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⑯ Detergent compositions.

⑯ Detergent compositions containing from 2% to 60% of anionic surfactant or mixtures thereof with nonionic, zwitterionic or ampholytic surfactants, and from 0.5% to 6% of cosurfactant comprising a 5 : 1 to 1 : 5 mixture of mono- or di- amine oxide surfactant and water-soluble mono- or di- quaternary ammonium surfactant, the weight ratio of surfactant:cosurfactant being at least 1:1, and the equivalent ratio of anionic surfactant to cationic surfactant being at least 1:1. The compositions provide excellent grease/oil and lipid soil removal performance simultaneously with good clay soil detergency and whiteness maintenance under realistic multi-cycle wash-wear conditions, including low wash temperatures and carry-over of rinse added softener.

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DETERGENT COMPOSITIONS

. Brian Garston

Technical Field

5 This invention relates to detergent compositions. In particular, it relates to detergent compositions suitable for washing fabrics, clothes etc in automatic washing machines with improved cleaning performance.

Background

10 Cationic surfactants have been frequently incorporated into detergent compositions of various types. However, the inclusion of such cationic surfactants is generally for the purpose of providing some adjunct fabric care benefit, and not for the purpose of cleaning. For example, certain cationic surfactants have been included in detergent 15 compositions for the purpose of yielding a germidical or sanitization benefit to washed surfaces, as is disclosed in U.S. Patent 2,742,434, Kopp, issued April 17, 1956; U.S. Patent 3,539,520, Cantor et al, issued November 10, 1970; and U.S. Patent 3,965,026, Lancz, issued June 22 1976. Other 20 cationic surfactants such as ditallowdimethylammonium chloride, have been included in detergent compositions for the purpose of yielding a fabric-softening benefit, as disclosed in U.S. Patent 3,607,763, Salmon et al, issued September 21 1971; and U.S. Patent 3,644,203, Lamberti et al, issued February 22 1972. Such components are also disclosed 25 as being included in detergent compositions for the purpose of controlling static, as well as softening laundered fabrics, in U.S. Patent 3,951,879, Wixon, issued April 20 1976; and U.S. Patent 3,959,157 Inamorato, issued May 25 1976.

30 Certain water-soluble cationic surfactants are also known to enhance cleaning performance, especially on greasy and oily soils, when used in combination with nonionic or anionic surfactants, see for instance European Patent

Application No 225. For optimum grease detergency performance, however, these compositions require relatively high levels of the cationic and nonionic surfactant components in relation to the anionic surfactant level and 5 this can result in a lack of "robustness", particularly in the areas of clay soil detergency and whiteness maintenance, when the compositions are used in multicycle wash-wear treatments in the presence of rinse-added cationic fabric softener. Moreover, the compositions have their greatest 10 effectiveness at medium to high wash temperature (50°C and above); at low wash temperatures (up to about 40°C) on the other hand, the rate of oil removal is greatly reduced and excessively long wash times are required for optimum performance.

15 The Applicants have now discovered, however, that excellent grease/oil and lipid soil removal performance can be secured simultaneously with good clay soil detergency and whiteness maintenance, under realistic multicycle wash-wear conditions, including low wash temperatures and carry-over of 20 rinse-added softener, by using an anionic surfactant together with a low level of an auxiliary surfactant system consisting of a mixture of a water-soluble cationic surfactant and a semipolar amine-oxide surfactant.

The addition of amine-oxides to detergent compositions 25 is not new of course. Thus U.S. Patents 3,531,526, 4,133,779 and 3,202,714 all relate to detergent compositions employing amine oxides at relatively high levels in a conventional detergent functionality. However, there is apparently no appreciation in the art of the value of low levels of mixed 30 amine-oxide/cationic surfactant systems in improving low temperature cleaning of greasy, oily and lipid soils under realistic multi-cycle wash-rinse-wear conditions.

The invention thus provides granular and liquid detergent compositions suitable for heavy duty laundering purposes having improved cleaning performance especially on greasy, oily and lipid soils without detriment to detergency performance on clay soils and without detriment to the soil suspending or fabric whitening characteristics of the compositions, across the range of wash temperatures and under realistic soil, fabric load and multi wash-rinse-wear cycle conditions.

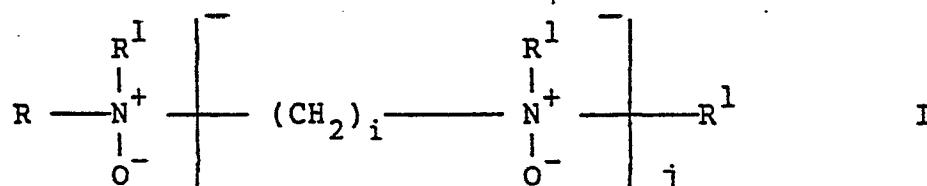
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Summary of the Invention

According to the present invention, there is provided a detergent composition having a pH in 1% aqueous dispersion of at least 7 comprising

- (a) from 2% to 60% of surfactant selected from anionic surfactants and mixtures thereof with nonionic, zwitterionic and ampholytic surfactants;
- (b) from 0.5% to 6% of cosurfactant comprising a 5:1 to 1:5 mixture of
 - (i) amine oxide having the general formula I:

