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WATER-DISPERSIBLE METAL SOAP COMPOSITIONS

Joseph Cunder, East Orange, and Francis J. Licata, West Caldwell, N. J., assignors to Nopco Chemical Company, Harrison, N. J., a corporation of New Jersey

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This invention relates to metal soap compositions in a dry powdered form which may readily and easily be dispersed in water to produce stable aqueous dispersions of metal soap.

It has long been known that the metal soaps are hydrophobic, and, consequently, for many years the metal soaps have been employed for a great variety of water proofing applications. In utilizing the metal soaps as waterproofing agents and for various other purposes, the most common practice has been to employ organic solvent solutions of the metal soaps. In a great many instances it is not possible to dissolve any appreciable amount of a metal soap in an organic solvent and still have a fluid material since the addition of only a very small amount of a metal soap causes many organic solvents to form firm gels. A number of materials have been suggested as peptizing agents to prevent such gelation from taking place and in some cases these peptizing agents have given very good results allowing solvent solutions containing relatively large amounts of metal soaps to be prepared. In many instances and for many purposes, however, an organic solvent solution of a metal soap is not a particularly desirable form in which to use a metal soap.

For many applications it would be highly desirable to have available aqueous dispersions of metal soaps, and in recent years a number of proposals have been advanced relative to the production of aqueous dispersions of metal soaps. However, because of the highly hydrophobic chracteristics of the metal soaps, such dispersions are often difficult to prepare. In many cases the preparation of such dispersions requires the use of expensive dispersing or homogenizing equipment such as colloid mills, etc. In other cases the metal soap is first dissolved in an organic solvent therefor, often with the aid of a solubilizing agent since, as has been pointed out above, metal soaps tend to form gels in many organic solvents whenever present in any appreciable concentration, and the solvent solution then emulsified with water employing various emulsifying agents and vigorous methods of agitation, e. g. colloid mill, etc.

Ammonia and various alkylamines have been found to be fairly effective in dispersing metal soaps in aqueous mediums. When these aqueous dispersions which have been so prepared are used as coating agents, the water and the ammonia or alkylamine which has been employed as the dispersing agent will evaporate leaving a film of metal soap. Although such dispersions are not as difficult to prepare as those mentioned above,

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they still have the disadvantage of requiring the transportation of large quantities of water whenever the dispersions are shipped from the manufacturer to the ultimate consumer. Also such dispersions are rather alkaline which makes them somewhat unsuited for some uses.

A considerable saving on freight charges and thus a reduction in the cost to the ultimate consumer could be effected if it were possible to provide metal soap compositions in a dry form which could readily and easily be dispersed in water. As was pointed out above, ammonia and various alkylamines are fairly effective dispersing agents for metal soaps; however, in view of their volatility it is apparent that they would be quite unsuitable for preparing dispersible metal soap compositions in dry form. Other dispersing agents which have been employed require the use of specialized dispersing equipment or of specialized and often complicated procedures in preparing metal soap dispersions. Consequently all of this has necessitated preparation by the manufacturer of the aqueous dispersions as such, and has thus required the transportation of large quantities of water when the dispersions have been shipped to the ultimate consumer. Although the advantages of having in a dry powdered form a metal soap composition which anyone may readily and easily disperse in water are quite obvious, no one appears to have been able heretofore to produce a commercially practicable composition of this type.

It is the object of this invention to provide water-dispersible metal soap compositions in dry, powdered form.

A further object of the invention is to provide dry, powdered metal soap compositions which may easily be dispersed in aqueous media to form stable, concentrated aqueous dispersions of metal soaps.

Other objects of the invention will in part be obvious and will in part appear hereinafter.

We have discovered that the above and other objects of the invention may be realized by admixing a pulverulent metal soap with a small amount of a sulfated aliphatic alcohol containing from 8 to 22 carbon atoms. Such a composition is readily and easily dispersible in aqueous mediums.

In preparing the dry compositions of our invention any pulverulent metal soap of a saturated fatty acid containing from 10 to 22 carbon atoms may be employed. The metal soaps which we employ are preferably prepared by double decomposition processes wherein water-soluble soaps of

the desired fatty acids and water-soluble inorganic salts of the desired metals are reacted together in an aqueous solution to form the desired metal soaps which, since they are water-insoluble, precipitate from the solution. Metal soaps produced in such a manner precipitate in a powdery form and after being separated from the aqueous solution and dried, usually need not be ground or further sub-divided before being utilized in preparing the products of our invention. In one instance, however, the metal soap employed in preparing the products of our invention is preferably produced by direct reaction between an inorganic salt of the desired metal and the desired fatty acid. This is the case when a soap of lithium is prepared. Since lithium is so closely related physically and chemically to sodium and potassium it would seem that lithium soaps would be water-soluble; however, that is not the case and in most instances, as in this specification, lithium soaps are included in the class of so-called "metal soaps" in view of their insolubility in water.

