United States Patent Office

3,146,079
Patented Aug. 25, 1964

3,146,079

FUEL OIL COMPOSITION

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No Drawing. Filed Sept. 13, 1960, Ser. No. 55,731
4 Claims. (Cl. 44—63)

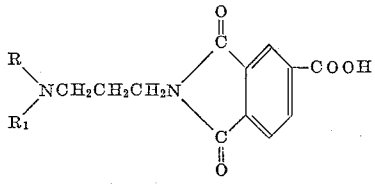
This invention relates to novel corrosion and/or rust inhibitors particularly adapted for use in preventing corrosion of metals especially iron, steel and ferrous alloys by liquids containing corrosive compounds such as, for example, petroleum fuel oil and to the method of preventing such corrosion.

The rusting of steel used in the transportation and storage of petroleum fuel oils has always presented a serious problem. The presence of sediment and rust as a result of corrosion and the carry-over of the sediment into the fuel burning installations presents a serious operating problem. In addition to the possibility of storage tank rusting through with the consequent loss of fuel oil, there is the additional danger that the furnace filters and furnace fuel lines may become clogged, thus causing the failure of the heating system.

The problem of corrosion or rusting is associated with the presence of moisture in the oil products caused by entrainment, condensation and solution. In most cases, the problem is accentuated by the presence of a separate water phase. Thus, in the storage and bulk shipment of fuel oil, it is common practice to maintain a water layer as tank bottoms. Even where a separate water layer is not maintained as tank bottoms, a separate water phase may be formed by repeated condensation of moisture associated with tank breathing or the repeated expansion and contraction of the bulk due to temperature changes unless special precautions are taken. Complete protection against rusting, therefore, requires a corrosion inhibitor which is effective in both the oil and water phase.

It is an object of the present invention to provide a corrosion and/or rust inhibitor adapted for use in preventing the corrosion and/or rusting of metals by liquids containing corrosive compounds associated with oleaginous materials such as petroleum fuel oils. It is a further object of this invention to provide a normally liquid nonlubricating hydrocarbon fuel oil composition having improved rust inhibiting properties for the protection of metal surfaces of oil storage and/or handling equipment whether metal surfaces be exposed to the oil or to the water phase. Other objects and advantages of the invention will become apparent from the following description thereof.

I have now discovered certain new corrosion inhibitors which find utility as inhibitors for fuel oils. The corrosion inhibitor is an imide prepared by reacting propylene diamine with polybasic aromatic acid. The corrosion inhibitor of the present invention is an imide represented by the formula



wherein R is C_{12-18} alkyl radical and R_1 is a member of the group consisting of H and a C_{1-22} alkyl radical.

The alkyl groups of the above formula are preferably hydrocarbon alkyl groups. The preferable hydrocarbon groups are those groups having from about 12 carbon atoms to about 18 carbon atoms such as, for example, those derived from higher fatty acids, e.g., lauryl, oleyl, linoleyl, tallow, soybean, coco, stearyl, palmityl, myristyl and the like.

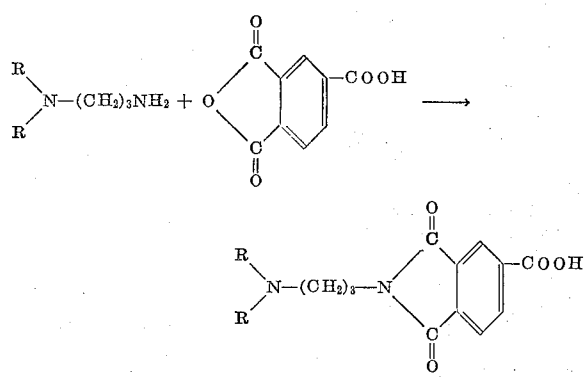
The corrosion inhibitors of this invention may be used to form a fuel oil composition containing a major proportion of a distillate fuel oil and a small or minor amount of the corrosion inhibitor. Such distillate fuel oil compositions may comprise a distillate fuel oil containing from about 0.0001 to about 5 weight percent and preferably from about 0.0001 to about 0.05 weight percent of the corrosion inhibitor. The corrosion inhibitor may also be formulated as an addition agent concentrate in a suitable organic solvent as more particularly described below. This concentrate may be used by further dilution with the distillate fuel oil to form the distillate fuel oil composition. The corrosion inhibitors of the present invention are advantageously oil-soluble.

