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ACID-TOLERATING SOLUBLE OIL COMPOSITION

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This invention relates to novel compositions of matter. More particularly, this invention relates to compositions of matter especially useful in metal working and treating operations.

Lubricating oil compositions of a particular class useful in metal working and treating operations are commonly referred to as soluble oils and comprise an oil having a capacity for substantial aqueous dilution to form a stable oil-in-water emulsion. Soluble oils find use as quench oils, cutting oils, grinding oils and the like. For all such applications soluble oils should, of course, maintain the emulsified form through extended periods of use. For particular applications other properties become important, for example, uniform heat conduction for quenching metal coated products, such as tin and lead coated steels. The variety of applications for soluble oils has resulted in compositions especially characterized for certain conditions of use. The present invention relates in particular to an acid-tolerating soluble oil.

We have discovered new compositions of matter especially useful as soluble oils. Our new compositions are characterized by the ability to form and maintain oil-in-water emulsions which are stable for extended periods of time under severe conditions of use. The new compositions have the salient advantage of evidencing their desirable properties under acid conditions and hence are, essentially, acid-tolerating soluble oils.

The compositions comprising this invention contain an oil as the major constituent and in addition thereto a minor amount of a cationic surface-active reaction product of ethylene oxide and aliphatic amines having 10 to 30 carbon atoms per molecule, a minor amount of non-ionic polyoxyethylene derivative of hexitol anhydride partial long chain fatty acid esters, a minor amount of non-ionic surface active long chain fatty acid partial esters of hexitol anhydrides, and when desired minor amounts of non-ionic surface active alkylaryl polyether alcohol having long and short polyether chains. As solution of these cationic and non-ionic surface active agents is essential to obtain a homogeneous composition, in the event that apparent insolubility of the cationic component exists a small amount of a mutual solvent for the surface active agents, preferably an oxygenated lower aliphatic hydrocarbon such as diethylene glycol, isopropanol, butyl carbitol, butyl and ethyl Cellosolves is included. The compositions comprising the invention have the following composition by weight:

	Wt. percent
Amine reaction product	2 to 5
Polyoxyethylene derivative of hexitol anhydride partial long chain fatty acid esters	2 to 5
Long chain fatty acid partial esters of hexitol anhydride	0.5 to 2.5
Alkylaryl polyether alcohol (short polyether chain)	0 to 4.0
Alkylaryl polyether alcohol (longer polyether chain)	0 to 4.0
Mutual solvent	0 to 5
Oil	Substantially the balance

It can be observed that these compositions, considering the components other than the solvent and oil, essentially comprise a cationic and a plurality of non-ionic surface active agents.

The compositions of the present invention are prepared by dispersing the various components in the oil. Advantageously, a slightly elevated temperature, i.e. about 100 to 150° F., is employed and the mixture is agitated to insure uniformity. No particular order of addition need be followed.

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 cationic surface active reaction products of aliphatic amines and ethylene oxide used in the invention are commercially available. The amines have about 10 to 30 carbon atoms, and preferably 15 to 25, per molecule and are reacted with about 2 to 10 moles of ethylene oxide per mole of amine. These products are oily liquids at room temperature having a specific gravity of about 0.95 to 1.05. An especially desirable commercially available material is marketed as Ethomeen 18/15 by Armour and Company and is the reaction product of 5 mols of ethylene oxide and a mol of amines having the composition of 93 weight percent of the primary amine of stearic acid, 6 weight percent of the primary amine of palmitic acid and 1 weight percent of the primary amine of oleic acid.

A commercially available material which is a polyoxyalkylene derivative of hexitol anhydride partial long chain fatty acid ester and which can be used in this invention is marketed as Tween 85, a product of the Atlas Powder Company. Tween 85 is the reaction product of about 5 mols of ethylene oxide and one mol of sorbitan trioleate and is an oily liquid at 25° C. having a flash point of about 565° F., a fire point of about 645° F. and a specific gravity of about 1.00 to 1.05. Such reaction products containing from about 2 to 25 mols or more of ethylene oxide per mole of the trioleate are especially preferred.

Span 80 is a commercially available (Atlas Powder Company) example of the long chain fatty acid partial esters of hexitol anhydrides which can be used in our invention and comprises essentially sorbitan monooleate. Span 80 is an oily liquid having a flash point of about 410° F., a fire point of about 545° F. and a specific gravity of about 1.00 to 1.05. The long chain fatty acids which are employed in producing both the fatty acid partial esters of hexitol anhydrides and their polyalkylene derivatives contain about 12 to 24 carbon atoms per molecule. The acids can be saturated or unsaturated and include, for example, lauric, palmitic, stearic and oleic acids. By "hexitol anhydride" is meant inner ethers having one cyclic oxygen per ring derivable from a hexahydric alcohol by intermolecular condensation and includes the mono-anhydro and dianhydro derivatives, i.e. hexides, hexitans, mannides, mannitans and the like. By "partial ester" is meant that the hydroxy groups of the anhydride are not all esterified; mono-, di- and triesters and mixtures thereof are preferred and these can be simple or mixed esters.