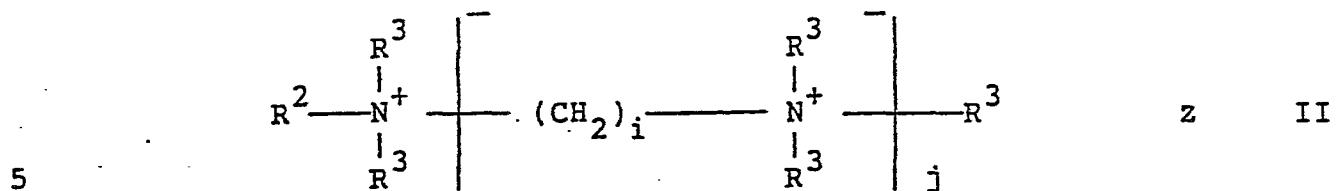
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wherein R is a linear or branched alkyl or alkenyl group having 8 to 20 carbon atoms, each R¹ is independently selected from C₁₋₄ alkyl and -(C_nH_{2n}O)_mH where i is an integer from 1 to 6, j is 0 or 1, n is 2 or 3 and m is from 1 to 7, the sum total of C_nH_{2n}O groups in a molecule being no more than 7, and

(ii) quaternary ammonium surfactant having the general formula II:



wherein R^2 is a linear or branched alkyl, alkenyl or alkaryl group having 8 to 16 carbon atoms and each R^3 is independently selected from C_{1-4} alkyl, C_{1-4} alkaryl and $-(C_nH_{2n}O)_m$ wherein i is an integer from 1 to 6, j is 0 or 1, n is 2 or 3 and m is from 1 to 7, the sum total of $C_nH_{2n}O$ groups in a molecule being no more than 7, and wherein Z represents counteranion in number to give electrical neutrality,

15 wherein the weight ratio of surfactant:cosurfactant is at least 1:1 and wherein the equivalent ratio of anionic surfactant:cationic surfactant is also at least 1:1.

Detergent compositions of the invention contain a primary surfactant which is an anionic surfactant or a mixture thereof with nonionic, zwitterionic or ampholytic surfactants, and a cosurfactant which is a mixture of water-soluble quaternary ammonium surfactant and amine-oxide. The primary surfactant constitutes from 2% to 60% of the detergent compositions, preferably from about 4% to about 25%, especially from about 8% to about 20% in the case of granular detergent composition, and preferably from about 10% to about 50%, especially from about 15% to about 40% in the case of liquid detergent compositions. The auxiliary surfactant system is preferably from about 1% to about 4% of the detergent composition with the amine oxide and quaternary

ammonium surfactants being present at a weight ratio of from about 3:1 to about 1:3, with the individual cosurfactants each preferably constituting up to about 1.5% by weight of composition.

5 The weight ratio of surfactant:cosurfactant is at least 1:1, preferably from about 2:1 to about 50:1, more preferably from about 3:1 to about 20:1. Importantly, the anionic surfactant component is present at an equivalent ratio with respect to the water-soluble quaternary ammonium surfactant 10 of at least 1:1. This is necessary for ensuring optimum grease and lipid soil removal and good suspension of soil in the detergent wash liquor, and for achieving excellent whiteness under multicycle wash-rinse-wear conditions.

15 Although as discussed above an anionic surfactant is an essential component of the present compositions, preferred compositions contain as the primary surfactant a mixture of anionic and alkoxylated nonionic surfactants in a weight ratio of from about 20:1 to about 1:5, more preferably from about 6:1 to about 1:3, especially from about 5:1 to about 20 1:1. Such compositions are desirable from the point of view of providing optimum grease, lipid and particulate detergency.

25 Optimum performance also depends sensitively on the choice of nonionic surfactant and especially desirable from the viewpoint of grease detergency are biodegradable nonionic surfactants having a lower consolute temperature in the range from about 25°C to about 65°C, more preferably from about 30°C to about 50°C. Highly suitable nonionic surfactants of this type have the general formula $RO(CH_2CH_2O)_nH$ wherein R is primary or secondary branched or unbranched 30 C_{9-15} alkyl or alkenyl and n (the average degree of ethoxylation) is from 2 to 9, especially from 3 to 8. More hydrophilic nonionic detergents can be employed for providing particulate detergency and anti-redeposition, however, for instance, nonionic detergents of the general formula given 35 above wherein R is primary or secondary, branched or unbranched C_{8-24} alkyl or alkenyl and n is from 10 to 40.

Combinations of the two classes of nonionic surfactants can also be used with advantage of course.

The compositions of the invention are formulated to have a pH of at least 7 in the laundry solution at conventional usage concentrations (about 1% by weight) in order to optimize cleaning performance. Granular compositions herein preferably have a pH of from about 8.5 to about 11; liquid compositions preferably have a pH of from about 7.5 to about 10.5.

10 The individual components of the present compositions will now be discussed in detail.

The anionic surfactant may be any one or more of the materials used conventionally in laundry detergents.

15 Suitable synthetic anionic surfactants are water-soluble salts of alkyl benzene sulphonates, alkyl sulphates, alkyl polyethoxy ether sulphates, paraffin sulphonates, alpha-olefin sulphonates, alpha-sulpho-carboxylates and their esters, alkyl glycetyl ether sulphonates, fatty acid monoglyceride sulphates and sulphonates, alkyl phenol .
20 polyethoxy ether sulphates, 2-acyloxy alkane-1-sulphonate, and beta-alkyloxy alkane sulphonate.

