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SOLUBILIZATION OF PETROLEUM
HYDROCARBONS

Leo Liberthson, New York, N. Y., assignor to L.
Sonneborn Sons, Inc., a corporation of Dela-
ware

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This invention relates to new and useful improvements in the solubilization of petroleum hydrocarbons.

Petroleum hydrocarbons and water are substantially incompatible with each other and can at best be brought into a homogeneous system only in the form of emulsions by the use of certain emulsifying agents. These emulsions usually constitute milky, opaque liquids useful for a variety of purposes. They cannot be readily used, however, for lubricating or cooling purposes when a substantial degree of visibility of the work piece through the bath or film of lubricant or cooling agent is required.

I have discovered that it is possible by the use of a specially compounded agent, to solubilize petroleum hydrocarbons in aqueous media to such extent that the resulting aqueous petroleum hydrocarbon systems possess all the attributes of solutions, i. e., the same constitute water-clear, transparent solutions substantially free from opalescence or fluorescence.

The solubilizing agent in accordance with the invention comprises the following:

1. 31 to 40% and preferably 38.5% alkali petroleum mahogany sulphonate and preferably alkali metal petroleum mahogany sulphonate.

2. 15 to 20% and preferably 18.5% of a surface tension depressant, being simultaneously an emulsifying agent for petroleum hydrocarbons in water and capable of freely form in all proportions clear and transparent aqueous solutions; satisfactory substances of this type are, for instance, the alkali salts of unsaturated aliphatic acids of the C_{16} to C_{18} series and their aryl, alkyl and aralkyl derivatives, alkali oleates, alkali ricinoleates, alkali salts of arachidic acid, alkali salts of linoleic acid; preferred are alkali metal ricinoleates and preferably potassium ricinoleate; mixtures of any of the aforementioned products may be used and preferably such mixtures, substantially stearin-free, as they are obtained by the saponification of natural vegetable oils such as castor oil, olive oil, peanut oil, teaseed oil, rapeseed oil and the like.

3. 25 to 30% and preferably about 27.7% water.

4. 12.5% to 17.5% and preferably 15.3% of substances consisting, in a ratio of 5:2:3 of the following:

(a) A preferentially oil soluble homogenizing substance with respect to the water phase of an oil-water system; suitable agents of this type are, for instance, the preferentially oil soluble glycol ethers having substantially not in excess

of 5 C atoms in any chain or side chain, ethylene glycol mono-butyl ether, di-ethylene glycol mono-butyl ether; preferred is the use of di-ethylene glycol mono-butyl ether.

(b) A preferentially water soluble homogenizing substance with respect to the oil phase of an oil-water system; satisfactory substances of this type in accordance with the invention are, for instance, polyalkylene glycols preferably of the type having not in excess of four ethylene groups; preferred is diethylene glycol.

(c) An agent for fortifying and supporting the action of the preferential water soluble homogenizing agent and for equalizing indices of refraction of an oil-water system, the oil phase of which contains the preferentially oil soluble homogenizing agent and mahogany sulphonate and the water phase of which contains the preferentially water soluble homogenizing agent together with the afore-mentioned surface tension depressant for aqueous phases; satisfactory agents in this class are polyhydric alcohols and preferably glycerine.

In preparing the solubilizing agent in accordance with the invention the foregoing ingredients are intimately mixed in their stated proportions. No particular order of addition is required. It is sometimes of advantage and recommended to gently stir the composition so as to secure complete homogeneity.

The solubilizing agent in accordance with the invention has a tolerance for petroleum hydrocarbons up to 40%, i. e., the solubilizing agent is capable to solubilize in water in all proportions a petroleum hydrocarbon oil containing at least 60% of the solubilizing agent. In most cases, however, it is preferred to use not less than 63% of the solubilizer. The solubilizing agent may be added to the petroleum hydrocarbons to be rendered substantially soluble in aqueous media either as such or the petroleum hydrocarbon may be incorporated ab initio together with the ingredients constituting the solubilizing agent so as to form a substantially water soluble petroleum hydrocarbon product. In the latter case, however, it is preferred to first dissolve the mahogany sulphonates in the petroleum hydrocarbon and to add the other ingredients thereafter to such petroleum hydrocarbon solution of the sulphonate. The water is preferably added by way of an aqueous solution of said surface tension depressant.

For the purpose of obtaining optimum results with a given oil, it is recommended to empirically adjust the percentages within the specified

ranges to the particular oil desired to be solubilized.

