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(54) Biodegradable detergent
composition

(57) A biodegradable detergent
composition comprises an aqueous
solution of the following active
components:

A 2 to 35 parts by weight of a

higher (C₈₋₂₄) alkylphenyl polyglycol
ether having from 5 to 25 glycol
residues, or a mixture thereof,

B 5 to 35 parts by weight of an
alkanolamine, and

C 0.5 to 6 parts by weight of a
cation sequestering agent.

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SPECIFICATION

Biodegradable detergent compositions

This invention relates to biodegradable detergent compositions.

- 5 The invention provides a biodegradable detergent composition comprising an aqueous solution of the following active components:

A 2 to 35 parts by weight of a higher (C_{8-24}) alkylphenyl polyglycol ether having from 5 to 25 glycol residues, or a mixture thereof,

10 B 5 to 35 parts by weight of an alkanolamine, and

C 0.5 to 6 parts by weight of a cation sequestering agent.

- 15 Preferred compounds for component A are the commercially available isooctylphenol-, di-tert-butylphenol- or nonylphenol polyglycol ethers, or mixtures thereof, having an average of from 8 to 12, preferably 9 or 10, glycol units per molecule.

- 20 Preferred alkanolamines (component B) are mono-, di- and triethanolamine, particularly monoethanolamine, triethanolamine or mixtures thereof.

- The cation sequestering agent C is preferably an alkali metal gluconate or glucoheptonate, particularly sodium gluconate or glucoheptonate, or a nitrilcarboxylic acid at least partially in form of an alkali metal salt, e.g. nitrilotriacetic acid $[N(CH_2COOH)_3]$ or, preferably, ethylene-diamine-tetraacetic acid. Suitable alkali metal salts of nitrilcarboxylic acid are lithium, potassium or sodium, preferably sodium salts. Other suitable sequestering agents include alkali metal salts, preferably sodium salts, of a carboxy group containing polymer, e.g. homopolymers of acrylic acid, α -hydroxyacrylic acid, maleic acid, itaconic acid, mesaconic acid, citraconic acid or copolymers of such acids, or of such an acid with one or more further ethylenically unsaturated compounds, e.g. ethylene, propylene, vinyl alcohol, vinyl ether, vinyl acetate, furan, acrolein, acryl amide, methacrylic acid and the like.

- The detergent composition of the invention has a pH from 11 to 12.5, preferably from 11.5 to 12.5.

Preferred proportions of the active components A, B and C in the mixture (not taking into account the water present) are as follows. All percentages are by weight.

- 50 Component A — 15—70%, more preferably 15—50%

Component B — 15—70%, more preferably 20—60%

- 55 Component C — 1—30%, more preferably 3—25%

- The detergent composition contains the sum of the above 3 active components A to C in a total amount of 15 to 30% by weight, the remainder of the composition being water optionally in admixture with further ingredients such as specified below.

The detergent composition may be prepared by adding the components, preferably in the order in which they are described above, to demineralised

- 65 water and stirring until the mixture is homogeneous.

The detergent composition of the invention may contain further ingredients, e.g.:

- a sulphosuccinic acid (C_{6-12}) alkyl ester, preferably the commercially available isooctyl(=2-ethylhexyl) sulphosuccinate;
 70 — a condensation product of a (C_{16-18}) alcohol mixture (comprising unsaturated and saturated alcohols) with 10 to 15 mols ethylene oxide, preferably a mixture of cetyl- and oleyl alcohol ethoxylated with an average of 10 to 12 ethylene oxide units per molecule;
 75 — a sulphated unsaturated (C_{16-18}) carboxylic acid (C_{2-4}) alkyl ester, preferably a sulphated oleic acid (C_{2-4}) alkyl ester;
 80 — a higher (C_{8-14}) alcohol, preferably a branched-chain primary alcohol, for example a commercial mixture of saturated primary nonanols carrying 4-methyl groups, e.g.
 85 tetramethylnonanol;
 — a water-soluble silicone;
 — a lower (C_{1-4}) alcohol;
 — a (C_{2-6}) glycol, for example hexyleneglycol;
 — soap, preferably soft soap;
 90 — an organic solvent non miscible with water such as white spirit or a chlorinated hydrocarbon;
 — a dispersing agent, for example the sodium salt of an aromatic sulphonic acid, preferably sodium dinaphthylmethane disulphonate.
 95 Both the higher (C_{8-14}) alcohol and the water-soluble silicone are preferably present when a detergent composition providing little or no foam is desired.

