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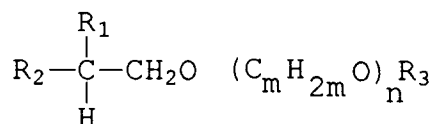
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(54) **Low sudsing liquid detergent compositions**

(57) The present invention relates to liquid detergent compositions containing a nonionic surfactant system, said surfactant system comprising one or more surfactants selected from the group of Guerbet nonionic surfactants having the following formula :



wherein R₁ and R₂ are independently C₃-C₂₂ alkyl groups, m is 2 to 4, n is greater than 0 and R₃ is a hydrogen or a C₁-C₂₂ alkyl group.

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DescriptionField of the invention

5 The present invention relates to detergent compositions having controlled sudsing profile. More particularly, the invention is directed to detergent compositions containing one or more nonionic surfactants selected from the group consisting of Guerbet nonionic surfactants.

Background of the invention

10 Detergent compositions useful for cleaning purposes, such as laundering of fabrics, have commonly utilized a variety of nonionic surfactants. However, said surfactants tend to be high sudsing.

This problem has been addressed in the prior art by the incorporation of suds suppressing systems in such conventional nonionic detergent mixture compositions. Suds suppressing systems include for example suds suppressing agents such as silicone. However, suds suppressing systems can be difficult to maintain as a dispersion in liquid compositions and are difficult to process. In addition silicone anti-foam agents are expensive.

Therefore, it is an object of the present invention to provide detergent compositions comprising nonionic surfactants, said composition having a controlled sudsing profile.

It has now been found that this can be achieved by formulating a detergent composition comprising a Guerbet nonionic surfactant.

An advantage of the present invention is that the compositions provide increased hydrophobic greasy stain removal.

Another advantage of the present invention is that the surfactants are easier to formulate due to the increased solubility of the surfactant. Furthermore, said compositions are easier to formulate as so-called 'concentrated' compositions because of the significant reduction of conventional suds suppressing agents. In addition the compositions of the present invention are cheaper to formulate.

Another advantage of the compositions of the present invention is that the liquid detergent compositions are phase stable.

The term "Guerbet" surfactant as used herein refers to branched surfactants derived from 2-alkyl-alkanols.

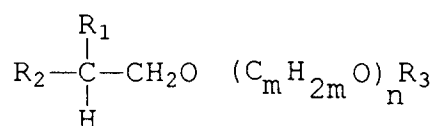
Guerbet surfactants are known in the art. EP 254 208 discloses a low sudsing surfactant mixture comprising linear and/or branched nonionic surfactants. However, there is no specific mention of Guerbet nonionic surfactants.

DE 40 21 265 discloses the use of Guerbet alcohols as suds suppressing agents. There is no mention of Guerbet nonionic surfactants.

WO 92/20768 discloses the combination of dialkylethers and Guerbet nonionic surfactants (C₁₆-C₂₀ EO₁₋₅) as a suds suppressing system.

Summary of the invention

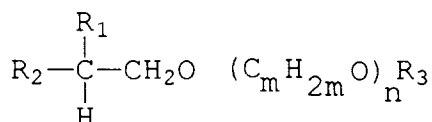
The present invention relates to detergent compositions containing a nonionic surfactant system, said surfactant system comprising one or more surfactants selected from the group of Guerbet nonionic surfactants having the following formula :



wherein R₁ and R₂ are independently C₃-C₂₂ alkyl groups, m is 2 to 4, n is greater than 0 and R₃ is a hydrogen or a C₁-C₂₂ alkyl group. Preferably, n is between 1 to 14, more preferably between 1 to 10, most preferably between 3 and 7.

Detailed description of the invention

The present invention relates to detergent compositions containing a nonionic surfactant system, said surfactant system comprising one or more surfactants selected from the group of Guerbet nonionic surfactants having the following formula :



wherein R_1 and R_2 are independently C_3 - C_{22} alkyl groups, m is 2 to 4, n is greater than 0 and R_3 is a hydrogen or a C_1 - C_{22} alkyl group. Preferably, n is between 1 to 14, more preferably between 1 to 10, most preferably between 3 and 7.

All amounts, ratios and percentages are given by % weight of the total composition unless otherwise stated.

The detergent compositions preferably comprise at least 1%, more preferably from 1% to 70% and most preferably from 25% to 40% by weight of the nonionic surfactant system as described herein.

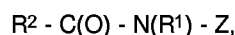
Preferably, the Guerbet nonionic surfactant is present in the nonionic surfactant system in levels from 1%-100%, preferably from 10-90%, more preferably from 30-70% by weight of the nonionic surfactant system.

Suitable non Guerbet nonionic surfactants for use in the nonionic surfactant system include those produced by condensing ethylene oxide with a hydrocarbon having a reactive hydrogen atom, e.g., a hydroxyl, carboxyl, or amido group, in the presence of an acidic or basic catalyst, and include compounds having the general formula $\text{RA}(\text{CH}_2\text{CH}_2\text{O})_n\text{H}$ wherein R represents the hydrophobic moiety, A represents the group carrying the reactive hydrogen atom and n represents the average number of ethylene oxide moieties. R typically contains from about 8 to 22 carbon atoms. They can also be formed by the condensation of propylene oxide with a lower molecular weight compound. n usually varies from about 2 to about 24.

A preferred class of nonionic ethoxylates is represented by the condensation product of a fatty alcohol having from 12 to 15 carbon atoms and from about 4 to 10 moles of ethylene oxide per mole of fatty alcohol. Suitable species of this class of ethoxylates include: the condensation product of C_{12} - C_{15} oxo-alcohols and 3 to 9 moles of ethylene oxide per mole of alcohol; the condensation product or narrow cut C_{14} - C_{15} oxo-alcohols and 3 to 9 moles of ethylene oxide per mole of fatty (oxo) alcohol; the condensation product of a narrow cut C_{12} - C_{13} fatty(oxo)alcohol and 6.5 moles of ethylene oxide per mole of fatty alcohol; and the condensation products of a C_{10} - C_{14} coconut fatty alcohol with a degree of ethoxylation (moles EO/mole fatty alcohol) in the range from 4 to 8.

Other suitable non Guerbet nonionic surfactants are semi-polar nonionic surfactants including water-soluble amine oxides containing one alkyl or hydroxy alkyl moiety of from about 8 to about 28 carbon atoms and two moieties selected from the group consisting of alkyl groups and hydroxy alkyl groups, containing from 1 to about 3 carbon atoms which can optionally be joined into ring structures.