The corrosion inhibitors of this present invention may be prepared by reacting the corresponding propylene diamine in the presence of inert solvent with polybasic aromatic acid. The reaction may be carried out in the presence of a solvent such as benzene, ethanol, n-butanol, isobutanol, xylene, etc. A acceptable temperature for the reaction may be in the range of from about 50° F. to about 200° F. although higher or lower temperatures may be used.

The following procedures illustrate the method of preparing the corrosion inhibitor of the invention.

PROCEDURE A

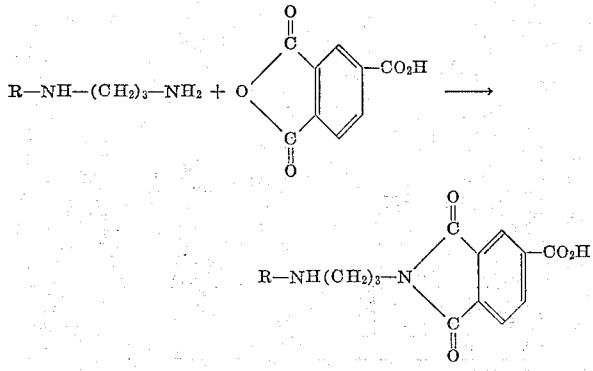
A mixture of 5.94 g. of N,N ditallow 1,3 propylene diamine, 1.92 g. of trimellitic anhydride, and 50 ml. of xylene were placed in a reactor. The reactor was heated to the reflux temperature of xylene and maintained at this temperature for a period of 8 hours after which 0.20 ml. of water was recovered. A total of 6.5 g. of product having the following formula was recovered:



PROCEDURE B

A mixture of 20 g. of N-tallow 1,3-propylene diamine, 9.6 g. of trimellitic anhydride, and 250 ml. of xylene were placed in a reactor. The reactor was heated to the reflux temperature of xylene after which 0.90 ml. of water was

recovered. A total of 29 g. of product having the following formula was recovered:



The corrosion inhibitors defined herein, such as those prepared as described above as well as those set forth in the above examples are usable in minor amounts from about 0.0001 to about 5 weight percent and preferably from about 0.001 to about 0.05 weight percent in distillate fuel oils.

The distillate fuel oil may be virgin or cracked petroleum distillate fuel oil. The fuel oil may boil in the range of from about 200° to about 750° F., and preferably in the range of 350° to 650° F. The distillate fuel oil may contain or consist of cracked components such as, for example, those derived from cycle oils or cycle oil cuts boiling heavier than gasoline, usually in the range of from about 450° to 750° F. and may be derived by catalytic or thermal cracking. The distillate oil may contain other components such as addition agents used for a particular function such as, for example, pour point depressants, combustion improvers, or the like.

The distillate fuel oil is preferably a heating oil in which the corrosion inhibitors of this invention are used in accordance herewith. These oils are intended for use by burning to obtain heat such as is intended for furnace or heater fuel use as opposed to internal combustion engine fuel wherein the explosiveness of the fuel in a combustion chamber is of prime importance. Examples of such heating oils are a heavy industrial residual fuel (e.g., Bunker C), a heater oil fraction, a gas oil, a furnace oil, kerosene, or any other light oil intended for furnace or heater fuel use.

The rust inhibiting properties of the above described compositions were evaluated by the following test:

INDIANA CONDUCTOMETRIC TEST (STATIC)

This test, which quantitatively measures corrosion rates, depends upon the measurement of the change in electrical resistance of a steel test strip immersed in the corrosive medium. The change in resistance is simply related to the decrease in the thickness of the test specimen caused by corrosion. In the test, specimen holders are designed to make electrical connections to two steel strips suspended in large glass test tubes. A mixture is prepared using six parts of hydrocarbon oil containing the rust inhibitor and four parts double distilled water. The corrosion test strips are first immersed in the oil containing the rust inhibitor for a period of one-half hour and subsequently suspended in the mixture such that approximately one-half of the specimen is above the oil-water interface and the remaining half of the specimen is below the oil-water interface. The strips are maintained in the mixture for a period of 24 hours at a temperature of 25° C. The corrosion rates are calculated on a quantative basis from the observed change in electrical resistance comparing the specimen from the inhibited mixture with a specimen run under the same conditions in an uninhibited mixture.

The data obtained by subjecting the products of this invention to the above test are tabulated in the following table and demonstrate the effectiveness of the herein described products in inhibiting rust in fuel oil compositions.

