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[54] **ALKALINE SOLUTIONS CONTAINING CERTAIN ALKYLBENZENE SULFONATE WETTING AGENTS**
6 Claims, No Drawings

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[51] **Int. Cl.** **D06m**
[50] **Field of Search** 252/138, 161, 156, 353, 8.7; 8/127, 125

[56] **References Cited**

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ABSTRACT: Aqueous alkaline solutions having a pH of at least 10 containing at least about 0.01 percent by weight of certain water-soluble alkylbenzene sulfonates which have been found to have unusually effective wetting properties in such alkaline solutions, said alkylbenzene sulfonates being characterized by the alkyl radical thereof containing from six to nine carbon atoms.

ALKALINE SOLUTIONS CONTAINING CERTAIN ALKYLBENZENE SULFONATE WETTING AGENTS

This invention relates to the utilization of certain alkyl benzene sulfonate surface active agents in highly alkaline aqueous media, namely, media or solutions having a pH of at least 10.

Long-chain alkylbenzene sulfonic acids and sulfonates are well-known surface-active agents and have been extensively used as detergents, wetting agents, emulsifiers and the like. It has long been recognized and taught by the prior art that those long-chain alkylbenzene sulfonates wherein the alkyl radical attached to the benzene nucleus contains from 10 to 18 carbon atoms, and particularly 12 to 14 carbon atoms, are generally the most effective materials for significantly reducing surface tension of aqueous solutions. Surface-active agents comprising, and compositions employing, long-chain alkylbenzene sulfonates are disclosed in very large numbers of patents as, for example, U.S. Pat. Nos. 2,061,618; 2,161,473; 2,232,117 and 2,463,497, and data are there presented showing the superior wetting efficiency of the C_{10} or higher alkylbenzene sulfonates when compared with alkylbenzene sulfonates wherein the alkyl radical attached to the benzene nucleus contains from six to nine carbon atoms, and it has been widely accepted in the art that alkylbenzene sulfonates having less than 10 carbon atoms in the alkyl radical are decidedly inferior wetting agents.

Alkylbenzene sulfonates such as the sodium and other water-soluble salts of methylbenzene sulfonate, ethylbenzene sulfonate, propyl- and isopropylbenzene sulfonates and cumene sulfonate have long been known and certain of them have been used as hydrotropes in detergent compositions. They have essentially little or no surface-active or wetting properties.

Those of the alkylbenzene sulfonates which are highly effective wetting agents, and which, as stated above, contain an alkyl radical of at least 10 carbon atoms, have heretofore been widely used in numerous environments and in numerous types of compositions, including compositions of acid, neutral and alkaline character, as in washing, cleaning and detergent compositions of numerous types. When such recognized highly effective wetting agents are used in strongly alkaline aqueous solutions, having a pH of 10 or more, as, for instance, pH 11, 12 or 13, as in caustic alkali and other strong alkali aqueous solutions, it has been found that said wetting action is seriously deficient which limits their usefulness in numerous applications where strongly alkaline environments are involved.

It has been discovered, in accordance with the present invention, that, although water-soluble alkylbenzene sulfonates in which the alkyl radical contains from six to nine, and especially from six to eight, carbon atoms, are distinctly inferior to C_{10} to C_{12} alkylbenzene sulfonates in wetting efficiency generally, when said C_6 to C_9 alkylbenzene sulfonates are used in strongly alkaline aqueous solutions, that is, having a pH of at least 10, they exhibit a wholly unexpectedly and markedly superior wetting efficiency in contrast to the C_{10} to C_{12} alkylbenzene sulfonates, all as will be shown in detail below.