Also suitable as nonionic surfactants are poly hydroxy fatty acid amide surfactants of the formula



wherein R^1 is H, or R^1 is C_{1-4} hydrocarbyl, 2-hydroxy ethyl, 2-hydroxy propyl or a mixture thereof, R^2 is C_{5-31} hydrocarbyl, and Z is a polyhydroxyhydrocarbyl having a linear hydrocarbyl chain with at least 3 hydroxyls directly connected to the chain, or an alkoxyated derivative thereof. Preferably, R^1 is methyl, R^2 is a straight C_{11-15} alkyl or alkenyl chain such as coconut alkyl or mixtures thereof, and Z is derived from a reducing sugar such as glucose, fructose, maltose, lactose, in a reductive amination reaction.

The compositions according to the present invention provide improved hydrophobic greasy soil removal on soils such as make-up, spaghetti sauce, shoe polish and other similar stains, while at the same time having a controlled sudsing profile.

Detergent Ingredients

In another embodiment of the present invention, a detergent composition is provided comprising the surfactant system of the present invention mixed with detergent ingredients. A wide range of surfactants can be used in the detergent composition of the present invention.

A typical listing of anionic, nonionic, ampholytic and zwitterionic classes, and species of these surfactants, is given in US Patent 3,664,961 issued to Norris on May 23, 1972.

ANIONIC SURFACTANTS

Suitable anionic surfactants include alkyl alkoxyated sulfate surfactants hereof are water soluble salts or acids of the formula $\text{RO}(\text{A})_m\text{SO}_3\text{M}$ wherein R is an unsubstituted C_{10} - C_{24} alkyl or hydroxyalkyl group having a C_{10} - C_{24} alkyl component, preferably a C_{12} - C_{20} alkyl or hydroxyalkyl, more preferably C_{12} - C_{18} alkyl or hydroxyalkyl, A is an ethoxy or

propoxy unit, m is greater than zero, typically between about 0.5 and about 6, more preferably between about 0.5 and about 3, and M is H or a cation which can be, for example, a metal cation (e.g., sodium, potassium, lithium, calcium, magnesium, etc.), ammonium or substituted-ammonium cation. Alkyl ethoxylated sulfates as well as alkyl propoxylated sulfates are contemplated herein. Specific examples of substituted ammonium cations include methyl-, dimethyl-, trimethyl-ammonium cations and quaternary ammonium cations such as tetramethyl-ammonium and dimethyl piperidinium cations and those derived from alkylamines such as ethylamine, diethylamine, triethylamine, mixtures thereof, and the like. Exemplary surfactants are C₁₂-C₁₈ alkyl polyethoxylate (1.0) sulfate (C₁₂-C₁₈E(1.0)M), C₁₂-C₁₈ alkyl polyethoxylate (2.25) sulfate (C₁₂-C₁₈E(2.25)M), C₁₂-C₁₈ alkyl polyethoxylate (3.0) sulfate (C₁₂-C₁₈E(3.0)M), and C₁₂-C₁₈ alkyl polyethoxylate (4.0) sulfate (C₁₂-C₁₈E(4.0)M), wherein M is conveniently selected from sodium and potassium.

Suitable anionic surfactants to be used are alkyl ester sulfonate surfactants including linear esters of C₈-C₂₀ carboxylic acids (i.e., fatty acids) which are sulfonated with gaseous SO₃ according to "The Journal of the American Oil Chemists Society", 52 (1975), pp. 323-329. Suitable starting materials would include natural fatty substances as derived from tallow, palm oil, etc.

The preferred alkyl ester sulfonate surfactant, especially for laundry applications, comprise alkyl ester sulfonate surfactants of the structural formula :



wherein R³ is a C₈-C₂₀ hydrocarbyl, preferably an alkyl, or combination thereof, R⁴ is a C₁-C₆ hydrocarbyl, preferably an alkyl, or combination thereof, and M is a cation which forms a water soluble salt with the alkyl ester sulfonate. Suitable salt-forming cations include metals such as sodium, potassium, and lithium, and substituted or unsubstituted ammonium cations, such as monoethanolamine, diethanolamine, and triethanolamine. Preferably, R³ is C₁₀-C₁₆ alkyl, and R⁴ is methyl, ethyl or isopropyl. Especially preferred are the methyl ester sulfonates wherein R³ is C₁₀-C₁₆ alkyl.

Other suitable anionic surfactants include the alkyl sulfate surfactants hereof are water soluble salts or acids of the formula ROSO₃M wherein R preferably is a C₁₀-C₂₄ hydrocarbyl, preferably an alkyl or hydroxyalkyl having a C₁₀-C₂₀ alkyl component, more preferably a C₁₂-C₁₈ alkyl or hydroxyalkyl, and M is H or a cation, e.g., an alkali metal cation (e.g. sodium, potassium, lithium), or ammonium or substituted ammonium (e.g. methyl-, dimethyl-, and trimethyl ammonium cations and quaternary ammonium cations such as tetramethyl-ammonium and dimethyl piperidinium cations and quaternary ammonium cations derived from alkylamines such as ethylamine, diethylamine, triethylamine, and mixtures thereof, and the like). Typically, alkyl chains of C₁₂-C₁₆ are preferred for lower wash temperatures (e.g. below about 50°C) and C₁₆-C₁₈ alkyl chains are preferred for higher wash temperatures (e.g. above about 50°C).