The fatty acids employed in preparing the metal soaps used in our novel compositions are the saturated fatty acids containing from 10 to 22 carbon atoms. In many cases instead of using the free fatty acids themselves, glycerides containing such fatty acids may be employed. Since in many cases glycerides contain varying amounts of unsaturated fatty acids and saturated fatty acids containing less than 10 carbon atoms, metal soaps prepared employing glycerides as the source of fatty acids will often contain varying amounts of such acids. Such metal soaps may be employed in preparing the products of our invention, however, as long as they contain sufficient saturated fatty acids of 10 to 22 carbon atoms to give soaps which have a powdery form or which on being ground will be in a powdery form. Excellent examples of such metal soaps are the so-called metal "palmitates" of commerce. The metal palmitates of commerce instead of being produced from palmitic acid as would be supposed are actually produced from the mixture of fatty acids contained in coconut oil. However, even though the metal palmitates contain some fatty acids other than saturated fatty acids containing from 10 to 22 carbon atoms, they all either have a powdery form or are capable of being reduced to a powdery form by grinding. Thus they are quite suitable for use in preparing the products of our invention.

As specific examples of metal soaps suitable for use in preparing the products of our invention there may be mentioned aluminum stearate, zinc stearate, calcium stearate, barium stearate, lithium stearate, magnesium stearate, lead stearate, copper stearate, the corresponding metal palmitates, etc. As is well known, the commercial metal stearates contain fatty acid chains of somewhat varying carbon content depending upon the source of the fatty material. In most cases, however, chain lengths of 16 and 18 carbon atoms will predominate.

The sulfated aliphatic alcohols suitable for use in producing the water-dispersible metal soap compositions of our invention may be prepared from any aliphatic alcohol containing from 8 to 22 carbon atoms. A convenient method of obtaining such alcohols is through hydrogenation in the presence of a catalyst of naturally occurring fatty acids. Among the many aliphatic alcohols which when sulfated may be employed in preparing the products of our invention there may be mentioned 2-ethylhexanol, octyl alcohol, nonyl alcohol, decyl alcohol, undecyl alcohol, lauryl alcohol, 7-ethyl-2-methyl-undeconal-4, cetyl alcohol, 3,9 diethyltridecanol-6, stearyl alcohol, oleyl alcohol, ricinoleyl alcohol, etc., or mixtures of such alcohols, e. g. such as would be obtained by the catalytic hydrogenation of a mixture of fatty acids. Procedures for the sulfation of such alcohols are well known in the art, and many sulfated alcohols of the types set forth above are sold commercially. If desired the sulfated alcohol may be prepared from a blown fatty alcohol as described in U. S. Patent No. 2,200,299.

The sulfated aliphatic alcohols which we employ may be neutralized with alkaline compounds such as sodium and potassium hydroxide, etc., if desired, to give salts thereof. The term "sulfated" is used in both the specification and claims to connote not only the unneutralized esters but also the various water-soluble salts of the esters.

Many of the sulfated alcohols which are available commercially are sold in the form of 25% or 50% aqueous solutions thereof. Such aqueous solutions may be employed in preparing the dry, water-dispersible products of the invention since the amount of water which is thus incorporated into the water-dispersible compositions is relatively small. If desired the sulfated alcohol which is employed may be completely free of water in which case the water-dispersible metal soap composition will be completely anhydrous. In many cases when aqueous solutions of the sulfated alcohols are employed, the water-dispersible metal soap compositions obtained are dry powders. Apparently in such cases the metal soap adsorbs the water in the aqueous solution. If the metal soap does not completely adsorb the water in the aqueous solution of a sulfated alcohol when such a solution is employed in preparing the products of our invention, it is preferred to heat the product obtained until sufficient water is driven off to give a product having a dry appearance and feel. In most cases it will be found that the physical character and appearance of the water-dispersible metal soap composition will be essentially the same as that of the metal soap which was employed in preparing the composition. Thus in most cases the metal soap and the water-dispersible compositions prepared therefrom will to all outward appearances be indistinguishable. It is to be understood that the term "dry" as used herein with reference to the water-dispersible compositions of our invention does not necessarily mean that the compositions are completely anhydrous although they may be if so desired. By the term "dry" we mean that they have a dry appearance and feel in the ordinary sense of the word.

