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DETERGENT COMPOSITION

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This invention relates to improved composi-
tions of matter useful as detergents or detergent
components of other compositions. It relates
more particularly to compositions containing one
or more soapless detergents and agents adapted
to improve the detergent and lathering power
of said soapless detergents.

There is a large class of new organic soapless
detergents consisting of aliphatic, or substituted
aromatic, polar-nonpolar compounds which con-
tain, in the nonpolar portion of the molecule,
one or more large acyclic or cyclic aliphatic
groups and, in the polar portion of the molecule,
one or more free or neutralized inorganic oxygen
acid groups which are derived from polybasic
acids; for example, sulfuric acid ($-\text{OSO}_3\text{H}$) or
sulfonic acid ($-\text{SO}_3\text{H}$) groups. Their aqueous
solutions display certain desirable properties
much superior to those of aqueous soap solutions;
for example, they do not precipitate insoluble
salts from hard water; their detergent powers
are unaffected by the solutions being made acid,
neutral or alkaline; and they rapidly wet textile
materials. In general the better detergent pow-
ers are possessed by those compounds which con-
tain an alkyl group or radical of about 10 or more
carbon atoms. Thus compounds which contain
alkyl groups of between 12 and 18 carbon atoms
are particularly effective as soapless detergents.
The alkyl group, when in the form of a carbon
chain may be linked to the other radicals of the
compounds by a terminal carbon atom of the
chain or by an intermediate carbon atom of the
chain. Examples of such soapless detergents
are:

Alkyl mono-nuclear aryl sulfonates in which
the alkyl group contains at least 10 carbon atoms
and is directly linked to the aromatic nucleus
(that is, the alkyl group is a nuclear substituent)
or is linked to the aromatic nucleus by an oxygen
or nitrogen atom; for example, lauryl benzene
sodium sulfonate, tetradecyl benzene sodium sul-
fonate, cetyl benzene sodium sulfonate, lauryl
phenol sodium sulfonate, cetyl phenol sodium
sulfonate, myristyl phenol sodium sulfonate,
lauryl acetyl amino benzene sodium sulfonate,
cetyloxy methyl benzene sodium sulfonate (cetyl
ether of cresol sodium sulfonate), and mixtures
of sodium salts of alkyl benzene sulfonic acids in
which the alkyl groups contain mainly 10 to 18
carbon atoms and are derived from petroleum
hydrocarbons.

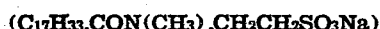
Monoalkyl sulfates containing at least 10 car-
bon atoms in an alkyl group; for example, am-
monium decyl sulfate, sodium lauryl sulfate, so-

dium cetyl sulfate, sodium myristyl sulfate,
sodium stearyl sulfate, and magnesium lauryl
sulfate.

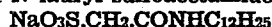
Monoalkyl sulfonates containing at least 10
carbon atoms in the alkyl group; for example,
sodium cetyl sulfonate and ammonium lauryl
sulfonate.

Monoalkyl carboxylic esters of sulfonated fatty
acids containing at least 10 carbon atoms in the
alkyl group; for example, sodium lauryl sulfo-
acetate and sodium cetyl sulfoacetate.

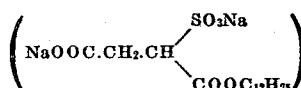
Alkylamino-alkylene and fatty acylamino alkyl-
ene sulfates and sulfonates containing at least
10 carbon atoms in the alkylamino and acylamino
group; for example, sodium N-lauryl taurine, so-
dium N-cetyl taurine, sodium palmitoyl tauride
($\text{C}_{15}\text{H}_{31}\text{CONH}\cdot\text{CH}_2\text{CH}_2\text{SO}_3\text{Na}$), sodium N-methyl
N-oley tauride



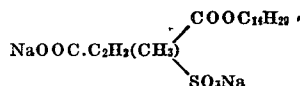
and sodium N-lauryl sulfoacetamide



Alkyl esters of sulfo-succinic acids containing
at least 10 carbon atoms in an alkyl group; for
example, disodium mono-lauryl sulfosuccinate



disodium mono-cetyl sulfosuccinate, disodium
mono-myristyl alphas methyl sulfosuccinate



According to the present invention improved
detergent compositions are obtained by mixing
a small amount of a water-soluble alkyl ether of
cellulose with a soapless detergent of the above
type. I have found that the dispersing and de-
tergent properties of the soapless detergents can
be increased to a disproportionately large and
unforeseeable extent by the addition of a com-
paratively small amount of water soluble alkyl
ether of cellulose. The remarkable increase in
detergent powers is particularly noticeable when
the alkyl ether of cellulose is added to an alkyl
mononuclear aryl sulfonate in which the alkyl
group is attached directly to the aromatic nucleus
or is part of an alkoxy or alkylamino substituent
on the nucleus, and the said alkyl group contains
10 or more carbon atoms, especially from about
12 to about 18 carbon atoms in an open hydro-
carbon chain.