Other anionic surfactants useful for deterative purposes can also be included in the laundry detergent compositions of the present invention. These can include salts (including, for example, sodium, potassium, ammonium, and substituted ammonium salts such as mono-, di- and triethanolamine salts) of soap, C₉-C₂₀ linear alkylbenzenesulfonates, C₈-C₂₂ primary or secondary alkanesulfonates, C₈-C₂₄ olefinsulfonates, sulfonated polycarboxylic acids prepared by sulfonation of the pyrolyzed product of alkaline earth metal citrates, e.g., as described in British patent specification No. 1,082,179, C₈-C₂₄ alkylpolyglycol ethersulfates (containing up to 10 moles of ethylene oxide); alkyl glycerol sulfonates, fatty acyl glycerol sulfonates, fatty oleyl glycerol sulfates, alkyl phenol ethylene oxide ether sulfates, paraffin sulfonates, alkyl phosphates, isethionates such as the acyl isethionates, N-acyl taurates, alkyl succinamates and sulfosuccinates, monoesters of sulfosuccinates (especially saturated and unsaturated C₁₂-C₁₈ monoesters) and diesters of sulfosuccinates (especially saturated and unsaturated C₆-C₁₂ diesters), acyl sarcosinates, sulfates of alkylpolysaccharides such as the sulfates of alkylpolyglucoside (the nonionic nonsulfated compounds being described below), branched primary alkyl sulfates, and alkyl polyethoxy carboxylates such as those of the formula RO(CH₂CH₂O)_k-CH₂COO-M⁺ wherein R is a C₈-C₂₂ alkyl, k is an integer from 0 to 10, and M is a soluble salt-forming cation. Resin acids and hydrogenated resin acids are also suitable, such as rosin, hydrogenated rosin, and resin acids and hydrogenated resin acids present in or derived from tall oil. Further examples are described in "Surface Active Agents and Detergents" (Vol. I and II by Schwartz, Perry and Berch). A variety of such surfactants are also generally disclosed in U.S. Patent 3,929,678, issued December 30, 1975 to Laughlin, et al. at Column 23, line 58 through Column 29, line 23 (herein incorporated by reference).

When included therein, the laundry detergent compositions of the present invention typically comprise from about 1% to about 40%, preferably from about 3% to about 20% by weight of such anionic surfactants.

NONIONICS

Polyethylene, polypropylene, and polybutylene oxide condensates of alkyl phenols are suitable for use as the non-ionic surfactant of the surfactant systems of the present invention, with the polyethylene oxide condensates being preferred. These compounds include the condensation products of alkyl phenols having an alkyl group containing from about 6 to about 14 carbon atoms, preferably from about 8 to about 14 carbon atoms, in either a straight-chain or branched-chain configuration with the alkylene oxide. In a preferred embodiment, the ethylene oxide is present in an amount equal to from about 5 to about 25 moles, more preferably from about 3 to about 15 moles, of ethylene oxide per

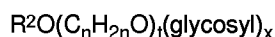
mole of alkyl phenol. Commercially available nonionic surfactants of this type include Igepal™ CO-630, marketed by the GAF Corporation; and Triton™ X-45, X-114, X-100 and X-102, all marketed by the Rohm & Haas Company. These surfactants are commonly referred to as alkylphenol alkoxyates (e.g., alkyl phenol ethoxylates).

The condensation products of primary and secondary aliphatic alcohols with from about 1 to about 25 moles of ethylene oxide are suitable for use as the nonionic surfactant of the nonionic surfactant systems of the present invention. The alkyl chain of the aliphatic alcohol can either be straight or branched, primary or secondary, and generally contains from about 8 to about 22 carbon atoms. Preferred are the condensation products of alcohols having an alkyl group containing from about 8 to about 20 carbon atoms, more preferably from about 10 to about 18 carbon atoms, with from about 2 to about 10 moles of ethylene oxide per mole of alcohol. Examples of commercially available nonionic surfactants of this type include Tergitol™ 15-S-9 (the condensation product of C₁₁-C₁₅ linear alcohol with 9 moles ethylene oxide), Tergitol™ 24-L-6 NMW (the condensation product of C₁₂-C₁₄ primary alcohol with 6 moles ethylene oxide with a narrow molecular weight distribution), both marketed by Union Carbide Corporation; Neodol™ 45-9 (the condensation product of C₁₄-C₁₅ linear alcohol with 9 moles of ethylene oxide), Neodol™ 23-6.5 (the condensation product of C₁₂-C₁₃ linear alcohol with 6.5 moles of ethylene oxide), Neodol™ 45-7 (the condensation product of C₁₄-C₁₅ linear alcohol with 7 moles of ethylene oxide), Neodol™ 45-4 (the condensation product of C₁₄-C₁₅ linear alcohol with 4 moles of ethylene oxide) marketed by Shell Chemical Company, and Kyro™ EOB (the condensation product of C₁₃-C₁₅ alcohol with 9 moles ethylene oxide), marketed by The Procter & Gamble Company.

Also useful as the nonionic surfactant of the surfactant systems of the present invention are the alkylpolysaccharides disclosed in U.S. Patent 4,565,647, Llenado, issued January 21, 1986, having a hydrophobic group containing from about 6 to about 30 carbon atoms, preferably from about 10 to about 16 carbon atoms and a polysaccharide, e.g. a polyglycoside, hydrophilic group containing from about 1.3 to about 10, preferably from about 1.3 to about 3, most preferably from about 1.3 to about 2.7 saccharide units. Any reducing saccharide containing 5 or 6 carbon atoms can be used, e.g., glucose, galactose and galactosyl moieties can be substituted for the glucosyl moieties (optionally the hydrophobic group is attached at the 2-, 3-, 4-, etc. positions thus giving a glucose or galactose as opposed to a glucoside or galactoside). The intersaccharide bonds can be, e.g., between the one position of the additional saccharide units and the 2-3-, 4-, and/or 6- positions on the preceding saccharide units.

Optionally, and less desirably, there can be a polyalkylene-oxide chain joining the hydrophobic moiety and the polysaccharide moiety. The preferred alkyleneoxide is ethylene oxide. Typical hydrophobic groups include alkyl groups, either saturated or unsaturated, branched or unbranched containing from about 8 to about 18, preferably from about 10 to about 16, carbon atoms. Preferably, the alkyl group is a straight chain saturated alkyl group. The alkyl group can contain up to about 3 hydroxy groups and/or the polyalkyleneoxide chain can contain up to about 10, preferably less than 5, alkyleneoxide moieties. Suitable alkyl polysaccharides are octyl, nonyldecyl, undecyldodecyl, tridecyl, tetradecyl, pentadecyl, hexadecyl, heptadecyl, and octadecyl, di-, tri-, tetra-, penta-, and hexagluco-sides, galactosides, lactosides, glucoses, fructosides, fructoses and/or galactoses. Suitable mixtures include coconut alkyl, di-, tri-, tetra-, and pentaglu-cosides and tallow alkyl tetra-, penta-, and hexagluco-sides.

