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OILS SELF-EMULSIFYING IN WATER

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The invention relates to a process for the preparation of clear mineral, animal, vegetable and synthetic oils which can be emulsified with any desired amounts of water to form stable emulsions.

It has already been suggested to use aliphatic and aromatic sulfonation products for the emulsification of oils. However, it has been found that in some cases it is not at all possible to obtain a stable emulsion and that in many instances extended tests are required to discover the suitable sulfonated emulsifier. The search for suitable emulsifiers has been made more difficult because some of the sulfonates which are generally suitable as emulsifiers are insoluble or at least difficultly soluble in the particular oil to be emulsified and are therefore unsuitable.

The use of non-ionic substances as emulsifiers is already known. With these products the problem of solubility of the emulsifier in the oil very often interferes, and under favorable solubility conditions the emulsifying power of the emulsifier decreases, so that the emulsions prepared therewith often do not have the required stability despite the use of large quantities of such emulsifiers.

It is also known that aliphatic and/or aromatic sulfonation products can be used together with non-ionic emulsifiers. These combination agents, however, generally have the same disadvantages as those described above for the individual components.

It is an object of the invention to obtain clear, self-emulsifying oil compositions which will form stable emulsions with any desired amount of water.

It is another object of the invention to obtain self-emulsifying oil compositions which contain an emulsifier comprising petroleum fraction sulfonates and ethylene oxide condensation products.

It is a further object of the invention to obtain novel emulsifiers comprised of petroleum fraction sulfonates and ethylene oxide condensation products.

These and other objects and advantages of the invention will become obvious from the following detailed description.

The self-emulsifying oil compositions of the invention are comprised of an oil and an oil emulsifier consisting of a mixture of petroleum fraction sulfonates having an average molecular weight of 400 or above and polyethylene oxide products. The oil compositions are clear solutions which will form stable emulsions with any desired amount of water.

The oil component may be an animal, vegetable mineral or synthetic oil or mixtures of these oils. The oil component may also contain solvents or other water-immiscible components such as fatty alcohols of the nature of oleyl alcohol. Examples of the oils are spindle oil, sperm oil, castor oil, train oil, neat's-foot oil, triolein and white mineral oil. Fatty oils and liquid waxes and their mixtures with synthetic or mineral oils for which there has not previously been a satisfactory emulsifier are particularly useful in the invention.

The petroleum fraction sulfonates may be obtained by the acid refining of mineral oils or by sulfonation of mineral oils. Their average molecular weight should be

400 or higher, preferably between 420 and 530. The usual commercial sulfonates have the formula

$$C_nH_{2n-10}SO_3Na$$

wherein n is an integer between 20 and 30.

The polyalkylene oxide products are the condensation product of 2 to 20 moles, preferably 5 to 10 moles of ethylene oxide with aliphatic hydrocarbon alcohols or alkyl phenols having 10 to 20 carbon atoms. The condensation products are formed by known methods of addition of ethylene oxide to the desired alcohol. Examples of suitable alcohols are alkanols such as decanol, tetradecyl alcohol, cetyl alcohol; alkenols such as oleyl alcohol; and alkyl phenols such as butyl phenol, octyl phenol and nonyl phenol.

The emulsifier mixture of petroleum fraction sulfonates having an average molecular weight of above 400 and the ethylene oxide condensation products has a synergistic emulsifying effect. Neither component of the emulsifier alone is an effective emulsifier, but together they possess an emulsifying effect considerably greater than that of the individual components and produce clear, self-emulsifying oil compositions. Further, the emulsifier mixture is less viscous than the individual components and dissolves more rapidly in the above-mentioned oils than the individual components so the formation of the oil compositions is facilitated.

The amount of the emulsifier mixture present in the oil composition may vary widely depending upon the oil and the intended use of the oil composition or emulsion. However, the emulsifier mixture is preferably between 10–40% of the oil composition.

The emulsifier mixture is comprised of 20% to 80% of the petroleum fraction sulfonates and 80% to 20% of the ethylene oxide condensation products for incorporation into the oils. Because of the oil solubility of the emulsifier mixtures, they can be mixed with all available oils and solvents to form oil compositions which are adaptable for many commercial requirements due to the range of their consistency.

A preferred embodiment of the invention is the oil composition in which the ethylene oxide product of the emulsifier is the condensation of 5 to 10 moles, preferably 8 moles of ethylene oxide and a fatty alcohol containing 10 to 20 carbon atoms and preferably oleyl alcohol or fatty alcohol mixtures containing oleyl alcohol. The emulsifier mixture is preferably 80 to 50% petroleum fraction sulfonates and 20 to 50% of the said ethylene oxide product. The oil may be animal, mineral or vegetable oil and highly stable emulsions are formed when the oil composition is diluted in any devised ratio with water.

Another preferred embodiment of the invention is the various oil compositions wherein the ethylene oxide product is the condensation product of 9 moles of ethylene oxide with 1 mole of nonyl phenol. If an emulsifier mixture of 80 to 50% petroleum fraction sulfonates and 20 to 50% of the above ethylene oxide product are used in the oil compositions, completely clear products are obtained which can be emulsified with any desired ratio of water to form a stable emulsion.

