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RUST INHIBITED MINERAL OIL COMPOSITIONS

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This invention relates to light liquid fuel fractions of mineral oil containing an improved rust inhibiting composition.

While the general problem of rusting of metal surfaces which are in contact with mineral oils has received considerable research attention in the past, particularly with respect to improving the rust inhibiting properties of lubricating oils and the like, it has only been recently that research attention has been directed to improving the rust inhibiting properties of "light products" i.e., naphtha, gasoline and kerosene. The rusting problems occurring with lubricating oils are different from those occurring with the light fuel fractions of mineral oil. For example, the rust preventive properties of a finished lubricating oil may be affected not only by the type of oil, but also by the presence of other additives, by the type of metal materials from which the engine parts are constructed, by the different types of physical mechanisms used in the engine, and other factors. The presence of other additives in lubricating oil may aggravate the problem of corrosion and rusting. Certain metal materials from which the engine may be constructed may be readily rusted in the corrosive atmosphere of the internal combustion chamber. The use of hydraulic valve lifters in place of mechanical valve lifters has presented another type of rusting problem which has only recently been solved after intensive research.

The rusting problem, presented in connection with light liquid fuel fractions such as gasoline, occurs because of the storage and/or transportation of the fuel fraction and because of the ingredients of the light liquid fuels. For example, gasoline may be stored in tanks, shipped in tankers over fresh water or salt water, or pumped through pipelines. Any rust inhibitor which is added to gasoline must not allow or cause the formation of emulsions of water which might be present in the storage tank, tanker compartment, or pipeline. The rust inhibitor must not be precipitated from the gasoline by the high pressures which occur in pipeline transportation. Also the color of the gasoline must not be affected by the addition of the rust inhibitor, i.e., the rust inhibitor must not cause a color change by reaction thereof with the hydrocarbons, anti-oxidants, dyes, components of tetraethyl lead, sulfur, etc., which may be contained in the gasoline. The color problem is a particularly difficult one when a non-dyed gasoline free of tetraethyl is involved. The presence of the rust inhibitor must not increase the amount of color formation beyond acceptable standards. In addition, the rust inhibitor must not affect the octane rating of the gasoline.

An object of this invention is to provide an improved rust inhibitor for light liquid fuel fractions of mineral oil. An additional object is to provide a highly effective and inexpensive additive for liquid fuel fractions such as gasoline which does not affect the quality of the gasoline nor the storage or transportation thereof and which reduces the amount of rusting of metals in contact therewith.

Other objects and advantages of the invention will become apparent from the following description thereof.

It has been found that these and other objects can be achieved by incorporating in a light liquid fuel fraction of mineral oil from between about 0.0001% and 0.01% by weight of a diamine salt of an acylsarcosine. Diamines having the general formula

$$RNHCH_2CH_2CH_2NH_2$$

wherein R is an alkyl radical having from 8 to 20 carbon atoms, are used in forming the salt. Acylsarcosines having the general formula $R'CON(CH_3)CH_2COOH$, in which R' is an alkyl radical having from 8 to 20 carbon atoms, are used in preparing the diamine salt thereof. The preferred N-alkyl propylene diamines used have 16 to 18 carbon atoms in the N-alkyl chain. For example, the N-octadecyl propylene diamine salts of N-lauroyl sarcosine may be used in amounts of from 0.0005 to 0.003% by weight in gasoline to obtain excellent rust prevention properties. While the N-alkyl propylene diamine and the acylsarcosine individually have some rust inhibiting ability, it has been found, to our surprise, that the salt formed from the two components produces a rust inhibiting effect which is greater than the additive effects of the two components, i.e., a synergistic rust inhibiting effect is obtained when using the diamine salt of acylsarcosines. The preformed salt may be added to the light liquid fuel fraction or the constituents thereof may be added separately or together to the light liquid fuel fraction to form the salt in situ. The salt is formed by slight heating, e.g., about 100° F. or so, of the N-alkyl propylene diamine with the acylsarcosine preferably dissolved in a hydrocarbon oil. Concentrated solutions of the N-alkyl propylene diamine salt of the acylsarcosine containing more than 1% by weight of the salt, preferably 1 to 50% by weight, can be added to the light liquid fuel fraction in an amount to produce the rust inhibited composition containing the desired amount of the N-alkyl propylene diamine salt of the acylsarcosine.