- The amount of the above-mentioned ingredients depends on various factors, e.g. the ingredient used, the mode of cleaning, etc. In general, these ingredients may be present in an amount up to 20% by weight of the composition (including water); however, the dispersing agent may be present in a higher amount, depending on the use of such a composition.

- Preferred compositions are for example those containing components A, B and C as specified and further 0 to 5 parts by weight of a sulphosuccinic acid (C_{6-12}) alkyl ester, 0 to 10 parts by weight of a reaction product of a (C_{16-18}) alcohol mixture (comprising unsaturated and saturated alcohols) with 10 to 15 mols ethylene oxide, 0 to 10 parts by weight of a sulphated unsaturated (C_{16-18}) carboxylic acid (C_{2-4}) alkyl ester, 0 to 10 parts by weight of a higher (C_{8-14}) alcohol, and 0 to 2 parts by weight of a water-soluble silicone.

- The detergent composition according to the invention has a powerful cleaning action. It may be used for example for the cleaning and degreasing of metal, plastics, synthetic materials, glass and ceramics in all branches of industry, including the foodstuff, animal feed, pharmaceutical, automotive, photography and nuclear energy sector, e.g. machinery, machine parts, kettles, tanks, autoclaves, moulds, instruments, tools, filter press components and filter cloths. It may be used to remove deposits of

mineral oil, grease, graphite, blood, albumen, starch derivatives, dust, carbon, dyestuffs etc. It may also be employed for clearing surfaces, e.g. table tops, floors, walls of hospitals, smoke chambers, slaughterhouses, butcher shops and tunnels. When used for clearing steel and chrome nickel steel, the detergent composition exhibits an additional, highly advantageous anticorrosive effect.

- 10 The detergent composition of the invention is also indicated as a detergent for the washing (pre-, main- and/or after-washing) of dyed or undyed natural and regenerated cellulose fibres, e.g. cotton, linen, viscose staple fibres, and
- 15 polyester/cellulosic fibre blends; it may be used for domestic purposes or in industrial laundries for the cleaning of e.g. hospital and institutional linens, workwear, aprons, overalls etc. It can be used in the normal industrial laundry ranges, e.g.
- 20 discontinuous washing machines such as wash centrifuges and continuous machines such as washing tunnels.

The detergent composition of the invention may also be used for ultrasonic cleaning.

- 25 Mechanical parts such as ball bearings, gear wheels, watches, valves, nozzles, jewellery, crystals, quartz, medical instruments, glass laboratory equipments, electronic circuits etc. may be cleaned with the detergent composition in the presence of an ultrasonic generator. The detergent composition containing additionally a dispersing agent such as specified is particularly indicated for the ultrasonic cleaning.

- For cleaning contaminated objects in a full
- 35 bath, the aqueous detergent composition (15—30% of components A, B and optionally C) is suitably used in a concentration of 1 to 10% by weight in water, according to the nature of the contamination to be removed. For cleaning by
- 40 spraying or wiping on, the aqueous detergent composition is preferably used in a concentration of 5 to 30% by weight in water. As an addition in sand- or steam-blasting, the aqueous detergent composition may be used undiluted or in a
- 45 concentration of 5 to 10% by weight in water. As a washing detergent, the composition is used in an amount depending on the nature and the degree of the contamination to be removed; preferably, the aqueous detergent composition is
- 50 used in a concentration of 1 to 5% by weight.

The following Examples, in which all parts and percentages are by weight, illustrate the invention. The temperatures are indicated in Centigrades degrees.

55 EXAMPLE 1

To a container are added at room temperature 700 parts of demineralised water. The following components are then added singly in the order given, with continuous stirring. As each

60 component is added, stirring is continued until mixing is complete before addition of the next component.

110 parts commercial nonylphenol polyglycol ether containing 10 ethylene oxide units/mol, in

- 65 35% aqueous solution (corresponding to approximately 40 parts anhydrous substance)
100 parts monoethanolamine
40 parts commercial EDTA in sodium salt form (powder)
- 70 50 parts commercial isooctyl sulphosuccinate, in approximately 35% aqueous solution.
After stirring for a further 10 minutes—1 hour (according to the size of the batch), the composition is ready for use.

75 EXAMPLE 2

Example 1 is repeated, except that the initial quantity of water used is 715 parts and 100 parts of the nonylphenol polyglycol ether solution (35 parts anhydrous substance) is taken. To the

80 resulting 4-component solution is then added with stirring 20 parts tetramethylnonanol and 5 parts water-soluble silicone oil (commercial antifoaming agent).