The water-soluble alkyl ethers of cellulose which may be employed in accordance with the present invention are those in which the alkyl group or groups are derived from the lower primary alcohols; for example, the water-soluble ethers described in U. S. P. 1,188,376 and Thorpe's "Dictionary of Applied Chemistry," 4th edition, vol. II, p. 477. Examples of such ethers are: methoxy celluloses (known commercially as "Tylose" and "Colloresin") and ethoxy cellulose.

The proportion of the alkyl ether of cellulose to the detergent (polar-nonpolar compound) may be varied within limits. Thus, I have found that the proportion of ether (or mixture of ethers) to detergent (or mixture of detergents) may vary from about 1:10 to about 1:50 parts by weight. Aqueous solutions of the compositions increase in viscosity as the content of alkyl ether of cellulose in the composition increases.

The water-soluble alkyl ether of cellulose may be mixed with the soapless detergent in any manner. Thus, the dry alkyl ether of cellulose may be mixed directly with the dry soapless detergent, as by grinding and milling. Or mixtures of the aqueous solutions of the alkyl ether of cellulose and of the soapless detergent may be made, and the resulting mixtures may be used directly, or the aqueous mixtures may be dried in the usual manner; for example, by spray drying, pan drying, or rotary drum drying at suitable temperatures (such as, between about 100 and 150° C. at atmospheric or subatmospheric pressures). The dry compositions may be readily stored and will easily form detergent baths with water. The solubility and detergent powers of the mixtures remain unimpaired by storage.

In preparing the compositions of the present invention, a single soapless detergent or a mixture of two or more of them may be used. Similarly, a single water-soluble alkyl ether of cellulose or a mixture of them may be used. Hence, where in the claims the soapless detergent and the cellulose ether are referred to in the singular, it will be understood that such mixtures are included.

The compositions of this invention may be used for various purposes; for example, as cleaning and washing compositions for textile fibers, leather, wood, metals, etc., as cosmetics, and particularly as cleaning and washing compositions for textile materials. Thus, 0.2 per cent aqueous solutions of mixtures containing the aforementioned amounts of methyl ether of cellulose are excellent cleaning and lubricating agents for textile materials which require unusual treatment, such as surface washing by sponging with foaming solutions, as in cleaning carpets, pile fabrics and the like. Due to their extremely high dispersing power, the compositions are very effective in preparing water-containing compositions for cleaning in the form of vascenols, shampoos for hair, creams, metal and shoe polishes, and the like. In cosmetic preparations they are especially valuable components, since they not only effect a high degree of dispersion, but they are resistant to attack and decomposition by bacteria. Compositions which contain higher alkyl phenol sulfonates as the soapless detergent are especially effective in this respect, since said sulfonates are bactericidal.

In general the soapless detergents are employed in the form of the sodium, potassium or ammonium salts. For the preparation of compositions in which the presence of certain metals as cations or in colloidal form is desirable, the particular

metal salt of the soapless detergent may be used effectively. Thus, the calcium, magnesium, and aluminum salts may be used for this purpose. Other valuable and effective preparations may be prepared in which the soapless detergent is employed in the form of salts derived from organic bases, such as triethanolamine, quinine, nicotine, polyaminoalkylolamines, amylamine and the like.

The following examples illustrate the invention.

10 The parts are by weight.

Example 1.—Five parts of a mixture of water-soluble methyl ethers of cellulose (which mixture is sold commercially under the name of "Colloresin DK") were mixed and ground intimately with 15 95 parts of a mixture of sodium monoalkyl phenol sulfonates in which the substituent alkyl groups were attached to carbon atoms of the aryl nuclei and had an average carbon content of about 14 carbon atoms. Two parts of the resulting composition were dissolved in 1000 parts of water. It was a highly efficient detergent especially useful for cleaning rugs by the "shampoo" method.

To test the cleansing quality of this aqueous solution one of two similar pieces of cotton cloth 25 soiled with oil and lampblack was washed with the said solution and compared with the other piece of cloth which was washed under like conditions with a 0.2 per cent aqueous solution of the same alkyl phenol sulfonate mixture, to which the cellulose ether mixture was not added. The washing effect obtained with the solution containing the alkyl cellulose ethers was markedly superior. It appeared to be about 250 per cent as efficient a cleaning solution as the solution containing the mixture of sodium alkyl phenol sulfonates alone.

Example 2.—Five parts of water-soluble methyl ethers of cellulose ("Colloresin DK") and 95 parts of "Gardinol WA" (which is chiefly a mixture of 40 cetyl sodium sulfate, lauryl sodium sulfate, and myristyl sodium sulfate) were mixed and 2 parts of the resulting mixture were dissolved in 1000 parts of cold water. When compared for detergent qualities with a 0.2 per cent aqueous solution of Gardinol WA, in the manner described in Example 1, the solution containing the cellulose ether was about 150 per cent as efficient a detergent as the aqueous solution of "Gardinol WA" free from alkyl ethers of cellulose.

