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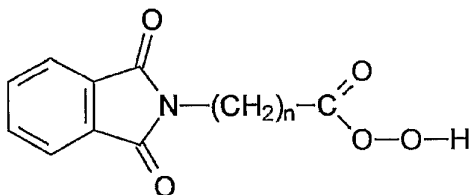
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(54) Title: BIOCIDIC DETERGENT



(I)

(57) Abstract: There is provided a disinfecting composition of an organic peroxiacid and a surfactant wherein the organic peroxiacid is selected from phthalimidopercarboxylic acids of the general formula (I), with n being an integer of from 1 to 5, and wherein the surfactant is selected from at least one non-ionic surfactant of the general formula (II), R<sup>1</sup>-(OC<sub>2</sub>H<sub>4</sub>)<sub>n</sub>-(OC<sub>3</sub>H<sub>6</sub>)<sub>m</sub>-OH, with R<sup>1</sup> representing a linear or branched alkyl or alkenyl group containing 7 to 20 carbon atoms and the sum of the mean degree

of ethoxylation n and the mean degree of propoxylation m lying between 0,5 and 7. Moreover a detergent useful for washing, cleansing and disinfecting, which contains the disinfecting composition is described.

## Biocidic Detergent

### FIELD OF THE INVENTION

5 [0001] The present invention relates to a disinfecting composition of an organic peroxiacid and a surfactant, and its use in detergents, especially in laundry detergents, cleansers and/or disinfectants.

### BACKGROUND OF THE INVENTION

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[0002] Especially with respect to the washing of textiles used in hospitals as well as in nursing areas of homes like for example homes for the aged there are strict requirements concerning the effectiveness of disinfecting agents. Generally, corresponding laundries use thermal or chemothermal methods for disinfecting washing. However, thermal disinfection is limited by the properties of the textiles.

[0003] Lately, a tendency towards the use of energy saving chemothermal methods can be observed. When applying chemothermal disinfecting procedures usually the disinfecting agent is added separately to liquid, powdered or pasty laundry detergents since the oxidating or bleaching ingredients commonly used in detergents do not exhibit disinfecting properties as well. Especially the known and customary bleaching system perborate/TAED (Tetraacetythylenediamine) is not appropriate for disinfecting textiles at low temperatures.

25 [0004] Disinfecting agents known in the art are for example peracetic acid containing compositions, compounds releasing active chloride as well as phenol derivatives. Because of the autoxidative effect of chloride and hypohalogenite formulations and the undesirable ecological properties of phenol derivatives, peracetic acid compounds are generally preferred for disinfective purposes.

30 However, these compounds do not sufficiently exhibit their disinfecting properties at temperatures lower than 60°C. Thus, delicate textiles which may not effectively be treated at temperatures above 40°C, cannot be disinfected by this method. The necessity to work at these excised washing temperatures generally represents increased stress to the textiles and accordingly decreases their lifetime. From the

economic as well as from the ecological point of view it also would be advantageous to reduce the disinfecting temperature, to save energy, and to maintain colors and textile lifetime.

[0005] Moreover, because of their aggressive properties peracetic acid compounds pose problems with respect to safety and handling, requiring specific safety measures like for example automatic dosing which may cause further costs and complicates the operation of the washing machine.

[0006] WO 01/48136 A1 describes the decrease of textile-fiber damaging effects induced by the presence of peroxiacids including phthalimidopercarboxylic acids, by using a disinfecting compound of a peroxiacid and a fatty acid, hydrotope, a surfactant and/or a complexing agent.

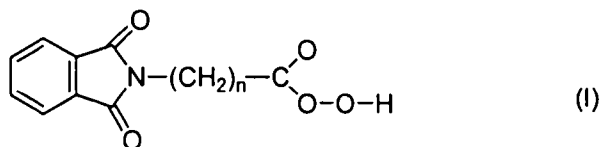
[0007] Phthalimidopercarboxylic acids and especially phthalimidoperoxycaproic acid may be prepared as described in EP 0 325 288 A1 and EP 0 349 940 B1, respectively. Both citations also mention their use as bleaching agents in detergent formulations for medium-low temperature washing.

#### SUMMARY OF THE INVENTION

[0008] Therefore, there is a need for a chemothermal disinfecting composition which may effectively be used at temperatures lower than 60°C and which does not only exhibit disinfecting properties but which as well serves further purposes in the washing process, for example as a surfactant or a bleaching/oxidizing agent.

