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DETERGENT COMPOSITIONS

Marvin M. Crutchfield, St. Louis, Mo., assignor to Monsanto Company, St. Louis, Mo.

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ABSTRACT OF THE DISCLOSURE

Formulations comprising a surfactant in combination with dialkali metal ketomalonate are effective detergent compositions.

BACKGROUND OF THE INVENTION

This invention relates to detergent compositions utilizing dialkali metal ketomalonate as a detergency builder.

Various materials are known to possess the property of improving the detergency levels of surfactants thereby providing, in combination with such surfactants, detergent formulations of enhanced cleaning capability. Such materials are known as detergency builders.

Hitherto, the most widely utilized detergency builders have been the inorganic polyphosphates, particularly, sodium tripolyphosphate. However, it has been recently suggested that the phosphorus content of such builders when introduced into the environment as base material from sewage processing plants and the like may contribute to an undesirable ecological phenomenon known as eutrophication. Accordingly, attempts have been made by many detergent manufacturers to totally or partially replace the polyphosphate builders with builders containing no phosphorus or greatly reduced amounts thereof.

It has been suggested that, the theoretically most desirable builder components are those containing minimal amounts of or free from phosphorus or nitrogen which may contribute to nutrition of algae involved in eutrophication. Further, in the case of organic materials, it is desirable that such materials be readily biodegradable so as not to persist for longer periods in waste water.

Unfortunately, the selection of materials having desired ecological characteristics and also providing effective detergency builder action is not a simple matter. The mechanism of builder function is complex, not fully understood and does not permit accurate prediction of compounds which will exhibit desirably high levels of builder activity. Thus, many materials which are satisfactory with respect to biodegradability and other chemical and physical characteristics are found unacceptable from the standpoint of builder activity and the selection of suitable builders remains largely a matter of emperical testing.

SUMMARY OF THE INVENTION

It is an object of this invention to provide novel detergent compositions free from or substantially reduced in phosphorus and/or nitrogen content. The objects of this invention are accomplished by compositions containing a dialkali metal ketomalonate as a builder in combination with conventional surfactants. The invention will be better understood from the following description of the preferred embodiments.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The detergency builder used in the formulations of this invention is a dialkali metal ketomalonate. Disodium ketomalonate is particularly preferred.

The preparation of such ketomalonate compounds is well known to those skilled in the art. For example, see

Deichsel J. Prakt. Chem. [1], 93,194 (1864), and Curtiss, Am. Chem. J. 35,477 (1906), for discussions of preparation of oxomalonic acid which is readily neutralized to form dialkali metal ketomalonate.

The ketomalonate builder can be the sole builder of the compositions of this invention or if desired can be utilized in combination with other known builders. For example, to the extent cost, ecological and performance considerations permit, the ketomalonate builder can be used in combination with maleic acrylate salts; alkali metal, ammonium or substituted ammonium or amino polycarboxylates, e.g., sodium and potassium, ethylene diamine tetra-acetate, alkali metal salts of fatty acids, e.g., sodium phytate, etc., polyphosphates, carbonates, bicarbonates, and silicates: nitrilotriacetates; and polycarboxylates such as disclosed in U.S. Pat. 3,308,067 in accordance with conventional detergent formulation practice.

Desirably the composition will contain sufficient alkaline material, e.g., sodium carbonate and/or sodium silicate to maintain a pH of about 9 to 10 during wash cycles wherein the composition is present in concentrations of from 0.1 to 0.21% by weight.

A further essential component of the formulations of this invention is a surfactant. In order to provide acceptable cleansing performance, the surfactant will constitute at least 5% of the total weight of the detergent formulation. The ketomalonate builder is observed to enhance or "build" the performance of any of the numerous well known anionic, nonionic, zwitterionic or ampholytic surfactants.

Examples of suitable anionic surfactants include alkyl ethyl sulfonates, alkyl sulfates, acyl sarcosinates; acyl esters of isethionates, acyl N-methyl taurides and alkyl aryl sulfonates. The foregoing materials are used in the form of their water soluble sodium potassium, ammonium and alkyl ammonium salts. Specific examples include sodium lauryl sulfate; sodium N methyl lauryl tauride; sodium dodecyl benzene sulfonate; and triethanolamine undecanol benzene sulfonate.

Examples of suitable nonionic detergents include alkyl phenol and alcohol alkoxylates including condensates of 1 decanol or 1-undecanol with from 3 to 5 molecular proportions of ethylene oxide such as described in U.S. patent application Ser. No. 707,480 filed Feb. 23, 1968 and copending herewith; condensates of monohydroxy or polyhydroxy alcohols such as oleyl alcohol or 1-tridecanol with from 9 to 15 molecular proportions of ethylene oxides; alkyl internal vicinal dialkoxy or hydroxy alkoxy compounds as described in U.S. patent application Ser. No. 852,898 filed Aug. 25, 1969, and copending herewith; and condensates of alkylene oxides with organo amines, for example, ethylene diamine and amides such as N-octadecyl diethanol amide.