A particularly suitable class of anionic surfactants includes water-soluble salts, particularly the alkali metal, ammonium and alkanolammonium salts or organic sulphuric 25 reaction products having in their molecular structure an alkyl or alkaryl group containing from about 8 to about 22, especially from about 10 to about 20 carbon atoms and a sulphonic acid or sulphuric acid ester group. (Included in the term "alkyl" is the alkyl portion of acyl groups).
30 Examples of this group of synthetic detergents which form part of the detergent compositions of the present invention are the sodium and potassium alkyl sulphates, especially those obtained by sulphating the higher alcohols (C_{8-18}) carbon atoms produced by reducing the glycerides of tallow or
35 coconut oil and sodium and potassium alkyl benzene

sulphonates, in which the alkyl group contains from about 9 to about 15, especially about 11 to about 13, carbon atoms, in straight chain or branched chain configuration, e.g. those of the type described in U.S.P. 2,220,099 and 2,477,383 and 5 those prepared from alkylbenzenes obtained by alkylation with straight chain chloroparaffins (using aluminium trichloride catalysis) or straight chain olefins (using hydrogen fluoride catalysis). Especially valuable are linear straight chain alkyl benzene sulphonates in which the average of the alkyl 10 group is about 11.8 carbon atoms, abbreviated as $C_{11.8}$ LAS.

Other anionic detergent compounds herein include the sodium C_{10-18} alkyl glyceryl ether sulphonates, especially those ethers of higher alcohols derived from tallow and coconut oil; sodium coconut oil fatty acid monoglyceride 15 sulphonates and sulphates; and sodium or potassium salts of alkyl phenol ethylene oxide ether sulphate containing about 1 to about 10 units of ethylene oxide per molecule and wherein the alkyl groups contain about 8 to about 12 carbon atoms.

Other useful anionic detergent compounds herein include 20 the water-soluble salts or esters of α -sulphonated fatty acids containing from about 6 to 20 carbon atoms in the fatty acid group and from about 1 to 10 carbon atoms in the ester group; water-soluble salts of 2-acyloxy-alkane-1-sulphonic acids containing from about 2 to 9 carbon atoms in the acyl 25 group and from about 9 to about 23 carbon atoms in the alkane moiety; alkyl ether sulphates containing from about 10 to 18, especially about 12 to 16, carbon atoms in the alkyl group and from about 1 to 12, especially 1 to 6, more especially 1 to 4 moles of ethylene oxide; water-soluble salts of olefin 30 sulphonates containing from about 12 to 24, preferably about 14 to 16, carbon atoms, especially those made by reaction with sulphur trioxide followed by neutralization under conditions such that any sultones present are hydrolysed to the corresponding hydroxy alkane sulphonates; water-soluble 35 salts of paraffin sulphonates containing from about 8 to 24, especially 14 to 18 carbon atoms, and β -alkyloxy alkane

sulphonates containing from about 1 to 3 carbon atoms in the alkyl group and from about 8 to 20 carbon atoms in the alkane moiety.

The alkane chains of the foregoing non-soap anionic surfactants can be derived from natural sources such as coconut oil or tallow, or can be made synthetically as for example using the Ziegler or Oxo processes. Water solubility can be achieved by using alkali metal, ammonium or alkanolammonium cations; sodium is preferred. Suitable fatty acid soaps can be selected from the ordinary alkali metal (sodium, potassium), ammonium, and alkyolammonium salts of higher fatty acids containing from about 8 to about 24, preferably from about 10 to about 22 and especially from about 16 to about 22 carbon atoms in the alkyl chain.

0 Suitable fatty acids can be obtained from natural sources such as, for instance, from oil, soybean oil, caster oil, tallow, whale and fish oils, grease, lard and mixtures thereof). The fatty acids also can be synthetically prepared (e.g., by the oxidation of petroleum, or by hydrogenation of 15 carbon monoxide by the Fischer-Tropsch process). Resin acids are suitable such as rosin and those resin acids in tall oil. Napthenic acids are also suitable. Sodium and potassium soaps can be made by direct saponification of the 20 fats and oils or by the neutralization of the free fatty acids which are prepared in a separate manufacturing process. Particularly useful are the sodium and potassium salts of the mixtures of fatty acids derived from tallow and 25 hydrogenated fish oil.

The nonionic surfactants useful in the present invention 30 are condensates of ethylene oxide with a hydrophobic moiety to provide a surfactant having an average hydrophilic-lipophilic balance (HLB) in the range from about 8 to 17, preferably from about 9.5 to 13.5, more preferably from about 10 to about 12.5. The hydrophobic moiety may be 35 aliphatic or aromatic in nature and the length of the polyoxyethylene group which is condensed with any particular hydrophobic group can be readily adjusted to yield a water-soluble compound having the desired degree of balance between hydrophilic and hydrophobic elements.

Examples of suitable nonionic surfactants include:

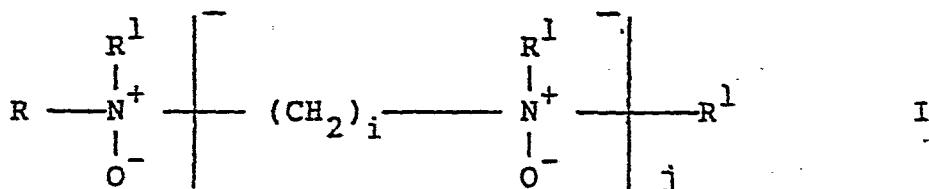
1. The polyethylene oxide condensates of alkyl phenol, e.g. the condensation products of alkyl phenols having an alkyl group containing from 6 to 12 carbon atoms in either a straight chain or branched chain configuration, with ethylene oxide, the said ethylene oxide being present in amounts equal to 3 to 30, preferably 5 to 14 moles of ethylene oxide per mole of alkyl phenol. The alkyl substituent in such compounds may be derived, for example, from polymerised propylene, di-isobutylene, octene and nonene. Other examples include dodecylphenol condensed with 9 moles of ethylene oxide per mole of phenol; dinonylphenol condensed with 11 moles of ethylene oxide per mole of phenol; nonylphenol and di-isooctylphenol condensed with 13 moles of ethylene oxide.
- 15 2. The condensation product of primary or secondary aliphatic alcohols having from 8 to 24 carbon atoms, in either straight chain or branched chain configuration, with from 2 to about 40 moles, preferably 2 to about 9 moles of ethylene oxide per mole of alcohol. Preferably, the aliphatic alcohol comprises between 9 and 18 carbon atoms and is ethoxylated with between 2 and 9, desirably between 3 and 8 moles of ethylene oxide per mole of aliphatic alcohol. The preferred surfactants are prepared from primary alcohols which are either linear (such as those derived from natural fats or, prepared by the Ziegler process from ethylene, e.g. myristyl, cetyl, stearyl alcohols), or partly branched such as the Lutensols, Dabanols and Neodols which have about 25% 2-methyl branching (Lutensol being a Trade Name of BASF, Dabanol and Neodol being Trade Names of Shell), or 30 Synperonics, which are understood to have about 50% 2-methyl branching (Synperonic is a Trade Name of I.C.I.) or the primary alcohols having more than 50% branched chain structure sold under the Trade Name Lial by Liquichimica. Specific examples of nonionic surfactants falling within the 35 scope of the invention include Dabanol 45-4, Dabanol 45-7, Dabanol 45-9, Dabanol 91-3, Dabanol 91-6, Dabanol 91-8, Synperonic 6, Synperonic 14, the condensation products of