The ratio of the sulfated alcohol to the metal soap in the compositions of our invention will vary slightly depending upon the concentration of the metal soap which will be desired in the dispersions later prepared from the dry dispersible products of the invention with a slightly higher proportion of the sulfated alcohol being employed as the concentration of the metal soap is increased. Ordinarily an amount of the sulfated alcohol equal to from about 5% to about 25% of the weight of the metal soap will be sufficient although larger amounts may be employed if desired since there is no critical upper limit. Likewise amounts smaller than 5% may be employed, e. g. 1%, although for best results it is preferred to use at least 5% of a sulfated alcohol.

In preparing the water-dispersible products of our invention, the metal soap and the sulfated alcohol may be admixed in any suitable manner. The dry metal soap may be thoroughly mixed with the sulfated alcohol or instead of mixing the sulfated alcohol with the dry metal soap, the compositions of the invention may be prepared in conjunction with the manufacture of the metal soaps. When the compositions of the invention are so prepared, the metal soap may be precipitated in the presence of the sulfated alcohol or the sulfated alcohol may be admixed with the wet metal soap just after it is precipitated. After the wet metal soap and the sulfated alcohol are thoroughly mixed, the resulting composition is dried, and then preferably ground or otherwise finely divided to more or less of a powdery form.

In employing the compositions of our invention to prepare aqueous dispersions of metal soaps, no special mixing or dispersing equipment is required. The dry dispersible products may merely be added to an aqueous medium or vice versa and the products then dispersed in the aqueous medium by means of moderate but thorough agitation. If desired the dry compositions or the aqueous medium, as the case may be, may be added a small amount at a time with each portion being thoroughly admixed before the next is added. Also, if desired the aqueous medium may be heated slightly, e. g. to about 60°–70° C., to aid in the dispersing.

The concentration of metal soap to be incorporated into an aqueous dispersion may vary considerably. Preferably not more than about 40% of metal soap is incorporated into an aqueous dispersion. The lower limit may be as low as the particular user may desire or it may be whatever concentration may be desirable for the particular application involved. In most cases, however, it is preferred to have at least about 5% of metal soap in the aqueous dispersions.

Metal soap dispersions prepared from the compositions of the invention may be employed to waterproof, mildewproof, etc. textiles, leather, paper, concrete, etc. They may also be used as defoamers, or used for any other purpose where an aqueous dispersion of a metal soap would be useful.

Although we are particularly concerned with the production of the dry water-dispersible metal soap compositions, the scope of our invention includes, of course, not only those compositions but also the aqueous dispersions produced therefrom.

For a fuller understanding of the nature and objects of the invention reference may be had to the following examples which are given merely to illustrate further the invention and are not to be construed in a limiting sense, all parts given being by weight.

Example I

Fifty parts of a 50% aqueous solution of the sodium salt of sulfated oleyl alcohol were admixed with 100 parts of powdered aluminum stearate by slowly adding the solution of the sulfated oleyl alcohol to the powdered aluminum stearate with thorough mixing. The resulting product was a dry powder which was easily dispersible in water. Twenty parts of the dry powder dispersed in 80 parts of water gave a stable fluid dispersion. Fifty parts of the dry powder dispersed in 50 parts of water gave a viscous, stable fluid. The aqueous dispersions were prepared merely by adding the proper amount of water in each case to the dry powder and then thoroughly agitating the mixture.

Example II

Ten parts of the 50% aqueous solution of the sodium salt of sulfated oleyl alcohol of Example I were admixed with 100 parts of powdered aluminum stearate in the same manner as in Example I, producing a dry powder which was easily dispersible in water. A 20% aqueous dispersion of the powdery product prepared as in Example I was stable and fluid.

Example III

One hundred parts of the 50% aqueous solution of the sodium salt of sulfated oleyl alcohol of Example I were admixed with 100 parts of powdered aluminum stearate giving a dry powder dispersible in water. Twenty parts of the dry powder admixed with 80 parts of water gave a stable, fluid dispersion. Both the dry powder and the aqueous dispersion thereof were prepared in the same manner as in Example I.