The preferred alkylpolyglycosides have the formula



wherein R² is selected from the group consisting of alkyl, alkylphenyl, hydroxyalkyl, hydroxyalkylphenyl, and mixtures thereof in which the alkyl groups contain from about 10 to about 18, preferably from about 12 to about 14, carbon atoms; n is 2 or 3, preferably 2; t is from 0 to about 10, preferably 0; and x is from about 1.3 to about 10, preferably from about 1.3 to about 3, most preferably from about 1.3 to about 2.7. The glycosyl is preferably derived from glucose. To prepare these compounds, the alcohol or alkylpolyethoxy alcohol is formed first and then reacted with glucose, or a source of glucose, to form the glucoside (attachment at the 1-position). The additional glycosyl units can then be attached between their 1-position and the preceding glycosyl units 2-, 3-, 4-and/or 6-position, preferably predominately the 2-position.

Although not preferred, the condensation products of ethylene oxide with a hydrophobic base formed by the condensation of propylene oxide with propylene glycol are also suitable for use as the additional nonionic surfactant of the nonionic surfactant systems of the present invention. The hydrophobic portion of these compounds will preferably have a molecular weight of from about 1500 to about 1800 and will exhibit water insolubility. The addition of polyoxyethylene moieties to this hydrophobic portion tends to increase the water solubility of the molecule as a whole, and the liquid character of the product is retained up to the point where the polyoxyethylene content is about 50% of the total weight of the condensation product, which corresponds to condensation with up to about 40 moles of ethylene oxide. Examples of compounds of this type include certain of the commercially-available Pluronic™ surfactants, marketed by BASF.

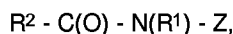
Also suitable for use as the nonionic surfactant of the nonionic surfactant system of the present invention, are the condensation products of ethylene oxide with the product resulting from the reaction of propylene oxide and ethylenediamine. The hydrophobic moiety of these products consists of the reaction product of ethylenediamine and excess propylene oxide, and generally has a molecular weight of from about 2500 to about 3000. This hydrophobic moiety is

condensed with ethylene oxide to the extent that the condensation product contains from about 40% to about 80% by weight of polyoxyethylene and has a molecular weight of from about 5,000 to about 11,000. Examples of this type of nonionic surfactant include certain of the commercially available Tetronic™ compounds, marketed by BASF.

Preferred for use as the nonionic surfactant of the surfactant systems of the present invention are polyethylene oxide condensates of alkyl phenols, condensation products of primary and secondary aliphatic alcohols with from about 1 to about 25 moles of ethylene oxide, alkylpolysaccharides, and mixtures thereof. Most preferred are C₈-C₁₄ alkyl phenol ethoxylates having from 3 to 15 ethoxy groups and C₈-C₁₈ alcohol ethoxylates (preferably C₁₀ avg.) having from 2 to 10 ethoxy groups, and mixtures thereof.

Highly preferred nonionic surfactants are polyhydroxy fatty acid amide surfactants.

Also suitable as nonionic surfactants are poly hydroxy fatty acid amide surfactants of the formula

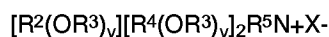


wherein R¹ is H, or R¹ is C₁₋₄ hydrocarbyl, 2-hydroxy ethyl, 2-hydroxy propyl or a mixture thereof, R² is C₅₋₃₁ hydrocarbyl, and Z is a polyhydroxyhydrocarbyl having a linear hydrocarbyl chain with at least 3 hydroxyls directly connected to the chain, or an alkoxyated derivative thereof. Preferably, R¹ is methyl, R² is a straight C₁₁₋₁₅ alkyl or alkenyl chain such as coconut alkyl or mixtures thereof, and Z is derived from a reducing sugar such as glucose, fructose, maltose, lactose, in a reductive amination reaction.

When included in such laundry detergent compositions, the nonionic surfactant systems of the present invention act to improve the greasy/oily stain removal properties of such laundry detergent compositions across a broad range of laundry conditions.

The laundry detergent compositions of the present invention may also contain cationic, ampholytic, zwitterionic, and semi-polar surfactants, as well as nonionic surfactants other than those already described herein.

Preferred cationic surfactant systems include nonionic and ampholytic surfactants. Cationic deterative surfactants suitable for use in the laundry detergent compositions of the present invention are those having one long-chain hydrocarbyl group. Examples of such cationic surfactants include the ammonium surfactants such as alkyldimethylammonium halogenides, and those surfactants having the formula :



wherein R² is an alkyl or alkyl benzyl group having from about 8 to about 18 carbon atoms in the alkyl chain, each R³ is selected from the group consisting of -CH₂CH₂-, -CH₂CH(CH₃)-, -CH₂CH(CH₂OH)-, -CH₂CH₂CH₂-, and mixtures thereof; each R⁴ is selected from the group consisting of C₁-C₄ alkyl, C₁-C₄ hydroxyalkyl, benzyl ring structures formed by joining the two R⁴ groups, -CH₂CHOH-CHOHCOR⁶CHOHCH₂OH wherein R⁶ is any hexose or hexose polymer having a molecular weight less than about 1000, and hydrogen when y is not 0; R⁵ is the same as R⁴ or is an alkyl chain wherein the total number of carbon atoms of R² plus R⁵ is not more than about 18; each y is from 0 to about 10 and the sum of the y values is from 0 to about 15; and X is any compatible anion.

Preferred cationic surfactants are the water-soluble quaternary ammonium compounds useful in the present composition having the formula :



wherein R₁ is C₈-C₁₆ alkyl, each of R₂, R₃ and R₄ is independently C₁-C₄ alkyl, C₁-C₄ hydroxy alkyl, benzyl, and - (C₂H₄₀)_xH where x has a value from 2 to 5, and X is an anion. Not more than one of R₂, R₃ or R₄ should be benzyl. The preferred alkyl chain length for R₁ is C₁₂-C₁₅ particularly where the alkyl group is a mixture of chain lengths derived from coconut or palm kernel fat or is derived synthetically by olefin build up or OXO alcohols synthesis. Preferred groups for R₂, R₃ and R₄ are methyl and hydroxyethyl groups and the anion X may be selected from halide, methosulphate, acetate and phosphate ions.

Examples of suitable quaternary ammonium compounds of formulae (i) for use herein are :

coconut trimethyl ammonium chloride or bromide;

coconut methyl dihydroxyethyl ammonium chloride or bromide;

decyl triethyl ammonium chloride;

decyl dimethyl hydroxyethyl ammonium chloride or bromide;

C₁₂-C₁₅ dimethyl hydroxyethyl ammonium chloride or bromide;

coconut dimethyl hydroxyethyl ammonium chloride or bromide;

myristyl trimethyl ammonium methyl sulphate;

lauryl dimethyl benzyl ammonium chloride or bromide;

lauryl dimethyl (ethenoxy)₄ ammonium chloride or bromide;

choline esters (compounds of formula (i) wherein R₁ is -CH₂-O-C(O)-C₁₂₋₁₄ alkyl and R₂, R₃, R₄ are methyl).