The invention is particularly applicable to the solubilization in water of petroleum hydrocarbons of the lubricating oil range and especially those of a viscosity in excess of 40 Saybolt notably petroleum hydrocarbons of the relatively viscous fluorescent heavy mineral oil type.

The alkali mahogany sulphonate prescribed in accordance with the invention is the well-known product derived from the acid refining of lubricating oil distillates and the same may be either used in its conventional form, i. e., in its solution "in retained oil" or in substantially dry form. When containing retained oil, allowance for the latter should be made in the petroleum hydrocarbon tolerance calculations of the solubilizing agent. I have found it of advantage and prefer to use a mahogany sulphonate product of high emulsifying efficiency and substantially free from inorganic impurities.

When the petroleum hydrocarbon composition containing the solubilizing agent is admixed with water, the pH prevailing at or after admixture should be not below substantially 6.5 and not above substantially 7.5. If the pH goes beyond these ranges, on either of the limits specified, the resulting product will not constitute a satisfactory solubilized petroleum hydrocarbon product in the aqueous medium, but will, on the acid side, between 6.5 and 2 and on the alkaline side between 7.5 and 12 form emulsions ranging with increasing acidity or alkalinity from translucent to heavy milky with final stratifications, i. e., separation of the oil from the water phase at pH 2 and pH 12, respectively. In the practice of my invention it is best to adjust the pH of the solubilizing agent in such manner that after its incorporation into the mineral oil to be solubilized in an aqueous medium, the resulting water-solubilizable mineral oil possesses a satisfactory pH within the prescribed limits. Care, of course, should be taken that the aqueous medium or the water to which the solubilizable petroleum hydrocarbon composition in accordance with the invention is added is substantially neutral or at least at or brought to a pH which will not shift the prevailing pH after the addition of the solubilizable petroleum hydrocarbon oil beyond the pH 6.5 to 7.5 range.

The petroleum hydrocarbon oil product solubilizable in water in accordance with the invention is completely miscible with water in all proportions, yielding brilliant water-clear solutions free from opalescence or fluorescence. The absence of fluorescence or opalescence is particularly remarkable in cases where the solubilized oil represents comparatively large amounts of slightly fluorescent mineral oil. The aqueous solutions have strong detergent and wetting action.

The following is a specific example illustrative of the invention without limiting the same:

A composition containing 23 parts by weight mahogany sulphonate, 12 parts by weight sodium ricinoleate, 18 parts by weight of water (introduced with the aqueous ricinoleate solution), 5 parts by weight diethylene glycol mono-butyl ether, 2 parts by weight diethylene glycol and 3 parts by weight glycerine is compounded by gentle agitation with 37 parts by weight of a 28° Bé. pale naphthenic Gulf Coast lubricating oil until complete homogenization is obtained. The resultant product is a substantially clear, transparent, viscously fluid liquid capable of infinite

dilution with water, yielding transparent, non-fluorescent solutions of strong detergent and wetting properties.

The aqueous solutions obtained with the solubilizable petroleum hydrocarbon compositions in accordance with the invention constitute transparent lubricating and cooling media, particularly useful in the working and machining of metals. In such cases it is preferred to use concentrations of preferably in excess of 3% of a solubilizable agent in water so as to permit the formation of a satisfactory oil film on the metal parts and thus inhibit rusting. If it is, however, desired to go below these proportions, or to fortify the non-corrosive properties of higher percentages of the aqueous mineral oil containing preparations in accordance with the invention, suitable water soluble rust inhibiting agents, such as chromates, phosphates, or the like, may be used. These corrosive inhibiting agents have proven, in accordance with the invention and as a further embodiment thereof, to be completely compatible with the solubilizing agent as such as well as with the petroleum hydrocarbon compound containing such solubilizing agent and may be incorporated with either.

The foregoing description is by way of illustration and not of limitation and I am not to be limited to any details but only by the appended claims in which I have endeavored to claim broadly all inherent novelty.

We claim:

1. A composition of matter comprising substantially 31 to 40% alkali petroleum mahogany sulphonate, substantially 15 to 20% of at least one alkali soap of unsaturated aliphatic acid of the C_{18} to C_{19} series, 25 to 30% of water and substantially 12.5 to 17.5% of substances consisting in a ratio of substantially 5:2:3, of at least one preferentially oil soluble glycol ether having not in excess of 5 carbon atoms in any chain or side chain, at least one preferentially water soluble polyalkylene glycol having substantially not in excess of 4 ethylene groups and at least one aliphatic polyhydric alcohol.