The diamine which is used in forming the salt is an aliphatic diamine, specifically an N-alkyl propylene diamine having the general formula $RNHCH_2CH_2CH_2NH_2$ in which R is an alkyl radical having from 8 to 20 carbon atoms. The alkyl radical may be a saturated or unsaturated aliphatic grouping, having either a branched or straight chain. Either a relatively pure N-alkyl propylene diamine or a mixture of N-alkyl propylene diamines wherein the alkyl grouping having different numbers of carbon atoms may be used. For example, N-octyl propylene diamine, N-nonyl propylene diamine, N-dodecyl propylene diamine, N-tetradecyl propylene diamine, N-pentadecyl propylene diamine, N-hexadecyl propylene diamine, N-octadecyl propylene diamine, may be used individually or mixtures of the various ones listed may be used.

Those N-alkyl propylene diamines having their alkyl radical derived from a natural fatty acid composition are very satisfactory. Such compounds may be obtained by converting a natural fatty acid such as may be obtained from tallow, soybean oil, coconut oil, palm oil, and the like (such natural fatty acid compositions consisted of a mixture of various saturated and unsaturated fatty acids which are obtained by splitting of the fat or fatty oil) to the corresponding fatty acid nitrile. The nitriles are reduced by catalytic hydrogenation to produce the primary amines. The mixture of amines produced is then reacted with acrylonitrile followed by hydrogenation to the corresponding N-alkyl propylene diamine product. Commercially available examples of such N-alkyl propylene diamines are the various "Duomeens." These compounds which have the formula

$$RNHCH_2CH_2CH_2NH_2$$

wherein R may be derived from coconut fatty acid (Duomeen C), from tallow fatty acid (Duomeen T), from lauric acid (Duomeen 12) or from soybean fatty acid (Duomeen S), etc. are industrial or technical grade chemicals with an amine content of approximately 80% calculated as diamine. The approximate melting ranges for each of the aforementioned "Duomeens" are:

	°C.
Duomeen C	20 to 24
Duomeen 12	28 to 32
Duomeen S	38 to 42
Duomeen T	44 to 48

The acylsarcosine employed in preparing this diamine salt is one which has the general formula

$$R'CON(CH_3)CH_2COOH$$

in which R' is an alkyl radical having from 8 to 20 carbon atoms. The alkyl radical may be a saturated or unsaturated grouping having either a branched or straight chain. Mixtures of various acylsarcosines can be employed in preparing the diamine salt, or individual acylsarcosines may be used. Those acylsarcosines whose alkyl radical is derived from a natural fatty acid composition are very satisfactory. For instance, lauroyl-, stearoyl-, oleyl-, cocyl- (from coconut oil) sarcosines may be used; lauroyl sarcosinate being commercially available and satisfactory for preparing the diamine salt thereof.

The acylsarcosines may be prepared by reacting the desired acylchloride (having from 8 to 20 carbon atoms) with the alkali metal salt of methyl aminoacetic acid (frequently termed methyl glycine or sarcosine) to form the alkali metal acylsarcosinate which may then be hydrolyzed to the desired acylsarcosine, e.g.,

$$C_{11}H_{23}COCl + HN(CH_3)CH_2COONa \rightarrow C_{11}H_{23}CON(CH_3)CH_2COONa \rightarrow C_{11}H_{23}CON(CH_3)CH_2COOH$$

The acylchlorides used are suitably derived from natural fatty acid compositions of the type discussed above.

The amount of the diamine salt of the acylsarcosine used may be between 0.0001 and 0.01% by weight, preferably between about 0.0005 and 0.003% by weight. This corresponds to a broad range of 1 p.p.m. to 100 p.p.m., preferably between about 5 p.p.m. and 30 p.p.m. on a weight basis. 0.0005% is approximately 1.25 lbs./1000 bbls. of light liquid fuel. The specific amount used may vary to some extent with the particular gasoline, kerosene, etc. which is used and the severity of the conditions conducive to rusting.