- Stirring is continued until the resulting 6-
85 component mixture is homogeneous.

EXAMPLE 3

Laboratory apparatus contaminated with dried blood, brain substance and albumin, which has been left to stand for a long period, is soaked in an

90 aqueous medium containing from 3 to 5% (according to the degree of contamination) of the composition of Example 1, either for 2—3 hours at 80° or for 12 hours at room temperature. The apparatus is fit for reuse after rinsing with water.

95 EXAMPLE 4

Glassware, metal parts and plastic equipment contaminated with oil or grease can be reused after soaking in an aqueous medium containing from 1 to 5% (according to the degree of

100 contamination) of the composition of Example 1.

EXAMPLE 5

Metal and glass laboratory apparatus, contaminated with old deposits of dried blood and dyestuffs, can be cleaned in an automatic

105 dishwashing machine at 90° with an aqueous medium containing from 2—50 g/l of the composition of Example 2, without problems of excessive foaming.

EXAMPLE 6

By following the procedure of Example 1, there

110 is obtained a detergent composition containing, per 1000 parts:

- 70 parts of a mixture of nonyl/isooctyl phenol polyglycol ether containing an average of 10 ethylene oxide units/mol
- 115 40 parts commercial EDTA in sodium salt form (powder), and
100 parts monoethanolamine.

By replacing the ethylenediamine-tetraacetic acid component by sodium gluconate or

120 sodiumglucoheptonate, and monoethanolamine by triethanolamine, a detergent composition with similar properties is obtained.

EXAMPLE 7

White hospital linens are washed in a continuous washing tunnel with 18 sections according to the counter current principle. The pre-washing is carried out in sections 1 to 5, the temperature being raised from 20°C to 50°C. In section 1, 6 l of a solution containing, per 1000 parts, 12 parts of the detergent composition of Example 6 and 20 g of a commercial soil suspending powder, is added; a further amount of 3 l of the same detergent solution is metered into section 5. The main washing is effected at 80—95°C in sections 6—10. After rinsing at 80—60°C (sections 11 to 15), the linens are treated in section 16 at 20—30°C with a sodium hypochlorite solution (containing 0.85 parts sodium hypochlorite 30% for 1000 parts of soft water) and in section 17 at 20°C with a solution containing 0.1 part hydrogen peroxide 35 vol.% per 1000 parts. After neutralisation with acetic acid if necessary, the linens are rinsed in section 18 at 15—18°C with hard water.

Perfectly cleaned white linens are obtained.

EXAMPLE 8

Heavily soiled polyester/cotton protective clothing is washed in a continuous washing tunnel as indicated in Example 7. The pre-washing is carried out as disclosed in Example 7 except that the 6 l and 3 l of detergent solution metered into sections 1 and 3 respectively, contains, per 1000 parts, from 30 to 50 parts of the detergent composition of Example 6 and from 40 to 80 parts of a commercial soil suspending powder. The main washing is carried out at 80—85°C, a further amount of 4 l of the same detergent solution being metered into section 10. After rinsing at 80—60°C in sections 11 to 17 and, if necessary, neutralising in section 17 with acetic acid, the clothing is rinsed in section 18 with hard water at 15—18°C.

The washed clothing is perfectly clean.

EXAMPLE 9

By following the procedure of Example 1, there is obtained a detergent composition containing:
42.5 parts of the detergent composition of Example 6
2.5 parts of soft soap
5 parts of hexylenglycol, and
50 parts of a commercial dispersing agent
based on an aromatic sulphonic acid sodium salt.

EXAMPLE 10

Contaminated semiprecious stones or electronic circuits are cleaned at 70°C with a solution containing 1% of the detergent composition of Example 9 by ultrasonic treatment at 25 kHz for 90 sec.

EXAMPLE 11

Watch cases contaminated with polishing paste are treated at 70—80°C in a bath containing 4% of the detergent composition of Example 9, with ultrasonics for 90 sec.