The oil compositions of the invention have various idustrial uses. The mineral oil compositions and their emulsions are used in metal working and the mineral oil compositions and sperm oils, castor oil, train oil, neats-foot oil and triolein oil compositions are used for leather fatting, textile finishing and textile oiling.

The optimum emulsifier mixture ratios of the petroleum fraction sulfonates and ethylene oxide product depend upon the type of oil to be emulsified and upon the ultimate use of the oil emulsion. For example, an emulsifier mixture with a content of 70% petroleum fraction sulfonate,

is particularly suitable for metal working purposes. For leather fatting, emulsifier mixtures with a content of 50 to 70% petroleum fraction sulfonate have proved to be advantageous, and for textile finishing emulsifier mixtures with a content of 30 to 50% petroleum fraction sulfonate are especially useful.

In the following examples there are described several preferred embodiments to illustrate the invention. However, it should be understood that the invention is not intended to be limited to the specific embodiments.

Example I

80 parts by weight of a petroleum fraction sulfonate having a molecular weight of about 400 and a sulfonate content of about 70% of theoretical content were admixed with 20 parts by weight of an oleyl alcohol having iodine number of 50–55 and ethoxylated with 5 moles of ethylene oxide. The viscous product thus obtained was incorporated in an amount of 10 to 20% into a mineral oil (characteristic values; density at 20° C.=0.915, viscosity at 50° C.=4.5° E.), and a clear oil was obtained which could be emulsified without difficulties into a stable oil-in-water emulsion which was further dilutable with water in any amount. The oil-in-water emulsion is suitable for use as a drilling oil, cutting oil and other metal working assistants.

Upon incorporation of the same amount of petroleum fraction sulfonate alone, the mineral oil could not be emulsified at all, and when the same amount of ethoxylated oleyl alcohol was used, unstable emulsions were obtained.

Example II

50 parts by weight of a petroleum fraction sulfonate having a molecular weight of about 400 were admixed with 50 parts by weight of an ethylene oxide addition product obtained by ethoxylating technical grade oleyl alcohol having an iodine number of 50 to 55 with 8 moles ethylene oxide. The viscous emulsifier mixture thus obtained could readily be incorporated in amounts of 15% into fatty oils or liquid waxes, such as sperm oil, and also into mineral oils, and resulted in clear products which could be worked up without difficulties into stable oil-in-water emulsions which could be further diluted with water in any amount and were useful in leather fatting.

Upon use of the individual emulsifiers alone, no satisfactory emulsions could be obtained. Moreover, the ethylene oxide product used in this mixture did not by itself form a clear solution in the above-mentioned oils.

Example III

A mixed emulsifier, consisting of 70 parts by weight petroleum fraction sulfonate having a molecular weight of about 400 and 30 parts by weight of a nonyl phenol-ethylene oxide product containing about 9 ethylene oxide groups, was dissolved in an amount of 10 to 20% in neat's-foot oil or triolein. Clear oils were obtained from which oil-in-water emulsions with a fine particle size could be prepared without difficulties and were useful for leather fatting.

When the individual components were used alone, no sufficiently stable emulsions could be obtained.

Example IV

50 parts by weight of a petroleum fraction sulfonate having a molecular weight above 400 were admixed with 50 parts by weight of the ethoxylation product of a predominantly unsaturated fatty alcohol mixture (C_{14-18}) with 8 moles of ethylene oxide. The emulsifier mixture thus obtained could readily be incorporated in amounts of 15% into fatty oils or liquid waxes, such as sperm oil, neat's-foot oil and castor oil, and also into mineral oils, such as spindle oil, diesel oils, motor oils, lubricating oils and mixtures thereof having a viscosity of about 3–25° E/20° C., and produced clear products which could be worked up without difficulty into stable oil-in-water emulsions which were further dilutable with water in any desired amount and which could be used for leather fatting.

When the individual components were used alone, no satisfactory emulsions could be obtained. In addition, the ethylene oxide product alone did not form clear solutions in all of the above-mentioned oils.

Example V

50 to 60 parts by weight of a petroleum fraction sulfonate having a molecular weight above 400 were admixed with 40 to 50 parts by weight of a nonyl phenol-ethylene oxide product having 9 ethylene oxide groups. The mixed emulsifier thus obtained could readily be worked into vegetable oils, such as castor oil or tea seed oil, and also into mineral oils and resulted in clear products which could be worked up without difficulty into stable oil-in-water emulsions which could be further diluted with water in any desired amount and which were useful for leather fatting.

When the individual emulsifier components alone were used, no satisfactory emulsions were obtainable. In addition, the ethylene oxide product alone did not produce a clear solution in all of the above-mentioned oils.

Example VI

A mixed emulsifier, consisting of 40 parts by weight of petroleum fraction sulfonate having a molecular weight of about 450 and 60 parts by weight of the ethoxylation product of a coconut oil fatty alcohol (C_{12-18}) with 8 moles of ethylene oxide, was dissolved in an amount of 15 to 25% in white mineral oil. A clear oil was obtained from which an emulsion for oiling of textiles could be prepared without difficulties.