coconut alcohol with an average of between 5 and 12 moles of ethylene oxide per mole of alcohol, the coconut alkyl portion having from 10 to 14 carbon atoms, and the condensation products of tallow alcohol with an average of between 7 and 5 12 moles of ethylene oxide per mole of alcohol, the tallow portion comprising essentially between 16 and 22 carbon atoms. Secondary linear alkyl ethoxylates are also suitable in the present compositions, especially those ethoxylates of the Tergitol series having from about 9 to 15 carbon atoms in 10 the alkyl group and up to about 11, especially from about 3 to 9, ethoxy residues per molecule.

The compounds formed by condensing ethylene oxide with a hydrophobic base formed by the condensation of propylene oxide with propylene glycol. The molecular weight of the 15 hydrophobic portion generally falls in the range of about 1500 to 1800. Such synthetic nonionic detergents are available on the market under the Trade Name of "Pluronic" supplied by Wyandotte Chemicals Corporation.

Especially preferred nonionic surfactants for use herein 20 are the C_9-C_{15} primary alcohol ethoxylates containing 3-8 moles of ethylene oxide per mole of alcohol, particularly the $C_{12}-C_{15}$ primary alcohols containing 6-8 moles of ethylene oxide per mole of alcohol.

A further essential component of the present 25 compositions is an amine-oxide having the general formula I



wherein R is a linear or branched alkyl or alkenyl group 30 having 8 to 20 carbon atoms, each R^1 is independently selected from C_{1-4} alkyl and $-(C_nH_{2n}O)_mH$ where i is an integer from 1 to 6, j is 0 or 1, n is 2 or 3 and m is from 1 to 7, the sum total of $C_nH_{2n}O$ groups in a molecule being no more than 7.

In a preferred embodiment R has from 10 to 14 carbon atoms and each R¹ is independently selected from methyl and -(C_nH_{2n}O)_mH wherein m is from 1 to 3 and the sum total of C_nH_{2n}O groups in a molecule is no more than 5, preferably no more than 3. In a highly preferred embodiment, j is 0 and each R¹ is methyl, and R is C₁₂-C₁₄ alkyl.

Another suitable class of amine oxide species is represented by bis-amine oxides having the following 10 substituents.

j : 1

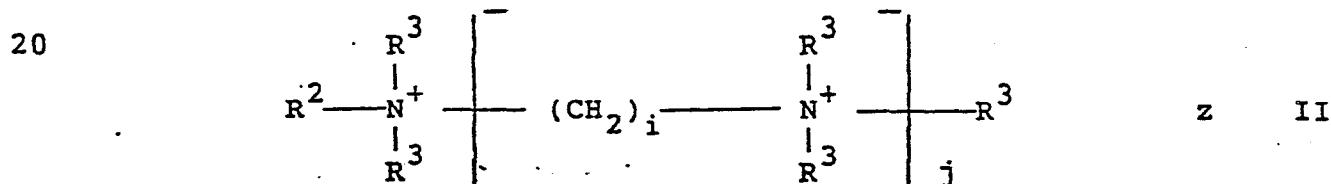
R : tallow C₁₆-C₁₈ alkyl; palmityl; oleyl; stearyl

R₁: hydroxyethyl

i : 2 or 3

15 A specific example of this preferred class of bis-amine oxides is: N-hydrogenated C₁₆-C₁₈ tallow alkyl-N,N',N'tri-(2-hydroxyethyl) -propylene-1,3-diamine oxide.

The quaternary ammonium surfactant component of the present composition is defined by the general formula:



25 wherein R² is a linear or branched alkyl, alkenyl or alkaryl group having 8 to 16 carbon atoms and each R³ is independently selected from C₁₋₄ alkyl, C₁₋₄ alkaryl and -(C_nH_{2n}O)_m wherein i is an integer from 1 to 6, j is 0 or 1, n is 2 or 3 and m is from 1 to 7, the sum total of C_nH_{2n}O groups in a molecule being no more than 7, and wherein z represents 30 counteranion in number to give electrical neutrality,

In a preferred embodiment, R² has from 10 to 14 carbon atoms and each R³ is independently selected from methyl and (C_nH_{2n}O)_mH wherein m is from 1 to 3 and the sum total

of $C_nH_{2n}O$ groups in a molecule is no more than 5, preferably no more than 3. In a highly preferred embodiment j is 0, R^3 is selected from methyl, hydroxyethyl and hydroxypropyl and R^2 is $C_{12}-C_{14}$ alkyl. Particularly 5 preferred surfactants of this class include C_{12} alkyl trimethylammonium salts, C_{14} alkyltrimethylammonium salts, coconutalkyltrimethylammonium salts, coconutalkyldimethylhydroxyethylammonium salts, coconutalkyldimethylhydroxypropylammonium salts, and C_{12} alkylhydroxyethylmethyl 10 ammonium salts.

