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EMULSIFIABLE OIL COMPOSITION

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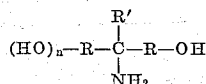
This invention relates to novel soluble oil compositions having rust inhibiting properties. More particularly this invention pertains to novel petroleum based emulsifiable oils exhibiting excellent rust inhibiting properties as a result of the addition of a combination of certain corrosion inhibiting additives.

Soluble oils are used as cutting, spraying and rust preventing oils and generally include a small amount of water, an emulsifying agent and a corrosion and rust inhibitor. Although an important function of cutting fluids is cooling, the prevention of corrosion to both the working material and the tool has become another important consideration as a result of the increased use of cast iron and low carbon steels. Emulsifiable cutting oils which are satisfactory for use with alloy steels frequently lack sufficient rust-inhibiting properties for satisfactory use with cast iron or low carbon steels. The fortification of a soluble oil with rust inhibitors is complicated not only by the solubility and compatibility of the inhibitors with the neat soluble oil, but also by the relatively high degree of toxicity of many of the otherwise acceptable rust inhibiting additives.

It is an object of this invention to provide a cutting and grinding fluid containing a particularly effective combination of materials to inhibit corrosion and rust. Another object of this invention is to provide a cutting and grinding fluid having excellent cooling and lubricating properties. Still another object of this invention is to provide a non-volatile, toxicologically acceptable, aqueous cutting and grinding fluid that can be used with cast iron or low carbon steels.

According to the invention, these desirable objectives are attained by novel soluble oils, which contain a base of mineral lubricating oil and one or more emulsifiers and complexing agents. I supplement the base composition with combinations of the following three rust inhibitors:

A. An alcohol amine having the structural formula:



wherein R is a divalent aliphatic hydrocarbon radical containing about 1 to 4 carbon atoms, R' is R or H, n is 0 to 1 and when n is 0, HO is H. Compounds of this type include, for instance, 2-amino-2-ethyl-1,3-propanediol, 2-amino-2-methyl propanediol, 2-amino-2-methyl propanol-1, 2-amino-2-ethyl propanol-1 and 2-amino propanol.

B. An oil-soluble tertiary amine having the structural formula:



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wherein R is an alkyl group, including cycloalkyl of 2 to 7 carbon atoms, preferably 3 to 6 carbon atoms.

The R groups may be mixed or substituted and are preferably normal chains and unsubstituted. The preferred amine is tri-n-butylamine.

C. A nitrite of an alkali metal having an atomic weight of 22 to 40, i.e. potassium and sodium. Sodium nitrite is preferred.

The rust inhibitors are employed in concentrations and ratios such that they exert corrosion inhibiting effects in the cutting oil.

The proportions of the various ingredients used in compositions of the character described above are quite flexible and may be varied according to the particular properties desired in the finished product. Ordinarily, however, the soluble oil will include about 40 to 85 weight percent mineral oil base, about 8 to 20 weight percent (dry basis) of an aromatic sulfonate emulsifier, about 1 to 5 weight percent of the combination of the three rust inhibitors and a small amount, for instance, about 1 to 5 weight percent, of water. Other ingredients, for example, from about 1 to 10% by weight, can be present as secondary emulsifiers, germicides, coupling agents, etc.

The oils used as a base and major component in the emulsifiable oils of the present invention are the refined mineral lubricating oils. Generally, the oils used are the conventionally refined coastal oils or conventional refined Mid-Continent oils. The oils may be refined by either acid-treatment or solvent extraction. Acid-treatment is directed primarily toward the removal of asphaltic and the more aromatic constituents from oils in order to improve their stability and reduce sludge and varnish-forming tendencies. Refining by solvent extraction also removes aromatic and asphaltic constituents from the more desirable paraffinic and naphthenic components of raw oil stocks. Accordingly, as I use a sulfonate as described later, to get good results, the oil of lubricating viscosity used in the practice of my invention must be capable of dissolving the sulfonate. Although any oil of lubricating viscosity can be used in the process of my invention I prefer to use a substantially anhydrous lubricating oil with a viscosity from about 50 to 1200 SUS at 100° F., preferably 50 to 150 SUS at 100° F. I get my best results with a conventionally refined coastal oil with a viscosity of about 100 SUS at 100° F.

As the primary oil-water emulsifier the oil-soluble aromatic sulfonates are generally used and include the sodium salts of aromatic oil-soluble sulfonic acids, such as the oil-soluble sodium soaps of sulfonic acids derived from petroleum hydrocarbons, as for example the sodium mahogany sulfonates, obtained as a result of treating a mineral lubricating oil fraction or other liquid petroleum hydrocarbon with concentrated or fuming sulfuric acid, or sulfur trioxide, followed by neutralization thereof with sodium hydroxide or the like. Although their exact general structure may vary, it appears that these sulfonates are composed to a large extent of aromatic hydrocarbons having either one or two aromatic rings per molecule possible with one or more long-chain alkyl groups containing from about 8 to 24 or more car-