Other cationic surfactants useful herein are also described in U.S. Patent 4,228,044, Cambre, issued October 14, 1980.

When included therein, the laundry detergent compositions of the present invention typically comprise from 0% to about 25%, preferably from about 3% to about 15% by weight of such cationic surfactants.

Ampholytic surfactants are also suitable for use in the laundry detergent compositions of the present invention. These surfactants can be broadly described as aliphatic derivatives of secondary or tertiary amines, or aliphatic derivatives of heterocyclic secondary and tertiary amines in which the aliphatic radical can be straight- or branched-chain. One of the aliphatic substituents contains at least about 8 carbon atoms, typically from about 8 to about 18 carbon atoms, and at least one contains an anionic water-solubilizing group, e.g. carboxy, sulfonate, sulfate. See U.S. Patent No. 3,929,678 to Laughlin et al., issued December 30, 1975 at column 19, lines 18-35, for examples of ampholytic surfactants.

When included therein, the laundry detergent compositions of the present invention typically comprise from 0% to about 15%, preferably from about 1% to about 10% by weight of such ampholytic surfactants.

Zwitterionic surfactants are also suitable for use in laundry detergent compositions. These surfactants can be broadly described as derivatives of secondary and tertiary amines, derivatives of heterocyclic secondary and tertiary amines, or derivatives of quaternary ammonium, quaternary phosphonium or tertiary sulfonium compounds. See U.S. Patent No. 3,929,678 to Laughlin et al., issued December 30, 1975 at column 19, line 38 through column 22, line 48, for examples of zwitterionic surfactants.

When included therein, the laundry detergent compositions of the present invention typically comprise from 0% to about 15%, preferably from about 1% to about 10% by weight of such zwitterionic surfactants.

Semi-polar nonionic surfactants are a special category of nonionic surfactants which include water-soluble amine oxides containing one alkyl moiety of from about 10 to about 18 carbon atoms and 2 moieties selected from the group consisting of alkyl groups and hydroxyalkyl groups containing from about 1 to about 3 carbon atoms; water-soluble phosphine oxides containing one alkyl moiety of from about 10 to about 18 carbon atoms and 2 moieties selected from the group consisting of alkyl groups and hydroxyalkyl groups containing from about 1 to about 3 carbon atoms; and water-soluble sulfoxides containing one alkyl moiety of from about 10 to about 18 carbon atoms and a moiety selected from the group consisting of alkyl and hydroxyalkyl moieties of from about 1 to about 3 carbon atoms.

Semi-polar nonionic detergent surfactants include the amine oxide surfactants having the formula



wherein R^3 is an alkyl, hydroxyalkyl, or alkyl phenyl group or mixtures thereof containing from about 8 to about 22 carbon atoms; R^4 is an alkylene or hydroxyalkylene group containing from about 2 to about 3 carbon atoms or mixtures thereof; x is from 0 to about 3; and each R^5 is an alkyl or hydroxyalkyl group containing from about 1 to about 3 carbon atoms or a polyethylene oxide group containing from about 1 to about 3 ethylene oxide groups. The R^5 groups can be attached to each other, e.g., through an oxygen or nitrogen atom, to form a ring structure.

These amine oxide surfactants in particular include C_{10} - C_{18} alkyl dimethyl amine oxides and C_8 - C_{12} alkoxy ethyl dihydroxy ethyl amine oxides.

When included therein, the laundry detergent compositions of the present invention typically comprise from 0% to about 15%, preferably from about 1% to about 10% by weight of such semi-polar nonionic surfactants.

The present invention further provides laundry detergent compositions comprising at least 1% by weight, preferably from about 3% to about 65%, more preferably from about 10% to about 25% by weight of total surfactants.

The compositions according to the present invention may further comprise a builder system. Any conventional builder system is suitable for use herein including aluminosilicate materials, silicates, polycarboxylates and fatty acids, materials such as ethylenediamine tetraacetate, metal ion sequestrants such as aminopolyphosphonates, particularly ethylenediamine tetramethylene phosphonic acid and diethylene triamine pentamethylenephosphonic acid. Though less preferred for obvious environmental reasons, phosphate builders can also be used herein.

Suitable polycarboxylates builders for use herein include citric acid, preferably in the form of a water-soluble salt, derivatives of succinic acid of the formula $R-CH(COOH)CH_2(COOH)$ wherein R is C_{10} -20 alkyl or alkenyl, preferably C_{12} -16, or wherein R can be substituted with hydroxyl, sulfo sulfoxyl or sulfone substituents. Specific examples include lauryl succinate, myristyl succinate, palmityl succinate, 2-dodecenylsuccinate, 2-tetradecenyl succinate. Succinate builders are preferably used in the form of their water-soluble salts, including sodium, potassium, ammonium and alkanolammonium salts.

Other suitable polycarboxylates are oxodisuccinates and mixtures of tartrate monosuccinic and tartrate disuccinic acid such as described in US 4,663,071.

Especially for the liquid execution herein, suitable fatty acid builders for use herein are saturated or unsaturated C_{10} -18 fatty acids, as well as the corresponding soaps. Preferred saturated species have from 12 to 16 carbon atoms in the alkyl chain. The preferred unsaturated fatty acid is oleic acid.

Other preferred builder system for liquid compositions is based on dodecenyl succinic acid and citric acid.

Detergency builder salts are normally included in amounts of from 3% to 50% by weight of the composition pref-

erably from 5% to 30% and most usually from 5% to 25% by weight.

The detergent composition according to the present invention may optionally contain bleaching agents or bleaching compositions containing a bleaching agent and one or more bleach activators. When present, bleaching agents will typically be at levels of from about 1% to about 30%, more typically from about 5% to about 20%, of the detergent composition, especially for fabric laundering. If present, the amount of bleach activators will typically be from about 0.1% to about 60%, more typically from about 0.5% to about 40% of the bleaching composition comprising the bleaching agent-plus-bleach activator.

The bleaching agents used herein can be any of the bleaching agents useful for detergent compositions in textile cleaning or other cleaning purposes that are now known or become known.

The bleaches suitable for the present invention can be activated or non-activated bleaches.