Example IV

Twenty-five parts of commercial sulfated lauryl alcohol in a dry, powdered form were admixed with 100 parts of powdered aluminum stearate merely by placing the two dry powders in a vessel and thoroughly mixing them together. The resulting dry powder was easily dispersible in water, and a 20% aqueous dispersion thereof prepared as in Example I was quite stable and fluid.

Example V

Fifty parts of the 50% aqueous solution of the sodium salt of sulfated oleyl alcohol employed in Example I were admixed in the same manner as in Example I with 100 parts of powdered zinc stearate giving a dry powder which could readily be admixed with water to form stable aqueous dispersions. An aqueous dispersion containing 20% of the powdered product prepared in the same manner as in Example I was a stable fluid.

Example VI

Twenty-five parts of a 25% aqueous solution of the sodium salt of sulfated 7-ethyl-2-methyl-undecanol-4 were admixed with 100 parts of powdered aluminum stearate. The aqueous solution was added to the powdered aluminum stearate a small amount at a time with each portion being thoroughly admixed before the next was added. The resulting product was a dry powder which was very easily dispersible in water. Twenty parts of the dry powder dispersed in 80 parts of water in the same manner as in Example I gave a stable fluid dispersion.

Example VII

One hundred parts of powdered calcium stearate were admixed in the same manner as in Example I with 50 parts of the 50% aqueous solution of the sodium salt of sulfated oleyl alcohol employed in Example I. A dry powder was obtained which could easily be dispersed in water. A 20% aqueous dispersion thereof prepared in the same manner as in Example I was fluid and stable.

Example VIII

Twenty-five parts of a 25% aqueous solution of the sodium salt of sulfated 3,9 diethyltridecanol-6 and 100 parts of powdered aluminum stearate were admixed by slowly adding the aqueous solution to the aluminum stearate with thorough

mixing, giving a dry powder easily dispersible in water. A 20% aqueous dispersion of the product prepared as in Example I was fluid and stable.

Example IX

One hundred parts of powdered lithium stearate were admixed in the same manner as in Example I with 50 parts of the 50% aqueous solutions of the sodium salt of sulfated oleyl alcohol employed in Example I. The product obtained was a slightly pasty powder readily dispersible in water. Twenty parts of the product dispersed in 80 parts of water in the same manner as in Example I gave a stable fluid dispersion.

Example X

Twenty-five parts of a 25% aqueous solution of the sodium salt of sulfated 2-ethylhexanol were admixed with 100 parts of powdered aluminum stearate by slowly adding the aqueous solution to the aluminum stearate with thorough mixing. The resulting pasty powder was easily dispersible in water. A 20% aqueous dispersion thereof prepared in the same manner as in Example I was fluid and stable.

Example XI

One hundred parts of powdered barium stearate and 50 parts of the 50% aqueous solution of the sodium salt of sulfated oleyl alcohol employed in Example I were admixed in the same manner as in Example I given a pasty powder which could readily be dispersed in water. A 20% aqueous dispersion of the product prepared in the same manner as in Example I was fluid and stable.

From the above description and examples it is quite apparent that our invention provides dry metal soap compositions which are highly suitable for forming any desired kind of an aqueous metal soap dispersion.

The dry, water-dispersible products of our invention may also have included therein other solid constituents, such as plasticizers, dyes, pigments or other coloring matter, etc.

Having described our invention, what we claim as new and desire to secure by Letters Patent is:

1. As a new composition of matter, a solid comprising an intimate mixture of a water-insoluble soap of a saturated fatty acid containing from 10 to 22 carbon atoms and a sulfated aliphatic alcohol containing from 8 to 22 carbon atoms, said composition of matter being characterized by the property of being readily dispersible in aqueous media and adapted to form free-flowing concentrated aqueous dispersions with aqueous media.

2. An aqueous dispersion of a metal soap comprising water and the composition of claim 1.

3. As a new composition of matter, a solid comprising an intimate mixture of a water-insoluble metal stearate and a sulfated aliphatic alcohol containing from 8 to 22 carbon atoms, said composition of matter being characterized by the property of being readily dispersible in aqueous media and adapted to form free-flowing concentrated aqueous dispersions with aqueous media.