2. A composition of matter comprising substantially 31 to 40% alkali mahogany sulphonate, substantially 15 to 20% alkali metal ricinoleate, substantially 25 to 30% of water, and substantially 12.5 to 17.5% of substances consisting, in a ratio of substantially 5:2:3, of diethylene mono-butyl ether, diethylene glycol and glycerine.

3. A composition of matter comprising substantially 38.5% alkali mahogany sulphonate, substantially 18.5% alkali metal ricinoleate, substantially 27.7% water, and substantially 15.3% of substances consisting, in a ratio of substantially 5:2:3, of diethylene glycol mono-butyl ether, diethylene glycol and glycerine.

4. A composition of matter comprising substantially 20 to 30% alkali petroleum mahogany sulphonate, substantially 10 to 15% of at least one alkali soap of an unsaturated aliphatic acid of the C_{18} to C_{19} series, substantially up to 40% of normally liquid petroleum hydrocarbons, at least substantially 15% of water, and substantially 7 to 13% of substances consisting, in a ratio of substantially 5:2:3, of at least one preferentially oil soluble glycol ether having not in excess of 5 carbon atoms in any chain or side chain, at least one polyalkylene glycol having not in excess of substantially 4 ethylene groups and at least one aliphatic polyhydric alcohol.

5. A composition of matter comprising substantially 20 to 30% alkali petroleum mahogany

sulphonate, substantially 10 to 15% alkali metal ricinoleate, up to 40% petroleum hydrocarbons, substantially 15 to 25% of water, and substantially 7 to 13% of substances consisting, in a ratio of substantially 5:2:3, of diethylene glycol mono-butyl ether, diethylene glycol and glycerine.

6. A composition of matter comprising substantially 23% alkali petroleum mahogany sulphonate, substantially 12% alkali metal ricinoleate, substantially up to 37% of petroleum hydrocarbons of the lubricating oil range, substantially 18% of water, substantially 5% diethylene glycol mono-butyl ether, substantially 2% diethylene glycol, and substantially 3% glycerine.

7. A substantially water-clear, transparent, aqueous petroleum hydrocarbon liquid comprising an aqueous medium and solubilized therein a composition comprising substantially 20 to 30% of alkali petroleum mahogany sulphonate, substantially 10 to 15% of at least one alkali soap of an unsaturated aliphatic acid of the C_{18} to C_{19} series, substantially 15 to 20% of water, substantially up to 40% hydrocarbons, and substantially 7 to 13% of substance consisting, in a ratio of substantially 5:2:3, of at least one preferentially oil soluble glycol ether having not in excess of 5 carbon atoms in any chain or side chain, at least one polyalkylene glycol having not more than substantially 4 ethylene groups and a polyhydric alcohol, said liquid being at a pH of substantially 6.5 to 7.5.

8. An aqueous petroleum hydrocarbon liquid in accordance with claim 7 in which said alkali metal soap is an alkali metal ricinoleate, in

which said glycol ether is diethylene glycol mono-butyl ether, in which said polyalkylene glycol is diethylene glycol, in which said polyhydric alcohol is glycerine and in which said aqueous medium contains solubilized therein at least 32% of said composition.

9. An aqueous substantially water-clear and transparent lubricating medium comprising an aqueous medium and substantially solubilized therein at least 3% of a composition comprising substantially 23% alkali petroleum mahogany sulphonate, substantially 12% alkali metal ricinoleate, substantially up to 37% petroleum hydrocarbons of the lubricating oil range, substantially 18% of water, substantially 5% of diethylene glycol mono-butyl ether, substantially 2% diethylene glycol and substantially 3% of glycerine, said liquid being at a pH of substantially 6.5 to 7.5.

10. Method for preparing an aqueous substantially water-clear and transparent lubricating medium comprising adding to an aqueous medium while maintaining during the addition and thereafter in said aqueous medium a pH of substantially 6.5 to 7.5, at least 3% of a composition comprising substantially 20 to 30% alkali petroleum mahogany sulphonate, substantially 10 to 15% alkali metal ricinoleate, substantially up to 40% petroleum hydrocarbons of the lubricating oil range, substantially 15 to 20% of water and substantially 7 to 13% consisting, in a ratio of substantially 5:2:3 of diethylene glycol mono-butyl ether, diethylene glycol and glycerine.

LEO LIBERTHSON.