Bleaches suitable for the present invention include peroxygen bleaches. Examples of suitable water-soluble solid peroxygen bleaches include hydrogen peroxide releasing agents such as hydrogen peroxide, perborates, e.g. perborate monohydrate, perborate tetrahydrate, persulfates, percarbonates, peroxydisulfates, perphosphates and peroxyhydrates. Preferred bleaches are percarbonates and perborates.

The hydrogen peroxide may also be present by adding an enzymatic system (i.e. an enzyme and a substrate therefore) which is capable of generating hydrogen peroxide at the beginning or during the washing and/or rinsing process. Such enzymatic systems are disclosed in EP Patent Application 91202655.6 filed October 9, 1991.

Other peroxygen bleaches suitable for the present invention include organic peroxyacids such as percarboxylic acids.

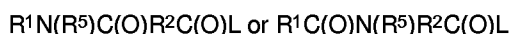
Suitable examples of this class of agents include magnesium monoperoxyphthalate hexahydrate, the magnesium salt of metachloro perbenzoic acid, 4-nonylamino-4-oxoperoxybutyric acid and diperoxydodecanedioic acid. Such bleaching agents are disclosed in U.S. Patent 4,483,781, Hartman, issued November 20, 1984, U.S. Patent Application 740,446, Burns et al, filed June 3, 1985, European Patent Application 0,133,354, Banks et al, published February 20, 1985, and U.S. Patent 4,412,934, Chung et al, issued November 1, 1983. Highly preferred bleaching agents also include 6-nonylamino-6-oxoperoxyacaproic acid as described in U.S. Patent 4,634,551, issued January 6, 1987 to Burns et al.

A preferred percarbonate bleach comprises dry particles having an average particle size in the range from about 500 micrometers to about 1,000 micrometers, not more than about 10% by weight of said particles being smaller than about 200 micrometers and not more than about 10% by weight of said particles being larger than about 1,250 micrometers. Optionally, the percarbonate can be coated with silicate, borate or water-soluble surfactants. Percarbonate is available from various commercial sources such as FMC, Solvay and Tokai Denka.

Mixtures of bleaching agents can also be used.

Peroxygen bleaching agents, the perborates, the percarbonates, etc., are preferably combined with bleach activators, which lead to the *in situ* production in aqueous solution (i.e., during the washing process) of the peroxy acid corresponding to the bleach activator. Various nonlimiting examples of activators are disclosed in U.S. Patent 4,915,854, issued April 10, 1990 to Mao et al, and U.S. Patent 4,412,934. The nonanoyloxybenzene sulfonate (NOBS) and tetraacetyl ethylene diamine (TAED) activators are typical, and mixtures thereof can also be used. See also U.S. 4,634,551 for other typical bleaches and activators useful herein.

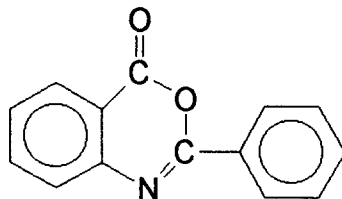
Highly preferred amido-derived bleach activators are those of the formulae:



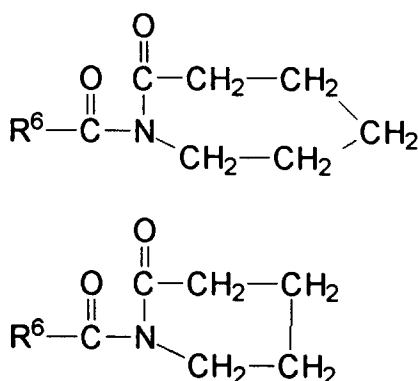
wherein R^1 is an alkyl group containing from about 6 to about 12 carbon atoms, R^2 is an alkylene containing from 1 to about 6 carbon atoms, R^5 is H or alkyl, aryl, or alkaryl containing from about 1 to about 10 carbon atoms, and L is any suitable leaving group. A leaving group is any group that is displaced from the bleach activator as a consequence of the nucleophilic attack on the bleach activator by the perhydrolysis anion. A preferred leaving group is phenyl sulfonate.

Preferred examples of bleach activators of the above formulae include (6-octanamido-caproyl)oxybenzenesulfonate, (6-nonanamidocaproyl)oxybenzenesulfonate, (6-decanamidocaproyl)oxybenzenesulfonate, and mixtures thereof as described in U.S. Patent 4,634,551, incorporated herein by reference.

Another class of bleach activators comprises the benzoxazin-type activators disclosed by Hodge et al in U.S. Patent 4,966,723, issued October 30, 1990, incorporated herein by reference. A highly preferred activator of the benzoxazin-type is :



Still another class of preferred bleach activators includes the acyl lactam activators, especially acyl caprolactams and acyl valerolactams of the formulae:



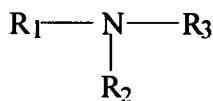
wherein R^6 is H or an alkyl, aryl, alkoxyaryl, or alkaryl group containing from 1 to about 12 carbon atoms. Highly preferred lactam activators include benzoyl caprolactam, octanoyl caprolactam, 3,5,5-trimethylhexanoyl caprolactam, nonanoyl caprolactam, decanoyl caprolactam, undecenoyl caprolactam, benzoyl valerolactam, octanoyl valerolactam, decanoyl valerolactam, undecenoyl valerolactam, nonanoyl valerolactam, 3,5,5-trimethylhexanoyl valerolactam and mixtures thereof. See also U.S. Patent 4,545,784, issued to Sanderson, October 8, 1985, incorporated herein by reference, which discloses acyl caprolactams, including benzoyl caprolactam, adsorbed into sodium perborate.

Bleaching agents other than oxygen bleaching agents are also known in the art and can be utilized herein. One type of non-oxygen bleaching agent of particular interest includes photo activated bleaching agents such as the sulfonated zinc and/or aluminum phthalocyanines. See U.S. Patent 4,033,718, issued July 5, 1977 to Holcombe et al. If used, detergent compositions will typically contain from about 0.025% to about 1.25%, by weight, of such bleaches, especially sulfonate zinc phthalocyanine.