The alkylbenzene sulfonates whose use is contemplated by our present invention are, most advantageously, monoalkyl benzene sulfonates in which the alkyl radical contains from six to nine, and especially largely or predominantly eight carbon atoms. However, dialkyl benzene sulfonates can be used so long as the total of the carbon atoms in the two alkyl radicals is in the range of six to nine. Mixtures of said monoalkyl benzene sulfonates and said dialkylbenzene sulfonates can, of course, also be used. The alkyl radical or radicals can be straight or branched chain. Illustrative of such C_6 to C_9 alkylbenzene sulfonates are sodium hexylbenzene sulfonate, sodium heptylbenzene sulfonate, sodium octylbenzene sulfonate, sodium nonylbenzene sulfonate and sodium hexyl methyl sulfonate; and mixtures of the same such as a mixture composed of 50 percent sodium hexylbenzene sulfonate and 50 percent sodium heptylbenzene sulfonate, or one of 30 percent sodium heptylbenzene sulfonate, 40 percent sodium octylbenzene sulfonate and 30 percent sodium nonylbenzene sulfonate. Especially suitable are those monoalkylbenzene sulfonates where the alkyl radical is a straight chain such as, for instance, sodium n-octylbenzene sulfonate, sodium n-hexylbenzene sulfonate, sodium n-heptylbenzene sulfonate, sodium n-nonylbenzene sulfonate and mixtures of the same, especially mixtures containing at least about 40 percent sodium n-octylbenzene sulfonate.

The water-soluble alkylbenzene sulfonates useful in preparing the compositions of the present invention are most advantageously employed in the form of the soluble salt such as the alkali metal or monovalent metal salts or ammonium or amine salts such as mono-di- and triethanolamine, isopropanolamines, propylamine, isopropylamine, butylamine and isobutylamine. They may, however, be added to the free acid form and neutralized in situ by the metal ions present in the aqueous alkaline solution. Most suitable and preferred are the alkali metal salts and particularly the sodium salts.

Aqueous alkaline solutions of inorganic detergent builders used alone or in conjunction with other surfactants are examples of compositions having a pH of 10 and above, whose wetting efficiency is greatly and surprisingly improved by utilizing the C_6 to C_9 alkylbenzene sulfonates in accordance with the present invention. These compositions find application in a wide range of areas where rapid wetting is of extreme importance, as for example, in the textile art the processes of scouring, kier boiling and open boiling, in leather pretanning operations, in the use of hard surface cleaners such as heavy-duty wax strippers, bottle cleaners, oven and drainline cleaners, aluminum cleaners, in paper-pulping operations, in alkaline soak cleaners, and electroplating baths for metal cleaning.

Aqueous alkaline solutions having a pH of at least 10, and whose solution wetting power is greatly improved by adding thereto the C_6 to C_9 alkylbenzene sulfonates in accordance with the present invention may comprise alkali metal and alkaline earth metal hydroxides such as potassium, sodium, magnesium, barium and calcium hydroxides. Other materials which usually impart a high alkalinity to aqueous solutions are detergent alkalies such as sodium carbonate (soda ash), sodium bicarbonate, sodium sesquicarbonate, sodium borate and the potassium and other metal analogs of these compounds. The phosphates and polyphosphates such as trisodium phosphate, tetrasodium pyrophosphate, tetrapotassium pyrophosphate, sodium tripolyphosphate, sodium and potassium hexametaphosphates are additional examples of inorganic detergent builders whose aqueous solutions have a high alkalinity and the wetting properties of which are greatly improved by adding thereto the C_6 to C_9 alkylbenzene sulfonate wetting agents in accordance with the present invention.

When the aforesaid C_6 to C_9 alkylbenzene sulfonate wetting agents are used in aqueous alkaline solutions having a pH of at least 10, the concentration of the aforesaid inorganic constituent or constituents is advantageously not in excess of about 25 percent–30 percent by weight, and the concentration of alkali metal hydroxides generally should not exceed about 20 percent by weight since the solubility of the C_6 to C_9 alkyl benzene sulfonate may be substantially reduced.

Only about 0.05 percent by weight of the C_6 to C_9 alkylbenzene sulfonic acid or sulfonate of the present invention, or even less, down to about 0.01 percent, is necessary to give the strongly alkaline solutions a significantly improved wetting time, but, preferably, the strongly alkaline solutions will contain from about 0.1 percent to 0.2 percent by weight of said C_6 to C_9 alkylbenzene sulfonates. Under special circumstances, greater percentages may be indicated and can be employed but this is generally unnecessary.