The diamine salt may be preformed and then added to the light liquid fuel fraction, or the components thereof may be added separately or together to the light liquid fuel fraction to form the salt in situ. Usually equimolar ratios of the N-alkyl propylene diamine and the acylsarcosine are employed in preparing the diamine salt of the latter compound, although obviously these ratios may be varied by employing as much as a ten-fold excess of either of the components used in preparing the diamine salt. A convenient manner consists of adding the N-alkyl propylene diamine and the acylsarcosine to a gasoline boiling range hydrocarbon oil, e.g., naphtha, gasoline, etc. in an amount more than 1% by weight, based on oil (up to about 25 to 50% by weight), and then heating to about 100° F. or so to form a concentrated solution of the diamine salt. Care should be taken to avoid temperatures higher than about 200° F., since it is believed that at such elevated temperatures a reaction occurs which costs a reduction in the effectiveness of the rust inhibitor. The concentrated solution so prepared may then be conveniently added to the light liquid fuel fraction, such as gasoline, to be inhibited in an amount so that it will contain the prescribed content of diamine salt of acylsarcosine.

The effectiveness of the N-alkyl propylene diamine, the acylsarcosine, as well as the salt formed from the two components were determined by a Modified ASTM D-665-54 T rust test. The ASTM rust test was conducted for 24 hours using synthetic sea water. Because of the volatility of the product tested, the test temperature was lowered from the standard 140° F. down to 80° F. In order for a specimen to pass the test, it must not show a single rust spot or streak under 60-foot candles illumination. The rust inhibitors were tested in gasoline containing no dye or tetraethyl lead fluid. The N-alkyl propylene diamine used was Duomeen T (N-alkyl radical being derived from the fatty acids of tallow). The acylsarcosine used was lauroyl sarcosine, a commercially available product sold under the trade name Sarkosyl L. The Duomeen T salt of Sarkosyl L was prepared by dissolving equimolar portions thereof in alcohol, warming slightly and mixing well, and then evaporating the alcohol. The resultant salt was then added to the gasoline and its rust inhibiting effect evaluated. The concentration in weight percent of the rust inhibitor which was needed for the test specimen to test the Modified ASTM rust test was determined by conducting separate tests with varying amounts of rust inhibitor until reproducible results were obtained at the minimum amount of rust inhibitor required to pass the test. Evaluation of the various rust inhibitors is shown in Table I which follows:

Table I

Rust Inhibitor	Concentration (Wt. Percent) Required to pass ASTM D-665-54 Rust Test
N-Octadecyl propylene diamine	0.1
Lauroyl sarcosine	0.004
N-Octadecyl propylene diamine salt of lauroyl sarcosine	0.0025

It is apparent from the foregoing results that the N-octadecyl propylene diamine salt of lauroyl sarcosine can be used in much smaller amounts by weight than can either of its components in obtaining complete inhibition of gasoline. Since the N-octadecyl propylene diamine is much less expensive (but also much less effective) than the lauroyl sarcosine, a great cost reduction is obtained while obtaining even better results than are possible from the lauroyl sarcosine. No problems were observed from the standpoint of undesirable discoloration of the gasoline or an undesirable amount of gum formation.

While the invention has been described with reference to certain specific examples, the invention is not to be considered as limited thereto but includes within its scope such modifications and variations as would occur to one skilled in the art.

Thus having described the invention, what is claimed is:

1. A light liquid fuel fraction of mineral oil containing between about 0.0001% and 0.01% by weight of a diamine salt of an acylsarcosine, wherein the diamine corresponds with the general formula $RNHCH_2CH_2CH_2NH_2$ and the acylsarcosine corresponds with the formula $R'CON(CH_3)CH_2COOH$ in which R and R' are alkyl radicals having from 8 to 20 carbon atoms.

2. The composition of claim 1 wherein the light liquid fuel fraction is gasoline.

3. The composition of claim 1 wherein R is an octadecyl radical.

4. The composition of claim 1 wherein R is derived from the fatty acids of tallow.

5. The composition of claim 1 wherein R' is a lauryl radical.

6. A gasoline containing between about 0.0005% and 0.003% by weight of N-octadecyl propylene diamine salt of N-lauroyl sarcosine.

7. An addition agent for producing rust inhibited gasoline, which agent comprises a concentrated solution of a

gasoline containing between about 1% and 50% of a diamine salt of an acylsarcosine, wherein the diamine corresponds with the formula $RNHCH_2CH_2CH_2NH_2$ and the acylsarcosine corresponds with the formula

$$R'CON(CH_3)CH_2COOH$$

in which R and R' are alkyl radicals having from 8 to 20 carbon atoms, which concentrated solution is capable of dilution with gasoline to form a rust inhibited gasoline containing between about 0.0001% and 0.01% by weight of said diamine salt of the acylsarcosine.

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