If desired, the bleaching compounds can be catalyzed by means of a manganese compound. Such compounds are well known in the art and include, for example, the manganese-based catalysts disclosed in U.S. Pat. 5,246,621, U.S. Pat. 5,244,594; U.S. Pat. 5,194,416; U.S. Pat. 5,114,606; and European Pat. App. Pub. Nos. 549,271A1, 549,272A1, 544,440A2, and 544,490A1; Preferred examples of these catalysts include $Mn^{IV}_2(u-O)_3(1,4,7\text{-trimethyl-1,4,7-triazacyclononane})_2(PF_6)_2$, $Mn^{III}_2(u-O)_1(u-OAc)_2(1,4,7\text{-trimethyl-1,4,7-triazacyclononane})_2(ClO_4)_2$, $Mn^{IV}_4(u-O)_6(1,4,7\text{-triazacyclononane})_4(ClO_4)_4$, $Mn^{III}Mn^{IV}_4(u-O)_1(u-OAc)_2(1,4,7\text{-trimethyl-1,4,7-triazacyclononane})_2(ClO_4)_3$, $Mn^{IV}(1,4,7\text{-trimethyl-1,4,7-triazacyclononane})-(OCH_3)_3(PF_6)$, and mixtures thereof. Other metal-based bleach catalysts include those disclosed in U.S. Pat. 4,430,243 and U.S. Pat. 5,114,611. The use of manganese with various complex ligands to enhance bleaching is also reported in the following United States Patents: 4,728,455; 5,284,944; 5,246,612; 5,256,779; 5,280,117; 5,274,147; 5,153,161; and 5,227,084.

As a practical matter, and not by way of limitation, the compositions and processes herein can be adjusted to provide on the order of at least one part per ten million of the active bleach catalyst species in the aqueous washing liquor, and will preferably provide from about 0.1 ppm to about 700 ppm, more preferably from about 1 ppm to about 500 ppm, of the catalyst species in the laundry liquor.

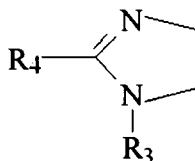
The detergent composition according to the present invention may comprise amines. Such amines will generally correspond to the formula :



wherein R_1 is C_6 - C_{22} alkyl, alkenyl, cycloaliphatic or polycyclic group which may be substituted with up to three hydroxyl or phenyl groups and which may optionally be interrupted with up to 12 ethylene oxide moieties;

wherein R_2 and R_3 are each H or C_1 - C_{18} straight or branched chain alkyl or alkenyl groups which may be substituted with up to 12 ethylene oxide moieties; and

wherein R_1 and R_2 may be taken together to form an imidazoline group of the structure:



wherein R_4 is C_8 - C_{18} alkyl.

Preferably in the above formulas, R_1 is C_6 - C_{18} alkyl; R_2 and R_3 are each C_1 - C_4 alkyl, optionally interrupted with 1 or 2 ethylene oxide moieties; and R_4 is C_{10} - C_{16} alkyl.

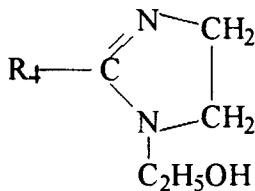
Amines of the above formulas, as indicated, are generally known as surfactant amines. Such materials are described in greater detail in Kirk-Othmer; *Encyclopedia of Chemical Technology, Fourth Edition, Volume 2, "Fatty Amines,"* Pages 405-425 (1992). This article is incorporated herein by reference.

Suitable primary amines, i.e., those wherein, in the above formulas, R_2 and R_3 are both hydrogen, include 1-hexylamine, 1-octylamine, laurylamine, palmitylamine, stearylamine, oleylamine, coconutalkylamine, tallowalkylamine, 6-amino-1-hexanol; 3-isopropoxypropylamine, 3-(2-methoxyethoxy)-propylamine, 2-(2-aminoethoxy)-ethanol and cyclohexylamine.

Suitable secondary amines, i.e., those wherein, in the above formulas, only one of R_2 and R_3 is hydrogen, include dicoconutalkylamine, di-n-dodecylamine, di-n-hexadecylamine, di-n-octadecylamine, and ditallowalkylamine.

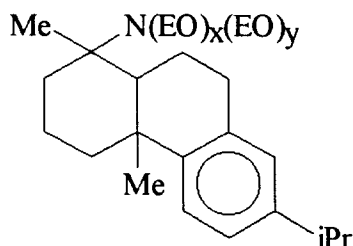
Suitable tertiary amines, i.e., those wherein, in the above formulas, neither R_2 nor R_3 is hydrogen, include coco-nutalkyldimethylamine, dimethyloleylamine, di-n-decylmethylamine, dicoconutalkylmethylamine, tri-n-octylamine, tri-n-dodecylamine, hexadecyltris(ethyleneoxy)dimethylamine, tallowalkylbis(2-hydroxyethyl)amine, stearylbis(2-hydroxyethyl)amine, and oleoylbis(2-hydroxyethyl)amine.

Suitable imidazolines useful herein are those of the formula:



wherein R₄ is C₉ - C₁₃ alkyl. Such materials are commercially marketed under the trade name VARINE.

Suitable polycyclic amines include those based on rosin acids. Examples of such amines are those of the formula:



wherein x and y range from 1 to 3. Amines of this type are marketed under the trade name POLYRAD.

Of all of the foregoing amines the preferred materials are the trialkyl amines marketed under the tradename ADOGEN, the long chain alkyldimethyl amines marketed under the tradename ARMEEN and the ethoxylated amines marketed under the tradename ETHOMEEN. The most preferred amines for use in the compositions herein are 1-hexylamine, 1-octylamine, n-dodecyldimethylamine (ARMEEN DM12D) and bis-hydroxyethylcoconutalkylamine (ETHOMEEN C/12).

Without being bound by theory, it is believed that amines of the foregoing type are protonated under the pH conditions of use for the detergent compositions herein. The resulting cationic protonated amine species then interacts with the oleoyl sarcosinate, and perhaps other anionic surfactants, to form a lipophilic surfactant pair. This in turn leads to greater surface absorptivity and superior detergency for greasy/oily soils. The alkylamines useful herein, which generally have pKa's 9-11, can also provide buffering capacity for the detergent compositions in which they are used.

Other components used in detergent compositions may be employed, such as enzymes and stabilizers therefore, soil-suspending agents, soil-release polymers, abrasives, bactericides, tarnish inhibitors, coloring agents, foam control agents, corrosion inhibitors and perfumes.

The detergent compositions according to the invention can be in liquid, paste, gels, bars or granular forms. Granular compositions according to the present invention can also be in "compact form", i.e. they may have a relatively higher density than conventional granular detergents, i.e. greater than about 600 g/l; in such case, the granular detergent compositions according to the present invention will contain a lower amount of "inorganic filler salt", compared to conventional granular detergents; typical filler salts are alkaline earth metal salts of sulphates and chlorides, typically sodium sulphate; "compact" detergents typically comprise not more than 10% filler salt.