bon atoms attached to the ring nuclei. However, other useful aromatic sulfonates are the synthetic aromatic sulfonates prepared from sulfonic acids, e.g., substituted naphthalenes and benzenes, by the reaction of paraffin chains of 8 to 24 or more carbon atoms with aromatic nuclei which are then sulfonated with fuming sulfuric acid followed by neutralization with sodium hydroxide. To obtain excellent results, I use a sodium mahogany sulfonate obtained from acid treating a coastal lube oil, for example, with a viscosity of about 100 to about 2,000 SUS at 100° F., although I prefer to use an oil with a viscosity of about 1,200 SUS at 100° F. Moreover, I get my quality sulfonates by treating separately, fractions of 100, 300, 1,200 and 2,000 SUS at 100° F. acid-treated coastal lubricating oils and blending proportions of these fractions to obtain a satisfactory balance of oil and water solubility when the oil is later mixed with large quantities of water. Since this is a mahogany sulfonate, it is primarily oil-soluble and is usually about a 10 to 60 percent concentrate in a mineral oil, for instance, of a lubricating oil base, which is included as part of a lubricating oil base in my composition. It can have an average molecular weight of about 350 to 500 although I prefer a range in between about 400 and 500. To get excellent results, however, I use a sulfonate with an average molecular weight of 430 to 450 and in an amount of about 8 percent to 20 percent (dry basis) in a mineral oil.

The corrosion inhibiting additives of the present invention when used in emulsifiable oils exert corrosion inhibiting properties better than any one, or any two of the three inhibitors at a concentration equal to the concentration of the three inhibitors. Although any dispersible amount of the corrosion inhibiting ingredients can be used, corrosion inhibiting amounts are generally employed. I prefer to use about 0.5 to 3 weight percent of the alkali metal nitrite, about 0.1 to 1 weight percent of the alcoholic amine and about 0.5 to 3 weight percent trialkylamine. For optimum quantities, I employ about 1 weight percent of the alkali metal nitrite, about 0.25 weight percent of the alcohol amine and about 1 weight percent of the trialkylamine.

As aforementioned, optional additives, for instance auxiliary emulsifying agents, corrosion inhibitors and bactericides can also be included in my novel composition. When using an auxiliary emulsifier, for example an alkali metal rosinate, up to 10% by weight can be used. Generally about 3 to 6% by weight is employed. When using a bactericide, I prefer to incorporate tetrachlorophenol; however, any compatible bactericide can be used, for example, phenylmercuric acetate, silver propionate, and ortho-phenyl phenol. Moreover, they can be used either alone or in combination in an amount of about 0.5 to 1 weight percent. Other agents in small amounts may be present including, for instance, additional corrosion inhibitors.

It may also be desirable to add a coupling agent to improve the emulsifiability of the various components, i.e., they couple the aqueous portion of the compounded neat soluble oil to the continuous oil phase to give a clear product and also couple the neat oil to diluent water added to provide the emulsified soluble oil suitable for use. Among the well known coupling agents useable in the composition are the aliphatic alcoholic compounds, particularly aliphatic ether-alcohol compounds containing from about 1 to 30 carbon atoms, for instance, diethylene glycol; the ether complexes of ethyl Cellosolves, Carbitol, and butyl Cellosolve; the polyether glycols with terminal ether groups; and the polyoxy-alkylene glycols, as well as ethylene glycol, propylene glycol, etc. One or more of the above coupling agents can be used either alone or in mixtures and in various amounts generally about 0.5 to 5%, preferably about

1 to 3 weight percent. The alcoholic amine rust inhibitor component of the present invention is also an excellent coupling agent and it by itself may provide sufficient coupling action in the final cutting oil composition.

The viscosity of the final oil produced by the process of my invention is preferably about 300 to 800 SUS at 100° F. to facilitate handling and storage thereof; however, the viscosity can be as high as 1200 SUS at 100° F. to minimize volatilization.

In use as a component of a soluble oil emulsion, the compositions are dispersed in about 1 to 200 or more parts of water, depending upon the particular application contemplated. Thus, where the resulting emulsion is to be used as a lubricant for grinding operations, for example, it has been found that about one part of the oil for each 10 to 30 parts of water, and particularly a one to 15 or 20 ratio, produces very satisfactory results. For use in quenching operations, emulsions formed with one part of soluble oil per 5 to 18 parts of water have been found to be very advantageous. As a rolling mill oil, emulsions containing one part of the composition for each 15 to 30 parts of water effect very desirable results.

The invention may be described further with reference to the following specific examples.

EXAMPLE I

57 parts of acid-treated coastal mineral lubricating oil with a viscosity of 100 SUS at 100° F. is charged into a kettle containing 32 parts of sodium mahogany sulfonate with an average molecular weight of 450 to 500 in an amount of 12.8 parts on a dry soap basis and the mixture heated to a temperature of about 150–160° F. 5 weight percent of potassium rosinate (87 percent solid, 13 percent water), 1.5 weight percent of diethylene glycol (corrosion inhibitor-coupling agent), .75 weight percent of tetrachlorophenol (bactericide), 0.25 weight percent of 2-amino-2-ethyl-1,3-propanediol, 1.0 weight percent of tri-n-butylamine and 1.0% sodium nitrite in an aqueous solution are blended in at this temperature. The amount of water in the soluble oil is adjusted to 1.50 weight percent. This mixture is agitated using the Lightnin mixer for an additional period of 2 hours.