Example 3.—95 parts of sodium salts of a mixture of monoalkyl benzene monosulfonic acids in which the alkyl groups mainly corresponded with petroleum hydrocarbons averaging in carbon content from about C₁₂ to about C₁₈ (obtained by chlorinating a kerosene fraction of petroleum distillate whose boiling range corresponded with hydrocarbons ranging mainly from about C₁₂H₂₄ to about C₁₈H₃₈, condensing the resulting mixed alkyl chlorides with benzene and an aluminum chloride condensing agent, and sulfonating the resulting mixture of alkyl benzenes) were employed instead of the mixture of sodium monoalkyl phenol sulfonates in Example 1. The resulting composition also displayed increased cleansing action.

Example 4.—The 0.2 per cent aqueous solutions prepared according to Example 1, were tested for lathering power by shaking 100 cc. of the solution 70 for 1 minute in a liter flask with a graduated neck, and noting the volume of liquid which was not converted to foam. The aqueous solution of the composition containing alkyl ethers of cellulose had between 200 and 300 per cent as much lathering power as the other aqueous solution 75

(the alkyl phenol sulfonate solution free from alkyl ether of cellulose).

The aqueous solutions of the new compositions combine their enhanced detergent qualities with the property of acting as textile lubricants, as is evidenced by the absence of lint in the usual aqueous solutions after washing operations. The following example illustrates this.

Example 5.—Equal amounts of the solutions prepared according to Examples 1 and 2 were used under equivalent conditions for washing equal portions of a mixture of soiled textile fabrics. After the washings were complete and the washed materials were withdrawn, the remaining aqueous baths derived from the new compositions contained much less lint than the similar remaining baths which initially did not contain the cellulose ethers.

The new compositions are also better detergents in hard water than the soapless detergents alone. This property becomes readily evident by the duplication in hard water of the washing effects which are illustrated in Examples 1, 2 and 3. Further, when the procedures of these examples are carried out with hard water, the baths obtained are free from the curdy precipitates which usually occur in baths prepared with hard water and soap. Thus, solutions prepared from hard water of 10° hardness are only slightly opalescent.

Solutions of the new compositions have been made in acid, alkaline, and neutral aqueous media. The acid solutions were used for washing soiled wool; the neutral and alkaline solutions were used for washing vegetable fiber or artificial fibers such as cellulose acetate. In these cases, the aqueous solutions (within a wide range of alkalinity and acidity) displayed excellent lathering and detergent qualities. Such solutions in hard or soft water are therefore very desirable treating baths for washing and fulling woolen goods; scouring raw wool; degumming silk; washing, soaping, lubricating vegetable and synthetic fibers and fabrics; washing in household and power laundries; and washing, cleaning and shampooing carpets, rugs, pile fabrics, etc.

I claim:

1. A detergent composition comprising essentially an alkyl mono-nuclear aromatic sulfonate having at least 12 carbon atoms in the alkyl group, and a water-soluble alkyl ether of cellulose in a weight ratio of not more than 1 part of the cellulose ether to about 10 parts of the sulfonate.

2. A detergent composition comprising essentially a detergent mixture of alkyl mono-nuclear aromatic sulfonates in which the alkyl groups are attached to nuclear carbon atoms and have an average carbon content of 12 to 18 carbon atoms, and a minor amount of a water-soluble alkyl ether of cellulose based on the weight of the detergent mixture.

3. A detergent composition comprising essentially at least 10 parts by weight of an alkyl mono-nuclear aromatic sulfonate having 12 to 18 carbon atoms in the alkyl group and about 1 part by weight of a water-soluble methyl ether of cellulose.

4. A detergent composition comprising about 95 parts by weight of a detergent mixture of sodium alkyl mono-nuclear aromatic sulfonates in which the alkyl groups are attached to nuclear carbon atoms and have an average carbon content of 12 to 18 carbon atoms, and about 5 parts by weight of a water-soluble alkyl ether of cellulose.

5. A detergent composition comprising about 95 parts by weight of a detergent mixture of sodium alkyl mono-nuclear aromatic sulfonates in which the alkyl groups are attached to nuclear carbon atoms and have an average carbon content of 12 to 18 carbon atoms, and about 5 parts by weight of a mixture of water-soluble methyl ethers of cellulose.

6. A detergent composition comprising essentially an alkyl mononuclear aromatic sulfonate having at least 10 carbon atoms in the alkyl group, and a minor amount of a water-soluble alkyl ether of cellulose based on the weight of the alkyl mononuclear aromatic sulfonate.

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