Preferably, the liquid compositions according to the present invention are in "concentrated form"; in such case, the liquid detergent compositions according to the present invention will contain a lower amount of water, compared to conventional liquid detergents. The level of water is less than 50%, preferably less than 30%, more preferably less than 20% of water by weight of the detergent compositions.

Said concentrated products provide advantages to the consumer, who has a product which can be used in lower amounts and to the producer, who has lower shipping costs.

The liquid compositions are especially effective when applied directly to soils and stains in a pretreatment step. The detergent compositions of the present invention can also be used as detergent additive products. Such additive products are intended to supplement or boost the performance of conventional detergent compositions.

The detergent compositions according to the present invention include compositions which are to be used for cleaning of substrates, such as fabrics, fibers, skin etc.,

for example laundry detergent compositions and automatic and non-automatic dishwashing compositions.

The following examples are meant to exemplify compositions of the present inventions, but are not necessarily

meant to limit the scope of the invention.

EXAMPLE 1

Aqueous liquid detergent compositions according to the present invention are prepared, having the following compositions :

% by weight of the total detergent composition

	A	B	C	D	E	F	G	H	I
Guerbet C ₁₂₋₁₅ alkyl ethoxylate (7EO)	4	8	15	10	20	10	8	3	10
Linear C ₁₂₋₁₄ alkyl ethoxylate (7EO)	4	-	-	3	-	-	-	7	-
Linear C ₁₂₋₁₄ alkyl sulphate. No salt	10	-	-	5	8	-	-	-	-
Guerbet C ₁₂₋₁₅ alkyl sulphate. No salt.	-	15	-	10	-	-	17	-	10
Linear alkyl benzene sulphonate	-	-	15	-	-	-	-	10	-
Linear C ₁₂₋₁₆ alkyl ether sulphate (EO3)	-	3	-	-	5	10	3	-	2
C12-14 N-Methyl glucamide	-	2	-	-	-	5	3	-	3
C12-14 fatty acids	10	10	10	10	10	10	10	10	10
Citric acid	1	1	1	1	1	1	1	1	1
Diethylenetriaminepentanethylenephosphonic acid	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
MEA	3	3	3	3	3	3	3	3	3
NaOH	up to pH 7.8								
1,2 Propane diol	3	3	3	3	3	3	3	3	3
Ethanol	10	10	10	10	10	10	10	10	10
Ethoxylated tetraethylene pentamine	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
Thermany ^R 300KNU/g	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13
Carezyme ^R 500 CEVU/g	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014
Protease 40mg/g	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
Lipolase ^R 100KLU/g	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14
Endoglucanase A5000 CEVU/g	0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.53
Water & minors (Isofol 12 ^R /Silicone)	up to 100 parts								

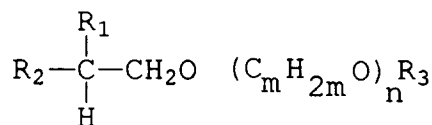
EXAMPLE 2

Non-aqueous liquid detergent compositions according to the present invention are prepared, having the following compositions :
% by weight of the total detergent composition

	A	B	C	D	E	F
Polyethyleneglycol 200	35	35	35	35	30	0
C ₁₂₋₁₄ EO 3	15	15	15	15	15	15
C ₁₂₋₁₄ EO7	15	15	15	15	15	15
Propanediol	0.6	0.6	1.1	1.1	0	35
Guerbet C ₁₂₋₁₅ alkyl ethoxylate (5EO)	5	5	10	10	6	10
Boric acid	0.82	1.67	1.67	3.28	1.7	1.2
Total parts						
Solid ingredients and minors up to 100						

Claims

1. A detergent composition comprising a nonionic surfactant system, said nonionic surfactant system comprising one or more of a surfactant selected from the group of Guerbet nonionic surfactants having the following formula :



- wherein R₁ and R₂ are independently C₃-C₂₂ alkyl groups, m is 2 to 4, n is greater than 0 and R₃ is a hydrogen or a C₁-C₂₂ alkyl group.
2. A detergent composition according to Claim 1 wherein n is between 1 to 14, more preferably between 1 to 10, most preferably between 3 and 7.
3. A detergent composition according to Claims 1-2 wherein the Guerbet nonionic surfactant is present in the nonionic surfactant system in levels from 1-100%, preferably from 10-90%, more preferably from 30-70% by weight from the nonionic surfactant system.
4. A detergent composition according to Claims 1-3 further comprising a nonionic surfactant selected from the poly-hydroxy fatty acid amides.
5. A detergent composition according to Claims 1-4 wherein the nonionic surfactant is C12-C14 N-methyl glucamide.
6. A detergent composition according to Claims 1-5 wherein the anionic surfactant is selected from an alkyl ethoxylated sulfate and/or alkyl sulfate.
7. A detergent composition according to Claim 1 further comprising surfactants, builders, enzymes and other conventional detergent ingredients.
8. Use of a detergent composition according to Claims 1-7 for pretreatment of fabrics.



European Patent
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EUROPEAN SEARCH REPORT

Application Number
EP 94 30 7794

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.6)
X	DE-A-22 43 307 (HENKEL) * page 10; claims; examples * ---	1-4,6-8	C11D1/72 C11D1/825 C11D1/835 C11D1/86
X	DE-A-23 01 728 (HENKEL) * claims; examples * ---	1-3,7,8	
X	DATABASE WPI Derwent Publications Ltd., London, GB; AN 86-121924 & JP-A-61 060 794 (LION CORP.) 28 March 1986 * abstract * ---	1-3,7	
X	DE-A-30 18 173 (HENKEL) * examples * ---	1-3,7	
X	DE-A-39 28 601 (HENKEL) * products A, B * * column 4; claims * ---	1-3,7	
X	DE-A-39 28 602 (HENKEL) * page 3; claims; examples * ---	1-3,7	TECHNICAL FIELDS SEARCHED (Int.Cl.6)
A	EP-A-0 593 406 (PROCTER&GAMBLE) * claims; examples * ---	1,5	C11D
A	WO-A-92 22629 (PROCTER&GAMBLE) * claims; examples * -----	1,5	
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 21 March 1995	Examiner Pfannenstein, H
CATEGORY OF CITED DOCUMENTS 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		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	

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