CLAIMS

1. A biodegradable detergent composition comprising an aqueous solution of the following active components:
 - A 2 to 35 parts by weight of a higher (C_{8-24})alkylphenyl polyglycol ether having from 5 to 25 glycol residues, or a mixture thereof,
 - B 5 to 35 parts by weight of an alkanolamine,
 - and
 - C 0.5 to 6 parts by weight of a cation sequestering agent.
2. A biodegradable detergent composition of claim 1 in which the active components are present in the following proportions by weight, excluding the water present:
 - A — 15—70%
 - B — 15—70%
 - C — 1—30%
3. A biodegradable detergent composition of Claim 2, in which the active components are present in the following proportions by weight, excluding the water present:
 - A — 15—50%
 - B — 20—60%
 - C — 3—25%
4. A biodegradable detergent composition according to any one of the preceding Claims, in which the aqueous solution contains from 15 to 30% by weight of the total active components.
5. A biodegradable detergent composition according to any one of the preceding Claims, in which component A is an isooctylphenol-, di-tert-butylphenol- or nonylphenol polyglycol ether or mixtures thereof, having an average of from 8 to 12 glycol units per molecule, component B is mono-, di- or triethanolamine or mixtures, thereof, and component C is an alkali metal gluconate or glucoheptonate or ethylenediamine-tetraacetic acid at least partially in form of an alkali metal salt.
6. A biodegradable detergent composition according to any one of the preceding Claims, containing further ingredients selected from the group consisting of:
 - a sulphosuccinic acid (C_{6-12})alkyl ester;
 - a condensation product of a (C_{16-18})alcohol mixture (comprising unsaturated and saturated alcohols) with 10 to 15 mols ethylene oxide;
 - a sulphated unsaturated (C_{16-18})carboxylic acid (C_{2-4})alkyl ester;
 - a higher (C_{8-14})alcohol;
 - a water-soluble silicone;
 - a lower (C_{1-4})alcohol;
 - a (C_{2-6})glycol;
 - soap;
 - an organic solvent non miscible with water;
 and/or
 - a dispersing agent.
7. A biodegradable detergent composition according to Claim 6, containing from 0 to 5 parts by weight of a sulphosuccinic acid (C_{6-12})alkyl ester, 0 to 10 parts by weight of a reaction product of a (C_{16-18})alcohol mixture (comprising unsaturated and saturated alcohols) with 10 to 15 mols ethylene oxide, 0 to 10 parts by weight of a sulphated unsaturated (C_{16-18})carboxylic acid

- (C₂₋₄)alkyl ester, 0 to 10 parts by weight of a higher (C₈₋₁₄)alcohol, and 0 to 2 parts by weight of a water-soluble silicone.
8. A biodegradable detergent composition
- 5 according to Claim 7, containing from 0 to 5 parts of isooctylsulphosuccinate or 0 to 10 parts of a mixture of cetyl- and oleylalcohol ethoxylated with 10 to 12 ethylene oxide units per molecule, at least one of such a component being present.
- 10 9. A biodegradable detergent composition according to any one of Claims 1 to 6, containing additionally soap, hexyleneglycol, and a dispersing agent.
- 15 10. A biodegradable detergent composition according to Claim 9, in which the dispersing agent is the sodium salt of an aromatic sulphonic acid.
- 20 11. A biodegradable detergent composition according to any one of the preceding Claims, containing a branched-chain primary (C₈₋₁₄)alcohol and a water-soluble silicone.
- 25 12. A biodegradable detergent composition according to any one of the preceding Claims substantially as hereinbefore described with reference to any one of Examples 1, 2, 6 and 9.
13. A process for the preparation of a biodegradable detergent composition of any one of Claims 1 to 5 comprising the steps of adding
- the active components to demineralised water and stirring until the mixture is homogeneous.
- 30 14. A process according to Claim 13 substantially as hereinbefore described with reference to any one of Examples 1, 2, 6 and 9.
15. A process for cleaning contaminated
- 35 articles comprising treatment with a biodegradable detergent composition according to any one of Claims 1 to 11.
16. A process according to Claim 15 comprising treatment in a full bath with an
- 40 aqueous solution containing from 1 to 10% by weight of a detergent composition according to any one of Claims 1 to 8 and 11.
17. A process according to Claim 15 comprising spraying or wiping on with an aqueous
- 45 solution containing from 5 to 30% by weight of a detergent composition according to any one of Claims 1 to 8 and 11.
18. A process according to Claim 15 comprising ultrasonic treatment in the presence of
- 50 a biodegradable detergent composition according to any one of Claims 1 to 5 and 9 to 11.
19. A process according to any one of Claims 15 to 18 substantially as hereinbefore described with reference to any one of Examples 3, 4, 5, 7,
- 55 8, 10 and 11.