The weight percent of the ingredients in the composition are:

Composition:	Weight percent
Sodium mahogany sulfonate (40% conc. in mineral lube oil) -----	32.00
Base oil acid-treated Coastal oil (100 SUS at 100° F.) -----	57.00
Potassium rosinate (87% conc. in H ₂ O) ----	5.00
Diethylene glycol -----	1.50
Tetrachlorophenol -----	0.75
2-amino-2-ethyl-1,3-propanediol -----	0.25
Sodium nitrite -----	1.00
Water* -----	1.50
Tributylamine -----	1.00

* Does not include water of potassium rosinate component.

The composition of this example, designated composition B, was subjected to a rust test to determine its usefulness as a rust inhibiting cutting oil. Other corrosion inhibited compositions can be made by replacing the 2-amino-2-ethyl-1,3-propanediol with a like amount of 2-amino-propanol or 2-amino-2-methylpropanol. The rust test procedure employed is described below.

Rust test procedure A

Freshly cut, clean, dry cast iron chips are sifted over a 12-mesh wire screen until they are relatively free from fines and dust. Approximately 40 grams of the sifted chips are placed in a clean, dry 100 ml. beaker and a

sufficient soluble oil emulsion is added to cover them. The mixture is allowed to stand for 20 minutes with

itor was added, was also tested. The results of emulsion stability and rust tests run on the samples in Table I.

TABLE I

Composition.....	A	B	C	D	E	F	G	H
Sodium mahogany sulfonate, percent.....	32.00	32.00	32.00	32.00	32.00	32.00	32.00	32.00
Base oil, percent.....	60.75	57.00	57.00	57.00	56.25	57.00	57.00	57.00
Potassium rosinate, percent.....	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Diethylene glycol, percent.....	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
Tetrachlorophenol, percent.....	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75
2-amino-2-ethyl-1,3-propanediol, percent.....		0.25	2.25				0.45	0.45
Sodium nitrite, percent.....		1.00			2.25	1.12		1.80
Water, percent.....		1.50	1.50	1.50	2.25	1.50	1.50	1.50
Tributylamine, percent.....		1.00		2.25		1.13	1.80	
Neat oil appearance.....	Bright	Bright	Separated	Hazy	Bright	Bright	Bright	Bright
Emulsion stability, 16 hours.....	Good	Good	Good	Good	Poor	Good	Good	Good
Rust test: Observed rust.....	Heavy	Slight trace	Heavy	Heavy	Heavy	Light medium	Heavy	Heavy

stirring at 5-minute intervals. At the end of this period the beaker is covered with a watch glass and is inverted, allowing the emulsion to drain from the chips as freely as possible. The inverted beaker, chips and watch glass are placed on clean paper towels. The beaker is drawn to the edge of the watch glass (but retaining the chips inside the beaker) so as to permit continued drainage and the combination is allowed to stand undisturbed for 48 hours. The beaker is removed and the chips are observed for presence of rust. Rust on chips that come in contact with the beaker are disregarded. The results are reported as follows:

No rust
Trace rust
Light rust
Medium rust
Heavy rust
Very heavy rust

Emulsion concentrations of one part oil to 20 and 50 parts tap water (125 p.p.m. hardness as Ca CO_3) were used in evaluating composition A. For purposes of comparison, tests were conducted on 6 variations of composition B to show that none of the inhibitors of the present invention alone, or any combination of two of the three rust inhibitors in a concentration equal to the total weight of the three inhibitors of the present invention, will provide rust inhibition equal to that obtained by the combination of rust inhibiting additives of composition B. A sample, designated composition A to which no inhib-

I claim:

1. An emulsifiable oil composition consisting essentially of a mineral lubricating oil base as the major component, an oil-soluble sodium mahogany sulfonate emulsifier, about 1 to 5 percent water, about 0.5 to 3 percent tri-n-butyl amine, about 0.1 to 1 percent 2-amino-2-ethyl-1,3-propanediol and about 0.5 to 3 percent of sodium nitrate.

2. An emulsifiable oil composition consisting essentially of a mineral lubricating oil base with a viscosity of about 50 to 150 SUS at 100° F., about 8 to 20 percent of sodium mahogany sulfonate, about 1 to 3 percent of ethylene glycol, about 3 to 6 percent of potassium rosinate, about 0.1 to 1 weight percent of 2-amino-2-ethyl-1,3-propanediol, about 0.5 to 3 weight percent of sodium nitrite, about 0.5 to 3 weight percent tri-n-butylamine and about 1 to 5 weight percent water.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

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August 17, 1965

Richard L. Quanstrom

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 6, line 25, for "nitrate" read -- nitrite --.

Signed and sealed this 29th day of March 1966.

(SEAL)

Attest:

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Commissioner of Patents