It will, of course, be understood that numerous other surfactants and detergents may be included as additional ingredients in the strongly alkaline solutions of the present invention generally without harmful results. Soaps, fatty acid esters, alkylaryl sulfonates, alkanolamides, quaternary ammonium compounds, and ethoxylated hydroxylic organic compounds are merely representative examples of other materials which

may be included in the solutions or compositions of the present invention, but are not required where the objective is to increase wetting efficiency, since the novelty here asserted is the surprising ability of the C_6–C_9 alkylbenzene sulfonates alone to dramatically increase the wetting power of the strongly alkaline solutions. As long as a pH level of at least 10 is maintained and no special solubility problems are encountered, the C_6 to C_9 alkylbenzene sulfonates utilized pursuant to the present invention will function as described herein.

The invention is further illustrated by the following examples which are not to be considered in any way as limitative of its scope. All percentages stated are by weight of the overall composition. Wetting times were determined by the Synthron Tape Method as reported in the American Dyestuff Reporter, 39, 38–45, 62(1950).

EXAMPLE I

This example demonstrates the effect upon wetting time of various concentrations of sodium octylbenzene sulfonate in a 6% NaOH aqueous solution, which solution, without the addition of the sodium octylbenzene sulfonate has a wetting time in excess of 5 minutes.

% Concentration of Sodium Octylbenzene Sulfonate	Wetting Time (Seconds)
0.03	14.2
0.05	3.9
0.10	2.6
0.20	Immediate

EXAMPLE II

Wetting Time in Seconds (Sulfonate Concentration: 0.1%)

Aqueous Alkaline System	Mixture of 50% Sodium Hexyl-, 50% Sodium Heptyl-Benzene Sulfonate	Sodium Dodecyl Benzene Sulfonate
6% NaOH	13.9	>3 mins.
10% NaOH	3.5	>5 mins.
15% NaOH	8.6	>5 mins.

A straight 15 percent water solution of NaOH has a wetting time in excess of 5 minutes.

EXAMPLE III

Wetting Time in Seconds (Sulfonate Concentration: 0.1%)

Aqueous Alkaline System	Mixture of 30% Heptyl-, 40% Octyl-, 30% Nonyl-Benzene Sulfonate (Na salts)
15% Tetrapotassium pyrophosphate	Immediate
15% Trisodium phosphate	3.1
15% Sodium metasilicate	5.2
15% Sodium carbonate	5.4

Example IV

Wetting Time (Sulfonate Concentration: 0.1%)

Aqueous Alkaline System	Mixture 30% Heptyl-, 40% Octyl-, 30% Nonyl-Benzene Sulfonate (Na salts)	Sodium Dodecyl Benzene Sulfonate	Sodium Cumene Sulfonate	Sodium Methyl Naphthalene Sulfonate
6% NaOH				
8% NaOH				

This example demonstrates the surprising and radically increased wetting effectiveness of the C_6 to C_9 alkylbenzene sulfonates when compared with alkylaryl sulfonates whose alkyl radical is, in one case, C_{12} in the sodium dodecyl benzene sulfonate, and C_1 in the sodium methyl naphthalene sulfonate.

What is claimed is:

1. In textile processing, wherein textiles are subjected to scouring, kier boiling and open boiling in an aqueous alkaline solution having a pH of at least 10, the improvement which comprises incorporating into said alkaline solution at least about 0.01 percent, by weight of said solution, of a wetting agent selected from the group consisting of water-soluble C_6 to C_9 alkylbenzene sulfonic acids, their salts, and mixtures thereof.

2. The textile processing of claim 1 wherein the wetting agent is a member selected from the group consisting of monoalkyl benzene sulfonic acids, their salts and mixtures thereof, the alkyl radical thereof being a straight-chain radical containing from six to nine carbon atoms.

3. The process of claim 2 wherein the alkylbenzene sulfonate is sodium octylbenzene sulfonate.

4. The process of claim 2 wherein the alkylbenzene sulfonate is a mixture consisting essentially of, by weight, about 50 percent sodium hexylbenzene sulfonate, and about 50 percent sodium heptylbenzene sulfonate.

5. The process of claim 2 wherein the alkylbenzene sulfonate is a mixture consisting essentially of, by weight, about 30 percent sodium heptylbenzene sulfonate, about 40 percent sodium octylbenzene sulfonate and about 30 percent sodium nonylbenzene sulfonate.

6. The process of claim 1 wherein said alkylbenzene sulfonate is present in a concentration from about 0.1 percent to about 0.2 percent by weight.

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