Another group of useful cationic compounds are the diammonium salts of formula II in which j is 1, R^2 is $C_{12}-C_{14}$ alkyl, each R^3 is methyl, hydroxyethyl or hydroxypropyl and i is 2 or 3. In a particularly preferred 15 surfactant of this type, R^2 is coconut alkyl, R^3 is methyl and i is 3.

The compositions of the invention, particularly those in granular form, can also include at least one detergent organic or inorganic builder salt which can be any one of the 20 water soluble or water insoluble salts conventionally used for this purpose. Suitable inorganic builder salts include orthophosphates, pyrophosphates, tripolyphosphates and the higher polymeric glassy phosphates, silicates, carbonates, and the water insoluble crystalline aluminosilicates such as 25 hydrated Zeolite A, X or P. Organic builder salts include the aminocarboxylates such as the salts of nitrilotriacetic acid (NTA), ethylenediaminetetra acetic acid (EDTA) and diethylenetriaminepenta acetic acid (DETPA) and the methylene phosphonate analogues of these materials NTMP, EDTMP and 30 DETPMP, as well as the salts of polycarboxylic acids such as lactic acid, glycollic acid and ether derivatives thereof as disclosed in Belgian Patents 821,368, 821,369 and 821,370; succinic acid, malonic acid, (ethylenedioxy) diacetic acid, maleic acid, diglycollic acid, tartaric acid, tartronic acid 35 and fumaric acid; citric acid, aconitic acid, citraconic acid, carboxymethyloxysuccinic acid, lactoxysuccinic acid, and 2-oxy-1,1,3-propane tri-carboxylic acid; oxydisuccinic

acid, 1,1,2,2-ethane tetracarboxylic acid, 1,1,3,3-propane tetracarboxylic acid and 1,1,2,3-propane
5 tetracarboxylic acid; cyclo-pentane-cis, cis,
cis-tetracarboxylic acid; cyclopentadienide pentacarboxylic
acid, 2,3,4,5-tetrahydrofuran-cis, cis, cis-tetracarboxylic
acid, 2,5-tetrahydrofuran-cis-dicarboxylic acid,
1,2,3,4,5,6-hexane-hexacarboxylic acid, mellitic acid,
pyromellitic acid and the phthalic acid derivatives disclosed
in British Patent 1,425,343.

0 The builder salts preferably comprise from about 5% to
about 70% by weight of the composition, preferably from about
10% to about 50% by weight for granular detergents, and
preferably from about 5% to about 20% for liquid detergents.

5 The compositions of the present invention can be
supplemented by all manner of detergent components. Soil
suspending agents at about 0.1% to 10% by weight such as
water-soluble salts of carboxymethyl-cellulose,
carboxyhydroxymethyl cellulose, and polyethylene glycols
having a molecular weight of about 400 to 10,000 are common
0 components of the present invention. Dyes, pigments, optical
brighteners, and perfumes can be added in varying amounts as
desired.

Other materials such as fluorescers, enzymes in minor
amounts, anti-caking agents such as sodium sulfosuccinate,
5 and sodium benzoate can also be added. Enzymes suitable for
use herein include those discussed in U.S. patents 3,519,570
and 3,533,139 to McCarty and McCarty et al issued July 7 1970
and January 5, 1971 respectively.

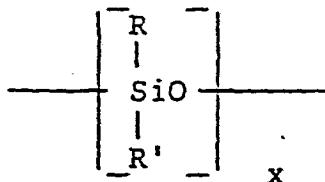
0 Anionic fluorescent brightening agents are well-known
materials, examples of which are disodium 4,4'-bis-(2-di-
ethanolamino-4-anilino-s-triazin-6-ylamino)stilbene-2:2'-
disulphonate, disodium 4,4'-bis-(2-morpholino-4-anilino-s-
triazin-6-ylaminostilbene-2:2'-disulphonate, disodium
4'4'-bis-(2,4-dianilino-s-triazin-6-ylamino)stilbene-2:2'-
5 disulphonate, disodium 4,4'-bis-(2-anilino-4-(N-methyl
N-2-hydroxyethylamino)-s-triazin-6-ylamino)stilbene-2,2'-
disulphonate, disodium 4,4'-bis-(4-phenyl-2,1,3-triazol-2yl)

-stilbene-2,2'-disulphonate, disodium 4,4';-bis-(2-anilino-4-(1-methyl-2-hydroxyethylamino)-5-triazin-6-ylamino) stilbene-2,2'-disulphonate and sodium 2(stilbyl-4'-(naphtho-1',2':4,5)-1,2,3-triazole-2')-sulphonate.

5 . . . An alkali metal, or alkaline earth metal, silicate can
also be present. The alkali metal silicate preferably is used
in an amount from 0.5% to 10% preferably from 3% to 8%.
Suitable silicate solids have a molar ratio of SiO_2 /alkali
metal₂O in the range from about 0.5 to about 4.0, but much
10 more preferably from 1.0 to 1.8, especially about 1.6. The
alkali metal silicates suitable herein can be commercial
preparations of the combination of silicon dioxide and alkali
metal oxide, fused together in varying proportions.