Particularly satisfactory polyether alcohols which can be employed in the present invention are available commercially from the Rohm and Haas Company, for example as Triton X–45 and Triton X–100, and comprise alkylaryl polyether alcohols having the general formula $R—(O—CH_2—CH_2)_n—OH$ where R is an alkylaryl radical and *n* is an integer from about 5 to 100 or more, preferably 5 to 25. The alkylaryl radical advantageously is essentially lower alkyl benzene derivatives such as the xylenes, durene and methylethyl benzene. The Tritons are the preferred polyether alcohols and are liquid mixtures of homologous polyether alcohols. Triton X–45 is readily miscible with formalin and the common organic solvents. Triton X–100 is essentially identical with Triton X–45 differing primarily in the average length of the polyether chains. Triton X–100 is water soluble at room temperature, is miscible with alcohol and compatible with esters, ketones and aromatic hydrocarbons. While polyether alcohols are not necessary to the production of an acid-tolerating soluble oil, they are preferably used since smoother coatings are obtained in quenching operations. Preferred compositions include a mixture of the polyether alcohols, advantageously comprising about equal parts of long and short polyether chain types, for example, a mixture of homologous dimethyl benzene polyether alcohols where about half of the mixture has an average chain length of about 8 ether radicals (Triton X–45) and the remaining portion has an average chain length of about 15 ether radicals (Triton X–100).

The oil component employed can be a mineral oil, such as a neutral or other lubricating oil fraction, or a fatty oil such as a vegetable, animal or fish oil or a synthetic oil such as di-[2-ethyl hexyl adipate], polymerized olefins or the like. The oil component can be highly refined if desired such as is a white oil, or lightly refined as by distillation, solvent extraction or clay or chemical treatment. The viscosity of the oil component is quite variable and can, for example, range from about 50 SUS at 100° F. to about 500 SUS at 210° F., the exact viscosity chosen depending upon the use contemplated. For the majority of applications, a mineral lubricating oil of a viscosity of 100 to 800 SUS at 100° F. will be satisfactory.

The invention will be described further in conjunction with the following examples. It should be understood that the details disclosed are not intended as limiting the invention.

EXAMPLE I

A composition of the invention was made by adding 3.5 weight percent of Ethomeen 18/15, 3.4 weight percent of Tween 85, 1.5 weight percent of Span 80, 2.0 weight percent of Triton X–45, 2.0 weight percent of Triton X–100 and 3.0 weight percent isopropanol to a mixed base mineral lubricating oil fraction having a viscosity of 100 SUS at 100° F. The mixture was heated at 100° F. for about five minutes while stirring and was then permitted to cool to ambient temperatures.

A second composition was made employing the same materials, quantities and conditions as above with the exception that further quantities of oil were used in place of the isopropanol. Routine laboratory data on each of these compositions are as follows:

Table I

	With Isopropanol	Without Isopropanol
Gravity, ° API	23.0	22.4
Flash, ° F	140	330
Fire, ° F	350	380
Vis./100° F., SUS	112.6	131.0
Vis./210° F., SUS	38.86	39.88
Pour, ° F	−15	15
Color, NPA	3−	3−
Percent Nitrogen	0.09	0.09

EXAMPLE II

A field test of the composition of Example I (without the isopropanol) as a quenching medium was made using the following commercial procedure. Three hundred gasoline tank filler pipes are placed on end in two tiers in a metal basket. The entire basket with pipes is placed in a pickling bath and pickled. The basket with contents is removed and washed and then placed in an aqueous solution containing a zinc chloride flux where they remain until used. For coating, the pipes are removed from the aqueous bath and allowed to drain. The pipes are placed on a metal fork, holding nine to eighteen pipes depending on their length, and immersed in a molten lead bath at a temperature of 625 to 650° F. which is covered with zinc chloride flux. They are removed, quickly drained of excess lead and immediately quenched in a 100 gallon soluble oil emulsion quench bath. As soon as the pipes are quenched, they are removed from the quench bath, discharged from the fork and the operation is repeated.

Using the optimum amount of a commercial soluble oil for the operation, this plant experienced emulsion breaking after only 3 or 4 quenches, requiring replacement of the emulsion and disposal of the waste material—a serious problem. The composition of Example I was then made into emulsion form using 7 parts of water per part of the composition and used as the quench bath. About 700 pipes were quenched resulting in excellent coatings without breaking the emulsion. In an identical test except that cooling coils were placed in the bath with the emulsion, 4200 pipes were successfully quenched as rapidly as possible without breaking the emulsion. Thus, under particularly adverse circumstances such as the high temperature of the material being quenched and the acid-acting flux, the composition of the present invention evidenced hundreds of percent longer effective life than the commercial soluble oil then being employed.