Examples of cationic surfactants include octadecyl ammonium chloride; straight chain fatty amines having 8 to 18 carbon atoms; and quaternary ammonium compounds such as octadecyl trimethyl ammonium chloride.

Suitable ampholitic surfactants include the amido alkene sulfonates such as sodium C-pentadecyl, N-methyl amido ethyl sulfonate potassium C-octyl N-napthalene amido propyl sulfonate; ammonium C-decyl, N-cyclo propyl amide butyl sulfonate, and aliphatic amine derivatives in which the aliphatic substituent contains an anionic water-solubilizing substituent such as a carboxy, sulfo, phosphato, or phosphino group, for example, sodium-3-dodecyl amino propionate and sodium-3-dodecyl amino propane sulfonate.

Examples of zwitterionic surfactants include derivatives of quaternary ammonium phosphonium and sulfonium compounds such as 3-(N,N-dimethyl-N-hexadecyl ammonio) propane-1-sulfonate and 3 - (N,N-dimethyl-N-

hexadecyl ammonio - 2 - hydroxy propane-1-sulfonate).

It will be understood that the above examples of supplementary surfactants are by no means comprehensive. Numerous other surfactants known to the those skilled in the art are set forth in such familiar references as Surface Active Agents by A. M. Schwarz and James W. Perry. It willl be further understood that the use of such surfactants will be in accordance with conventional, well-understood practices of detergent formulation. For example, cationic and anionic detergents will not normally be employed in combination due to recognized problems of precipitation of insoluble products.

Since the alkali metal ethene tetracarboxylate builder is substantially totally bio-degradable, preferably the surfactant chosen will be similarly bio-degradable.

The ketomalonate builder is found to be particularly effective in combination with the well known linear alkylbenzene sulfonates containing an average of 11 to 13 carbon atoms in the alkyl chain; linear alkane (14 to 20 carbon atom alkane chain) vicinal methyl ether sulfates which can be prepared by reacting epoxy alkanes with methyl alcohol and sulfating the product; alcohol ethoxylate sulfates such as sulfates of condensates of primary alcohols containing 12 to 15 carbon atoms with 3 to 5 molecular proportions of ethylene oxide; and alkane vicinal dihydroxy alcohol sulfates.

In the formulations of this invention, the weight ratio of the ketomalonate builder to surfactant will be from about 1:2 to about 12:1.

If desired, the formulations of this invention may also contain various well known detergent additives such as soil suspending agents, optical brighteners, dyes, perfumes, deodorants, disinfectants, corrosion inhibitors and the like in accordance with conventional practice.

The compositions of this invention are further illustrated by the following examples wherein all percentages and parts are by weight unless otherwise specified.

Example

Detergent formulations containing 45% disodium ketomalonate; 20% of the surfactant indicated in the table below; 10% sodium carbonate; 10% sodium silicate and 15% sodium sulfate are prepared. The performance of the compositions is determined by measuring the difference in reflectance (ΔRd) of uniformly soiled cotton swatches prior to and following washing in water of 150 p.p.m. hardness and containing 0.15% detergent formulation at 120° F. For comparison, formulations containing no builder and sodium tripolyphosphate instead of

disodium ketomalonate are tested. All formulations are superior to the unbuilt formulation. "Relative performance" of the compositions is reported in the table as a fraction obtained by dividing the ΔRd value determined for the ketomalonate built formulation by the ΔRd determined by a comparable sodium tripolyphosphate built formulation.

TABLE

Formulation number	Surfactant	Relative performance
1	Neodal 25-3S sodium sulfate of a condensate of a primary alcohol (12-15 carbon atoms) with 3 molecular proportions of ethylene oxide.	.93
2	Alkane vicinal methyl ether sulfate (14-15 carbon atoms in alkane chain.	.93
3	Disulfate of vicinal dihydroxy alcohol containing 20 carbon atoms.	.93
4	Linear alkyl benzene sulfonate having an average of 11 to 12 carbon atoms in alkyl chain.	.95

What is claimed is:

1. A detergent composition comprising at least 5% by weight of a detergent surfactant selected from the group consisting of anionic, nonionic, zwitterionic and ampholytic surfactants and, as a detergency builder, dialkali metal ketomalonate, the weight ratio of said dialkali metal ketomalonate to said surfactant being from 1:2 to 12:1.

2. The composition of claim 1 wherein said dialkali metal ketomalonate is disodium ketomalonate.

3. The composition of claim 2 additionally comprising sufficient alkaline material selected from the group consisting of sodium carbonate, sodium silicates and mixtures thereof to maintain a pH of from 9 to 10 when the composition is added to water in concentrations of from 0.10% to 0.20% by weight.

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JOHN DAVID WELSH, Primary Examiner

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