The present compositions also contain suds regulating components in an amount of from about 0.05% to about 3%. Preferred are microcrystalline waxes having a melting point in the range from 35°C-115°C and saponification value of less than 100. The microcrystalline waxes are substantially water-insoluble, but are water-dispersible in the presence of organic surfactants. Preferred microcrystalline waxes having a melting point from about 65°C to 100°C, a molecular weight in the range from 400-1000; and a penetration value of at least 6, measured at 77°C by ASTM-D1321. Suitable examples of the above waxes include microcrystalline and oxidized micro-crystalline petrolatum waxes; Fischer-Tropsch and oxidized Fischer-Tropsch waxes; ozokerite; ceresin; montan wax; beeswax, candelilla; and carnauba wax.

U.S. Patent 3,933,672 issued January 20 1976, to Bartolotta et al., incorporated herein by reference, discloses 30 silicone suds controlling agent suitable herein. The silicone material can be represented by alkylated polysiloxane materials such as silica aerogels and xerogels and hydrophobic silicas of various types. The silicone material can be described as siloxane having the formula:



wherein x is from about 20 to 2,000 and R and R' are each alkyl or aryl groups, especially methyl, ethyl, propyl, butyl and phenyl. The polydimethylsiloxanes (R and R' are methyl) having a molecular weight within the range of from about 200 to about 2,000,000, and higher, are all useful as suds controlling agents. Additional suitable silicone materials wherein the side chain groups R and R' are alkyl, aryl, or mixed alkyl or aryl hydrocarbyl groups exhibit useful suds controlling properties. Examples of the like ingredients include diethyl-, dipropyl-, dibutyl-, methyl-, ethyl-, phenyl-, methylpolysiloxanes and the like. Additional useful silicone suds controlling agents can be represented by a mixture of an alkylated siloxane, as referred to hereinbefore, and solid silica. Such mixtures are prepared by affixing the 5 silicone to the surface of the solid silica. A preferred silicone suds controlling agent is represented by a hydrophobic silanated (most preferably trimethylsilanated) silica having a particle size in the range from about 10 millimicrons to 20 millimicrons and a specific surface area 10 above about 50 m^2/g . intimately admixed with dimethyl silicone fluid having a molecular weight in the range from about 500 to about 200,000 at a weight ratio of silicone to silanated silica of from about 1:1 to about 1:10. The 15 silicone suds suppressing agent is advantageously releasably incorporated in a water-soluble or water-dispersible, 20 substantially non-surface-active detergent-impermeable carrier. 25

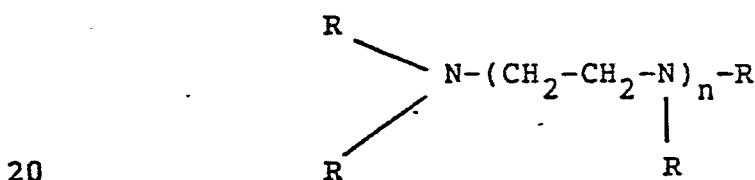
Particularly useful suds suppressors are the self-emulsifying silicone suds suppressors, described in German Patent application DTOS 2,646,126 published April 28, 30 1977 and incorporated herein by reference. An example of such a compound is DB-544, commercially available from Dow Corning, which is a siloxane/glycol copolymer.

The granular detergent compositions herein can also advantageously contain a peroxy bleaching component in an 35 amount from about 3% to about 40% by weight, preferably from about 8% to about 33% by weight. Examples of suitable peroxy

bleach components for use herein include perborates, persulfates, persilicates, perphosphates, percarbonates, and more generally all inorganic and organic peroxy bleaching agents which are known to be adapted for use in the subject 5 compositions. The composition can also advantageously include a bleach activator which is normally an organic compound containing an N-acyl, or an O-acyl (preferably acetyl) group. Preferred materials are N,N,N',N'-tetraacetyl ethylene diamine and N,N,N',N'-tetraacetylglycouril. The 10 bleach activator is preferably added at a level from 0.5% to 5% by weight of composition.

A further preferred ingredient of the instant compositions is from about 0.01 to about 4%, especially from about 0.1 to about 1.0% by weight of a polyphosphonic acid or salt thereof which is found to provide bleachable stain 15 detersity benefits.

Especially preferred polyphosphonates have the formula:-



wherein each R is $\text{CH}_2\text{PO}_3\text{H}_2$ or a water-soluble salt thereof and n is from 0 to 2. Examples of compounds within this class are aminotri-(methylenephosphonic acid), ethylene diamine tetra(methylenephosphonic acid) and diethylene triamine penta(methylene phosphonic acid). Of these, ethylenediamine tetra(methylene phosphonic acid) is particularly preferred.

· · · A further optional component is from about 0.1% to about 3%, especially from about 0.25% to about 1.5% of a polymeric material having a molecular weight of from 2000 to 2,000,000 and which is a copolymer of maleic acid anhydride and a polymerisable monomer selected from C_1-C_{12} alkyl vinyl

ethers, acrylic and methacrylic acid and C_1-C_{20} esters thereof, alkenes having from 2 to 12 carbon atoms, N-vinyl pyrrolidone and styrene. Highly preferred examples of such carboxylates are 1:1 styrene/maleic acid copolymer, di-isobutylene/maleic acid copolymers and methyl vinyl ether/maleic acid copolymers. Other suitable polycarboxylates are poly- α -hydroxy acrylates and lactones thereof as described in Belgian Patent 817,678 and B.P. 1,425,307.