Table I

Additive from Procedure	Concentration, lbs./1,000 bbls.	Hydrocarbon Phase	Aqueous Phase	Percent Corrosion Reduction over Uninhibited Blank
A	2	Virgin gas oil.	Double distilled water.	92
B	5	do	do	92
B	2	Gasoline	10^{-4}M HCl	93
B	2	do	0.1% NaCl+10^{-4}M NaOH.	97.5
B	2	Heater oil	0.1% NaCl	98
B	2	Gasoline	10^{-4}M NaOH	92

The corrosion inhibitors of the present invention may, for convenience, be prepared as an addition agent concentrate. Accordingly, the corrosion inhibitor is prepared in or dissolved in a suitable organic solvent therefor in amounts greater than 10% and preferably from about 25% to about 65%. The solvent, in such concentrate, may conveniently be present in amounts of from about 35% to about 75%. The organic solvent preferably boils within the range of from about 100° F. to about 700° F. For the preferred heating oil use, the organic solvents may advantageously be hydrocarbon solvents, for example, petroleum, petroleum fractions, such as naphtha, heater oil, mineral spirits and the like, because of their clean burning properties. The solvents selected should, of course, be selected with regards to beneficial or adverse effects it may have on the ultimate fuel oil composition. Thus, the solvent should preferably burn without leaving a residue and should be non-corrosive with regard to metal, and especially ferrous metals. Other desirable properties are obvious from the intended use of the solvent.

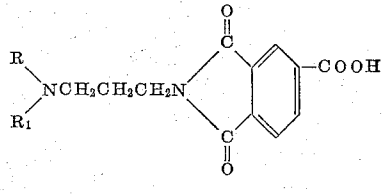
The terms "coco," "soybeans," "tallow," and the like as used herein denote that the group so identified is derived from a particular source. The "coco" groups are derived from mixtures of coco fatty acids; the "soybean" groups are derived from soybean fatty acids; the "tallow" groups are derived from tallow fatty acids. Such coco, soybean and tallow fatty acids are derived from coconut, soybean and tallow oils and are marketed commercially. Each such group is usually a mixture of carbon chains differing slightly in length and/or configuration. For example, the tallow groups are a mixture of C_{14} to C_{18} groups predominating in stearyl and palmityl groups. The groups are well known in the additive art.

Wherever percentages are given herein, weight percentages are intended unless otherwise indicated.

It is evident from the foregoing that I have provided new and useful corrosion inhibitors for distillate fuel oils and particularly in distillate heating oils.

I claim:

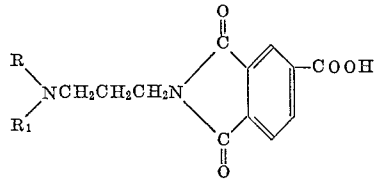
1. A distillate fuel oil composition comprising a major proportion of a hydrocarbon oil fraction in the fuel oil distillation range and from about 0.0001 to about 5.0% by weight of an imide having the formula



wherein R is a C_{12-18} alkyl radical and R_1 is a member of the group consisting of H and a C_{1-22} alkyl radical.

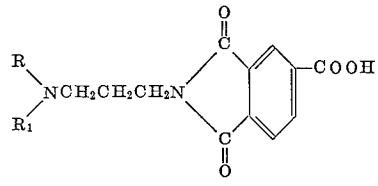
2. A corrosion inhibitor concentrate for use in a distillate fuel oil comprising from about 35% to about 75% by weight of an organic solvent and from about 25% to

about 65% by weight of an imide having the formula



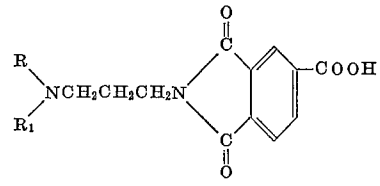
wherein R is a C_{12-18} alkyl radical and R_1 is a member of the group consisting of H and a C_{1-22} alkyl radical.

3. A fuel oil composition comprising a major proportion of a hydrocarbon oil fraction in the fuel oil distillation range and from about 0.0001 to about 5.0% by weight of an imide having the formula



wherein R_1 and R_2 are each a C_{12-18} alkyl radical.

4. A fuel oil composition comprising a major proportion of a hydrocarbon oil fraction in the fuel oil distillation range and from about 0.0001 to about 5.0% by weight of an imide having the formula



wherein R is a C_{12-18} alkyl radical and R_1 is hydrogen.

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