4. An aqueous dispersion of a metal soap comprising water and the composition of claim 3.

5. As a new composition of matter, a pulverulent solid comprising an intimate mixture of a water-insoluble soap of a saturated fatty acid containing from 10 to 22 carbon atoms and sulfated oleyl alcohol, said composition of matter being characterized by the property of being readily dispersible in aqueous media and adapted to form free-flowing concentrated aqueous dispersions with aqueous media.

6. An aqueous dispersion of a metal soap comprising water and the composition of claim 5.

7. As a new composition of matter, a pulverulent solid comprising an intimate mixture of a water-insoluble soap of a saturated fatty acid containing from 10 to 22 carbon atoms and sulfated lauryl alcohol, said composition of matter being characterized by the property of being readily dispersible in aqueous media and adapted to form free-flowing concentrated aqueous dispersions with aqueous media.

8. An aqueous dispersion of a metal soap comprising water and the composition of claim 7.

9. As a new composition of matter, a pulverulent solid comprising an intimate mixture of a water-insoluble soap of a saturated fatty acid containing from 10 to 22 carbon atoms and sulfated 2-ethylhexanol, said composition of matter being characterized by the property of being readily dispersible in aqueous media and adapted to form free-flowing concentrated aqueous dispersions with aqueous media.

10. As a new composition of matter, a pulverulent solid comprising an intimate mixture of a water-insoluble metal stearate and sulfated oleyl alcohol, the sulfated oleyl alcohol being present in the mixture in an amount of between about 1% and about 50% based upon the weight of the metal stearate, said composition of matter being characterized by the property of being readily dispersible in aqueous media and adapted to form free-flowing concentrated aqueous dispersions with aqueous media.

11. As a new composition of matter, a pulverulent solid comprising an intimate mixture of a water-insoluble metal stearate and sulfated lauryl alcohol, the sulfated lauryl alcohol being present in the mixture in an amount of between about 1% and about 50% based upon the weight of the metal stearate, said composition of matter being characterized by the property of being readily dispersible in aqueous media and adapted to form free-flowing concentrated aqueous dispersions with aqueous media.

12. As a new composition of matter, a pulverulent solid comprising an intimate mixture of a water-insoluble metal stearate and sulfated 2-ethylhexanol, the sulfated 2-ethylhexanol being present in the mixture in an amount of between about 1% and about 50% based upon the weight of the metal stearate, said composition of matter being characterized by the property of being readily dispersible in aqueous media and adapted to form free-flowing concentrated aqueous dispersions with aqueous media.

13. As a new composition of matter, a pulverulent solid comprising an intimate mixture of aluminum stearate and a sulfated aliphatic alcohol containing from 8 to 22 carbon atoms, the sulfated alcohol being present in the mixture in an amount of between about 1% and about 50% based upon the weight of the aluminum stearate, said composition of matter being characterized by the property of being readily dispersible in aqueous media and adapted to form free-flowing concentrated aqueous dispersion with aqueous media.

14. An aqueous dispersion of a metal soap comprising water and the composition of claim 13.

15. As a new composition of matter, a pulverulent solid comprising an intimate mixture of aluminum stearate and sulfated oleyl alcohol, the sulfated oleyl alcohol being present in the mixture in an amount of between about 1% and about 50% based upon the weight of the aluminum stearate, said composition of matter being characterized by the property of being readily dispersible in aqueous media and adapted to form free-flowing concentrated aqueous dispersions with aqueous media.

16. An aqueous dispersion of a metal soap comprising water and the composition of claim 15.

17. As a new composition of matter, a pulverulent solid comprising an intimate mixture of aluminum stearate and sulfated lauryl alcohol, the sulfated lauryl alcohol being present in the mixture in an amount of between about 1% and about 50% based upon the weight of the aluminum stearate, said composition of matter being characterized by the property of being readily dispersible in aqueous media and adapted to form free-flowing concentrated aqueous dispersions with aqueous media.

18. An aqueous dispersion of a metal soap comprising water and the composition of claim 17.

19. As a new composition of matter, a pulverulent solid comprising an intimate mixture of aluminum stearate and sulfated 2-ethylhexanol, the sulfated 2-ethylhexanol being present in the mixture in an amount of between about 1% and about 50% based upon the weight of the aluminum stearate, said composition of matter being characterized by the property of being readily dispersible in aqueous media and adapted to form free-flowing concentrated aqueous dispersions with aqueous media.

20. An aqueous dispersion of a metal soap comprising water and the composition of claim 19.

JOSEPH CUNDER.
FRANCIS J. LICATA.

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