Another suitable component of the present compositions is a water soluble magnesium salt which is added at levels in the range from about 0.015% to about 0.2%, preferably from about 0.03% to about 0.15% and more preferably from about 0.05% to about 0.12% by weight of the compositions (based on weight of magnesium). Suitable magnesium salts include magnesium sulfate, magnesium sulfate heptahydrate, magnesium chloride, magnesium chloride hexahydrate, magnesium fluoride and magnesium acetate. Desirably, the magnesium salt is added to granular compositions as part of the aqueous slurry crutcher mix and is then converted to dry granular form for instance by spray drying.

Liquid detergent compositions of the invention can additionally be supplemented by pH regulators such as potassium hydroxide, potassium carbonate, potassium bicarbonate, sodium hydroxide, sodium carbonate, sodium bicarbonate, and mono-, di- and triethanolamine; solvents such as ethyl alcohol, isopropanol, propylene glycol, propane-1, 2-diol, hexyleneglycol; and hydrotropes such as urea.

Granular detergent compositions of the invention are preferably prepared by spray-drying an aqueous slurry comprising the primary surfactant, cosurfactant and detergency builder. The aqueous slurry is mixed at a temperature in the range 70-90°C and the water-content of the slurry adjusted to a range of 25% to 45%, preferably 30%-38% by weight. Spray drying is undertaken with drying gas inlet temperature of from about 250-350°C, preferably 275-330°C, providing a final moisture content in the range of from 8% to 14% by weight. Nonionic surfactant, where present, can then be sprayed in fluid form onto the spray-dried detergent granules.

In the Examples which follow, the abbreviations used have the following designation:-

LAS : Linear C₁₁-8 alkyl benzene sulphonate.

AS : Sodium linear C₁₂-14 alcohol sulfate.

5 MAO : C₁₂-C₁₄ alkyl dimethylamine oxide.

DAO : N-hydrogenated tallow-N,N'-tri (2-hydroxyethyl) - propylenediamine - 1,3-N,N'-dioxide.

TAS : Tallow alcohol sulfate.

10 CATAB : Coconut alkyl trimethyl ammonium bromide.

Dobanol 45-E-7 : A C₁₄-15 oxo-alcohol with 7 moles of ethylene oxide, marketed by Shell.

TAED : Tetraacetyl ethylene diamine.

15 Silicate : Sodium silicate having an SiO₂:Na₂O ratio of 1.6:1.

Wax : Microcrystalline wax - Witcodur 272 M.pt 87°C.

Silicone Prill : Comprising 0.14 parts by weight of an 85.15 by weight mixture of silanated silica and silicone granulated with 1.3 parts of sodium tripolyphosphonate, and 0.56 parts of tallow alcohol condensed with 25 molar proportions of ethylene oxide.

20 25 Gantez AN119 : Trade Name for maleic anhydride/vinyl methyl ether co-polymer, believed to have an average molecular weight of about 240,000, marketed by GAF. This was prehydrolysed with NaOH before addition.

30 Brightener : Disodium 4,4'-bis (2-morpholino-4-anilino-s-triazino-6-ylamino)stilbene -2:2'-disulphonate.

Dequest 2060 : Trade Name for diethylenetriamine penta(methylenephosphonic acid), marketed by Monsanto.

35 Dequest 2041 : Trade Name for ethylenediamine tetra(methylene phosphonic acid) monohydrate, marketed by Monsanto.

EXAMPLES I TO V

Built low-sudsing detergent compositions are prepared having the formulae given below. To make the products a slurry is prepared containing all the components except the nonionic surfactant, silicone prill, bleach and enzyme and the slurry is then spray dried to form a granular intermediate. The bleach and enzyme are then dry-mixed with the granular intermediate and the nonionic surfactant is finally sprayed onto the granular mixture. All figures are given as % by weight.

EXAMPLES

	I	II	III	IV	V
LAS	-	12	7	8	-
AS	6	-	-	-	9
TAS	2	-	3	4	3
MAO	1	-	1.5	1.8	1.2
DAO	-	1.5	-	-	-
CATAB	1	1.5	1.5	1.0	1.8
Dobanol 45-E-7	4	4.2	3.2	5	3
Tallowalcohol E-11	1	-	0.7	1.0	-
TAED	-	4	-	6	-
Silicate	8	6	5	1	10
Wax	0.4	0.5	0.7	0.5	0.8
Silicone Prill	4	2.5	3.3	2	3.5
Gantrez AN119	0.5	0.9	0.5	0.5	0.8
Brightener	0.4	0.2	0.2	0.2	0.2
Dequest 2060	0.2	0.3	-	-	0.1
Dequest 2041	-	-	0.15	0.4	-
Sodium perborate	25	10	15	8	18
Alcalase Enzyme	-	0.8	0.4	-	-
Sodium tripolyphosphate	30	25	32	25	35
Magnesium sulfate	-	0.15	0.25	0.2	-
Sodium sulfate, moisture and miscellaneous			to 100		

The above products provide excellent grease/oil and lipid soil removal performance simultaneously with good clay soil detergency and whiteness maintenance under realistic multi-cycle wash-wear conditions, including low wash 5 temperatures and carry-over of rinse added softener.