Example VII

30 parts by weight of a petroleum fraction sulfonate with a molecular weight of about 450 and 70 parts by weight of the ethoxylation product of a coconut oil fatty alcohol (C_{12-18}) with 8 moles of ethylene oxide were admixed with each other. The mixed emulsifier thus obtained could readily be worked in amount of 15 to 25% into a mixture of 1 part oleyl alcohol and 3 parts white mineral oil and produced clear products which could be worked up without difficulty into emulsions which were suitable for finishing and oiling of textiles.

Various modifications of the compositions of the invention may be made without departing from the spirit or scope thereof and it is to be understood that the invention be limited only as defined in the appended claims.

We claim:

1. A clear oil composition self-emulsifying in water consisting of 90 to 60% of an oil selected from the group consisting of mineral oil, animal oil, vegetable oil and synthetic oil and 10 to 40% of an emulsifier mixture consisting of 80 to 20% of a petroleum fraction sulfonate having an average molecular weight of at least 400 and 20 to 80% of a condensation product formed by the addition of 2 to 20 moles of ethylene oxide to a member selected from the group consisting of aliphatic hydrocarbon alcohols having 10 to 20 carbon atoms and alkyl phenols having 10 to 20 carbon atoms.

2. A clear oil composition self-emulsifying in water consisting of 90 to 60% of an oil selected from the group consisting of mineral oil, animal oil, vegetable oil and synthetic oil and 10 to 40% of an emulsifier mixture consisting of 80 to 50% of a petroleum fraction sulfonate having an average molecular weight of at least 400 and 20 to 50% of a condensation product formed by the addition of 5 to 10 moles of ethylene oxide to a member selected from the group consisting of aliphatic hydrocarbon alcohols having 10 to 20 carbon atoms and alkyl phenols having 10 to 20 carbon atoms.

3. The composition of claim 2, wherein 8 moles of ethylene oxide are added.

4. A clear oil composition self-emulsifying in water consisting of 90 to 60% of an oil selected from the group consisting of mineral oil, animal oil, vegetable oil and synthetic oil and 10 to 40% of an emulsifier mixture consisting of 80 to 50% of a petroleum fraction sulfonate having an average molecular weight of 400 to 530 and 20 to 50% of a condensation product formed by the addition of 5 to 10 moles of ethylene oxide to oleyl alcohol.

5. The composition of claim 4, wherein 8 moles of ethylene oxide are added to the oleyl alcohol.

6. A clear oil composition self-emulsifying in water consisting of 90 to 60% of an oil selected from the group consisting of mineral oil, animal oil, vegetable oil and synthetic oil and 10 to 40% of an emulsifier mixture consisting of 80 to 50% of a petroleum fraction sulfonate having an average molecular weight of at least 400 and 20 to 50% of a condensation product formed by the addition of 9 moles of ethylene oxide to nonyl phenol.

7. A clear oil composition, self-emulsifying in water, consisting of 90 to 60% of an oil selected from the group consisting of mineral oil, animal oil, vegetable oil and synthetic oil and 10 to 40% of an emulsifier mixture consisting of 80 to 50% of petroleum sulfonates having an average molecular weight of 400 to 530 and 20 to 50% of a condensation product formed by the addition of 2 to 10 moles of ethylene oxide to a member selected from the group consisting of aliphatic hydrocarbon alcohols having 10 to 20 carbon atoms and alkyl phenols having 10 to 20 carbon atoms.

8. An oil emulsifier composition consisting of 80 to 20% of a petroleum fraction sulfonate having an average molecular weight of at least 400 and 20 to 80% of a condensation product formed by the addition of 2 to 20 moles of ethylene oxide to a compound selected from the group consisting of aliphatic hydrocarbon alcohols having 10 to 20 carbon atoms and alkyl phenols having 10 to 20 carbon atoms.

9. An oil emulsifier composition consisting of 80 to 50% of a petroleum fraction sulfonate having an average molecular weight of at least 400 and 20 to 50% of a condensation product formed by the addition of 5 to 10 moles of ethylene oxide to a compound selected from the group consisting of aliphatic hydrocarbon alcohols having 10 to 20 carbon atoms and alkyl phenols having 10 to 20 carbon atoms.

10. The composition of claim 9, wherein 8 moles of ethylene oxide are added.

11. An oil emulsifier composition consisting of 80 to 50% of a petroleum fraction sulfonate having an average molecular weight of at least 400 and 20 to 50% of a condensation product formed by the addition of 5 to 10 moles of ethylene oxide to oleyl alcohol.

12. The composition of claim 11 wherein 8 moles of ethylene oxide are added to the oleyl alcohol.

13. An oil emulsifier composition consisting of 80 to 50% of a petroleum fraction sulfonate having an average molecular weight of at least 400 and 20 to 50% of a condensation product formed by the addition of 9 moles of ethylene oxide to nonyl phenol.

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