take place before or after the unsaturated acid is reacted with the polyhydroxy compound, and is accomplished simply by heating the acid or ester in the presence of elementary sulfur. The exact manner in which the sulfur becomes attached to the acid radical is not known.

Examples of the esters which may be sulfurized to form additives in accordance with the present invention include sorbitan monooleate, mannitol monooleate, hexitan monooleate, sorbitan monooleate, glucose monooleate, fructose monoerucate, pentaerythritol monooleate, pentaerythritol monoerucate, pentaerythritol monooleate, and homologous compounds.

The additives of the present invention are preferably added to mineral oils in proportions ranging from 0.01 to 10%, the proportions being preferably about 1.0 to 5.0% when employed as rust inhibitors in mineral lubricating oils. The proportions giving the best results will vary somewhat according to the nature of the additive for the specific quality characteristics of the oil to be improved by the use of the additive. For commercial purposes, when the additives are to be employed in mineral lubricating oils, it is convenient to prepare concentrated oil solutions in which the amount of additive in the compositions ranges from 25 to 50% by weight and to transport and store them in such form. In preparing lubricating oil compositions for use as crankcase lubricants the additive concentrate is merely blended with the base oil in the required amount.

Below are given detailed descriptions of preparations of two examples of additives of the type described above as well as various laboratory tests which were applied to determine their effectiveness when employed in lubricating oil compositions. It is to be understood that these examples are given to illustrate the present inven-

tion and are not to be construed as limiting the scope thereof in any way.

Example 1

A 300 ml. Pyrex flask with a ground glass joint leading to a return condenser was charged with 50.1 g. (0.117 mol) of sorbitan monooleate and 3.5 g. (0.109 mol) of flowers of sulfur. The mixture was heated to 150° C. for 4 hours and to 170° C. for 2½ hours. The entire product after heating weighed 53.5 g. After removal of the liquid product 1.9 g. of solid residue remained, which consisted in part of unreacted sulfur. The liquid product was a clear, dark red-brown very viscous oil which on analysis was found to contain 3.94% sulfur, 68.19% carbon, and 10.40% hydrogen.

Example 2

A reaction flask of the type employed in Example 1 was charged with 50.0 g. (0.125 mol) of pentaerythritol monooleate and 3.5 g. (0.109 mol) of flowers of sulfur. The mixture was heated to 150° C. for 4 hours and to 170° C. for 2½ hours. The entire product weighed 52.7 g. after heating. After removal of the liquid product, 3.2 g. of solid residue remained, which consists in part of unreacted sulfur. The liquid product was a clear, dark red-brown very viscous oil which on analysis was found to contain 3.82% sulfur, 69.82% carbon, and 11.09% hydrogen.

Example 3

The materials obtained in the foregoing examples were evaluated for their rust inhibiting properties by employing them in 5% by weight concentration in two types of base oil, one being a conventional refined Coastal naphthenic oil of 40 seconds viscosity (Saybolt) at 210° F., and the other being a phenol-treated Mid-Continent lubricating oil of 120 seconds viscosity (Saybolt) at 210° F.

These blends were submitted to a humidity cabinet test to determine the degree to which the oils prevent the rusting of steel surface in a warm humid atmosphere. This test was conducted by dipping panels of 1020 cold rolled steel 2' x 4' in size, in the oil blends and hanging them in an AN-H-31 humidity cabinet maintained at a temperature of 120±2° F., the panels being surrounded by air of 100% humidity. Failure under this test is considered to take place when rusting occurs to an extent greater than 3 rust spots, no one of which is greater than 1 mm. diameter.

Under the above test the base oils used were found to fail in less than 3 hours, but the blends containing 5% of each of the two additives did not fail at the end of a period of 1,008 hours. The test was discontinued after this time.

Example 4

Four blends were prepared, using as base oils the two oils described in connection with Example 3, and 2% blends of these oils with the two additives sulfurized sorbitan monooleate and sulfurized pentaerythritol monooleate were prepared. These blends were submitted to a copper strip test to determine the amount of free sulfur present. This test is a modification of the C. R. C. method L-16-445 and consists in immersing a polished metallic copper strip in the oil blend to be tested for 3 hours at 212° F. and noting the extent of staining. No discoloration of the copper strip was noted in the case of any of the blends tested.