EXAMPLES VI TO VIII

Liquid detergent compositions are prepared having the following compositions:

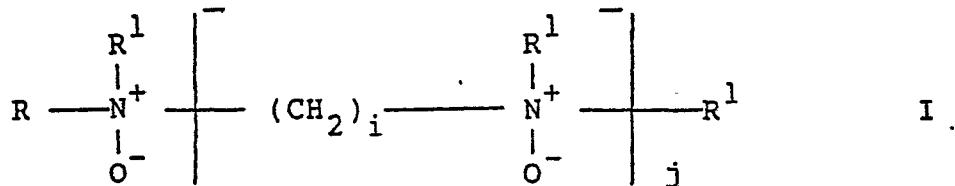
		VI	VII	VIII
10	LAS	18	14	17
	MAO	1.5	1.5	-
	DAO	-	-	1.8
	CATAB	1.5	1.5	1
	Dobanol 45-E-7	5	15	15
15	Sodium hydroxide	-	to pH 8	to pH 8
	Sodium citrate	10	-	-
	Dequest 2060	-	0.6	0.6
	Polydimethylsiloxane	-	0.2	0.2
	Sodium formate	-	1	1
20	Sodium xylene sulfonate	5.5	-	-
	Water and minors		to 100	

The above products provide excellent grease/oil and lipid soil removal performance simultaneously with good clay soil detergency and whiteness maintenance under realistic 25 multicycle wash-wear conditions, including low wash temperatures and carry-over of rinse added softener.

CLAIMS

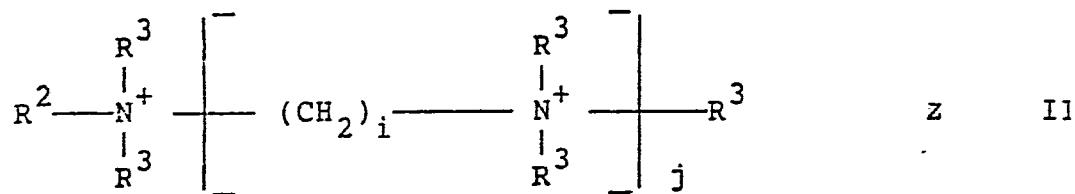
1. A detergent composition having a pH in 1% aqueous dispersion of at least 7, being characterized by:

- (a) from 2% to 60% of surfactant selected from anionic surfactants and mixtures thereof with nonionic, zwitterionic and ampholytic surfactants;
- (b) from 0.5% to 6% of cosurfactant comprising a 5:1 to 1:5 mixture of
 - (i) amine oxide having the general formula I:



15 wherein R is a linear or branched alkyl or alkenyl group having 8 to 20 carbon atoms, each R¹ is independently selected from C₁₋₄ alkyl and -(C_nH_{2n}O)_mH where i is an integer from 1 to 6, j is 0 or 1, n is 2 or 3 and m is from 1 to 7, the sum total of C_nH_{2n}O groups in a molecule being no more than 7, and

(ii) quaternary ammonium surfactant having the general formula II:



5 wherein R^2 is a linear or branched alkyl, alkenyl or
 alkaryl group having 8 to 16 carbon atoms and each R^3
 is independently selected from C_{1-4} alkyl, C_{1-4}
 alkaryl and $-(C_nH_{2n}O)_m$ wherein i is an integer
 from 1 to 6, j is 0 or 1, n is 2 or 3 and m is from 1 to
 7, the sum total of $C_nH_{2n}O$ groups in a molecule
 10 being no more than 7, and wherein Z represents
 counteranion in number to give electrical neutrality,

wherein the weight ratio of surfactant:cosurfactant is at least 1:1 and wherein the equivalent ratio of anionic surfactant:cationic surfactant is also at least 1:1.

15 2. A composition according to Claim 1 characterized in that
in formula I, R has from 10 to 14 carbon atoms and each R¹
is independently selected from methyl and -(C_nH_{2n}O)_mH
wherein m is from 1 to 3 and the sum total of C_nH_{2n}O
groups in a molecule is no more than 5.

20 3. A composition according to Claim 1 or 2 characterized in
 that in formula II, R^2 has from 10 to 14 carbon atoms and
 each R^3 is independently selected from methyl and
 $(C_nH_{2n}O)_m$ H wherein m is from 1 to 3 and the sum total
 of $C_nH_{2n}O$ groups in a molecule is no more than 5.

25 4. A composition according to any of Claims 1 to 3
characterized by from 1% to 4% of the cosurfactant system
comprising amine oxide and quaternary ammonium surfactant in
a weight ratio of from 3:1 to 1:3.

- 3 -

5. A composition according to any of Claims 1 to 4 characterized in that the weight ratio of surfactant:cosurfactant lies in the range from 2:1 to 50:1, preferably from 3:1 to 20:1.
6. A composition according to any of Claims 1 to 5 characterized in that the surfactant comprises a mixture of anionic and alkoxyolated nonionic surfactants in a weight ratio of from 20:1 to 1:5, preferably from 6:1 to 1:3, more preferably from 5:1 to 1:1.
- .0 7. A granular detergent composition according to any of Claims 1 to 6 characterized by from 4% to 25% of surfactant, from 1% to 40% of cosurfactant, from 10% to 50% of detersity builder, from 3% to 40% of peroxy bleach and from 0% to 5% of organic peroxyacid bleach precursor.

BAD ORIGINAL



DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. ²)
D, A	EP-A-0 000 225 (PROCTER & GAMBLE CO.) * Claims 1, 2 *		C 11 D 1/86 C 11 D 1/75 C 11 D 1/62
A	EP-A-0 008 142 (PROCTER & GAMBLE CO.) * Claims 1, 8 *		
A	US-A-4 174 304 (J.J. FLANAGAN) * Claims 1, 2 *		
A	US-A-4 264 479 (J.J. FLANAGAN) * Claims *		
A, P	EP-A-0 060 003 (PROCTER & GAMBLE CO.) * Page 15; examples; claim 1 *		TECHNICAL FIELDS SEARCHED (Int. Cl. ³)
	-----		C 11 D 1/00 D 06 M 13/00
<p>The present search report has been drawn up for all claims</p>			
Place of search BERLIN	Date of completion of the search 30-03-1983	Examiner SCHULTZE D	
CATEGORY OF CITED DOCUMENTS		<p>T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document</p>	
<p>X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document</p>			