In a similar field test at another plant using substantially the same procedure except that the lead bath was at 675° F., only two pipes were quenched at one time and the quench bath contained 120 gallons of quench emulsion. it had been the experience that new emulsion had to be employed each four hours. With an emulsion made from the composition of Example I using 14 parts of water per part of emulsion, pipes were quenched satisfactorily without any evidence of needing to replace the emulsion. During this field test, pipes were weighed before and after the quenching operation and from the weight changes it was determined that 20 percent less lead was being used to coat the pipes, thereby indicating that a stripping action was occurring. Since the stripped lead is recoverable, this is a decided advantage in the use of the oil. Thus, the composition not only performed its primary function to great advantage but also resulted in the entirely unexpected result of stripping excess lead during the operation.

In a more severe test in the same plant, where 20 to 30 elbows were coated and quenched at a time, using a concentration of oil to water of 1 to 7, the composition again performed satisfactorily, remaining as a stable emulsion throughout the entire length of the test.

From the foregoing, it is apparent that a composition has been discovered which is especially useful in metal working operations, for example, as an acid-tolerating soluble oil. Contrary to the usual property of the soluble oils of their emulsions breaking in the presence of acid, the present composition forms an even more stable oil-in-water emulsion in the presence of acid.

In addition to the components above described, the usual additives such as anti-oxidants, extreme pressure agents and the like can be incorporated in the compositions of the present invention in the normal amounts so long as they do not deleteriously affect the invention.

We claim:

1. A new composition of matter which is an acid-

tolerating soluble oil characterized by being capable of forming stable oil-in-water emulsions consisting essentially of about 2 to 5 weight percent of a cationic surface active polyoxyethylene derivative of an aliphatic primary amine having 10 to 30 carbon atoms per molecule and about 2 to 10 mols of ethyleneoxide per mol of amine, about 2 to 5 weight percent of a non-ionic surface active polyoxyethylene derivative of hexitol anhydride partial long chain fatty acid ester containing about 2 to 25 mols of ethylene oxide per mol of ester, about 0.5 to 2.5 weight percent of a non-ionic long chain fatty acid partial ester of hexitol anhydride, wherein the fatty acid portion of said partial esters contains 12 to 24 carbon atoms per molecule, a minor amount up to about 8 weight percent of a mixture of non-ionic lower alkyl benzene polyether alcohols having relatively long and short polyethoxy radicals within the range of 5 to 25 ether groups, about 0 to 5 weight percent of a mutual solvent for the surface active agents with substantially the balance mineral oil.

2. An oil-in-water emulsion consisting essentially of water and the composition of claim 1.

3. The composition of claim 1 wherein the mixture of lower alkyl benzene polyether alcohols consists essentially of dimethyl benzene polyether alcohol having an average chain length of about 8 ether radicals and dimethyl benzene polyether alcohol having an average chain length of about 15 ether radicals.

4. An oil-in-water emulsion consisting essentially of water and the composition of claim 3.

5. A new composition of matter which is an acid-tolerating soluble oil characterized by being capable of forming stable oil-in-water emulsions consisting essentially of about 2 to 5 weight percent of a cationic surface active polyoxyethylene derivative of an aliphatic primary amine having 15 to 25 carbon atoms per molecule and about 2 to 10 mols of ethylene oxide per mol of amine, and having a specific gravity of about .95 to 1.05 at room temperature, about 2 to 5 weight percent of a non-ionic surface active polyoxyethylene derivative of hexitol anhydride partial long chain fatty acid ester containing about 2 to 25 mols of ethylene oxide per mol of ester, about 0.5 to 2.5 weight percent of a non-ionic long chain fatty acid partial ester of hexitol anhydride, wherein the fatty acid portion of said partial esters contains 12 to 24 carbon atoms per molecule, a minor amount up to about 8 weight percent of a mixture of non-ionic lower alkyl benzene polyether alcohols having relatively long and short polyethoxy radicals within the range of 5 to 25 ether groups, about 0 to 5 weight percent of a mutual solvent for the surface active agents with substantially the balance mineral oil.

6. The composition of claim 5 wherein the primary amine is stearyl amine.

7. An oil-in-water emulsion consisting essentially of water and the composition of claim 5.

8. The composition of claim 7 wherein the primary amine is stearyl amine.

9. A new composition of matter which is an acid-tolerating soluble oil characterized by being capable of forming stable oil-in-water emulsions consisting essentially of about 2 to 5 weight percent of a cationic surface active polyoxyethylene derivative of stearyl amine and about 5 mols of ethylene oxide per mol of amine, about 2 to 5 weight percent of a non-ionic surface active polyoxyethylene derivative of hexitol anhydride partial long chain fatty acid ester containing about 5 mols of ethylene oxide per mol of ester, about 0.5 to 2.5 weight percent of a non-ionic long chain fatty acid partial ester of hexitol anhydride, wherein the fatty acid portion of said partial esters contains 12 to 24 carbon atoms per molecule, about 2 weight percent of a dimethyl benzene polyether alcohol having an average chain length of about 8 ether radicals and about 2 weight percent of a dimethyl benzene polyether alcohol having an average chain length of about 15 ether radicals, about 0 to 5 weight percent of a mutual solvent for the surface active agents with substantially the balance mineral oil.

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