The rust preventing agents of the present in-

vention may be advantageously employed in connection with any hydrocarbon solvent, especially of the petroleum hydrocarbon type, and such solvent oils may, for example, be naphthas, spindle oils, light and heavy lubricating oil fractions, etc., and may be used when other ingredients are present such as in greases, sprays, paints, etc., and in lubricating oils containing other additives such as detergents, pour depressants, thickeners, extreme pressure agents, and the like.

What is claimed is:

1. A composition consisting essentially of a hydrocarbon solvent containing dissolved therein 0.01 to 10% of a monoester of a C₁₂ to C₂₄ unsaturated fatty acid with a polyhydroxy aliphatic compound containing 5 to 6 carbon atoms and having 4 to 6 hydroxyl groups attached to carbon atoms separated from each other by not more than one carbon atom containing no hydroxyl group, which monoester has been sulfurized by a reaction with elementary sulfur.

2. A composition according to claim 1 in which the acid is oleic acid.

3. A composition according to claim 1 in which the polyhydroxy aliphatic compound is a dehydrated hexitol.

4. A composition according to claim 3 in which the dehydrated hexitol is sorbitan.

5. A composition according to claim 1 in which the polyhydroxy aliphatic compound is pentaerythritol.

6. A composition consisting essentially of a hydrocarbon solvent containing dissolved therein 0.01% to 10% of sorbitan monooleate sulfurized by a reaction with elementary sulfur.

7. A composition according to claim 6 in which the hydrocarbon solvent is a mineral lubricating oil.

8. A composition consisting essentially of a hydrocarbon solvent containing dissolved therein 0.01% to 10% of pentaerythritol monooleate sulfurized by a reaction with elementary sulfur.

9. A composition according to claim 8 in which the hydrocarbon solvent is a mineral lubricating oil.

10. A composition consisting essentially of a mineral lubricating oil and the sulfurized monoester as defined in claim 1, the amount of said monoester in the composition being 25 to 50% by weight.

11. A composition consisting essentially of a mineral lubricating oil and sorbitan monooleate sulfurized by a reaction with elementary sulfur, the amount of the sulfurized sorbitan monooleate in the composition being 25 to 50% by weight.

12. A composition consisting essentially of a mineral lubricating oil and pentaerythritol monooleate sulfurized by a reaction with elementary sulfur, the amount of the sulfurized pentaerythritol monooleate in the composition being 25 to 50% by weight.

13. As a new composition of matter sorbitan monooleate sulfurized by a reaction with elementary sulfur.

14. As a new composition of matter pentaerythritol monooleate sulfurized by a reaction with elementary sulfur.

15. A composition consisting essentially of a hydrocarbon solvent containing dissolved therein 0.01 to 10% of a monoester of a polyhydroxy aliphatic compound containing 5 to 6 carbon atoms and having 4 to 6 hydroxyl groups attached to carbon atoms separated from each other by not more than one carbon atom containing no hydroxyl group, with the reaction product of ele-

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mentary sulfur with a C₁₂ to C₂₄ unsaturated fatty acid.

16. As a new composition of matter the reaction product of elementary sulfur with a monoester of a C₁₂ to C₂₄ unsaturated fatty acid with a polyhydroxy aliphatic compound containing 5 to 6 carbon atoms and having 4 to 6 hydroxyl groups attached to carbon atoms separated from each other by not more than one carbon atom containing no hydroxyl group.

17. As a new composition of matter a monoester of a polyhydroxy aliphatic compound containing 5 to 6 carbon atoms and having 4 to 6 hydroxyl groups attached to carbon atoms separated from each other by not more than one carbon atom containing no hydroxyl group, with the reaction product of elementary sulfur with a C₁₂ to C₂₄ unsaturated fatty acid.

18. A composition according to claim 16 in which the acid is oleic acid.

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19. A composition according to claim 16 in which the polyhydroxy aliphatic compound is a dehydrated hexitol.

20. A composition according to claim 16 in which the polyhydroxy aliphatic compound is sorbitan.

21. A composition according to claim 16 in which the polyhydroxy aliphatic compound is pentaerythritol.

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