A first aspect of the invention provides for a disinfecting composition consisting only of an organic peroxiacid and a surfactant wherein

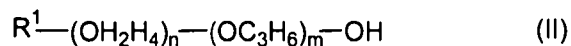
the organic peroxiacid is selected from phthalimidopercarboxylic acids of the general formula (I)



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wherein n is an integer of from 1 to 5,

and the surfactant is selected from at least one non-ionic surfactant of the general formula (II)



wherein  $R^1$  represents a linear or branched alkyl or alkenyl group containing  
5 7 to 20 carbon atoms, the sum of the mean degree of ethoxylation  $n$  and the mean degree of propoxylation  $m$  lies between 0.5 and 7 and having a disinfecting activity when used as a laundry detergent with 20 or 40 min contacting time.

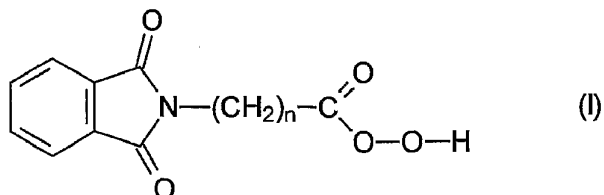
A second aspect of the invention provides for a detergent containing the disinfecting composition according to the first aspect of the invention, wherein the  
10 content of organic peroxiacid of the total detergent is between 3 and 30 percent by weight, preferably between 5 and 20 percent by weight.

A third aspect of the invention provides for the use of a detergent according to the second aspect of the invention for washing laundry.

A fourth aspect of the invention provides for a method of disinfecting laundry  
15 comprising applying to laundry a disinfecting composition according to the first aspect of the invention, wherein the contact time of the laundry with the disinfecting composition is 20 or 40 minutes.

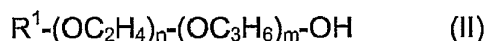
[0009] The present invention satisfies this need by providing a disinfective composition of an organic peroxiacid and a surfactant wherein the organic peroxiacid is  
20 selected from phthalimidopercarboxylic acids of the general formula (I)

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[0010] with n being an integer of from 1 to 5, and wherein the surfactant is selected from at least one non-ionic surfactant of the general formula (II),

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[0011] with  $R^1$  representing a linear or branched alkyl or alkenyl group containing 7 to 20 carbon atoms, the sum of the mean degree of ethoxylation n and the mean degree of propoxylation m lying between 0,5 and 7 and the weight ratio of peroxiacid and surfactant preferably being between 20:1 and 1:1, more preferred between 10:1 and 4:1.

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#### DETAILED DESCRIPTION OF THE INVENTION

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[0012] Phthalimidopercarboxylic acids and especially phthalimidoperoxicaproic acid may be prepared as described in EP 0 325 288 A1 and EP 0 349 940 B1, respectively. Both citations also mention their use as bleaching agents in detergent formulations for medium-low temperature washing. But while EP 0 325 288 does not refer to disinfecting effects of the above compounds at all, EP 0 349 940 B1 just generally mentions the disinfective properties of phthalimidopercaproic acid. However, this characteristic is increased if the non-ionic surfactant according to the present invention is present at the same time.

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[0013] WO 01/48136 A1 describes the decrease of textile-fiber damaging effects induced by the presence of peroxiacids including phthalimidopercarboxylic acids, by using a disinfecting compound of a peroxiacid and a fatty acid, hydrotone, a surfactant and/or a complexing agent. However, the disinfective compound is used

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- 4 -

only as disinfectant in combination with a common detergent composition and it is not a part of the detergent composition like in the present invention. Thus, one or more of the above mentioned compounds together with the peroxyacid are further added to a common detergent even if they already are identically contained therein. This leads to increased costs with respect to the higher amount of chemicals needed and to the chemicals having to be degraded after the washing process.

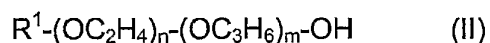
[0014] In contrast thereto one of the advantages of the inventive disinfecting composition is that the components represent typical ingredients of detergents, namely the organic peroxyacid functions as well as oxidizing/bleaching agent and the surfactant as cleansing component. Thus, the disinfecting composition does not have to be supplementary added to a common detergent composition but already represents a component thereof. This leads to a reduction in costs, in the total amount of required chemicals for the disinfecting washing process as well as in a simplification of the handling of the washing machine since the detergent exhibiting at the same time disinfecting and cleansing properties may be added in only one step.

[0015] Preferably, the weight ratio of peroxyacid to surfactant in the inventive disinfective composition is between 20:1 and 1:1, more preferably between 10:1 and 4:1.

[0016] In the composition according to the present invention the phthalimidocarboxylic acid may be selected from phthalimidoperacetic acid, phthalimidoperpropionic acid, phthalimidoperbutyric acid, phthalimidoperamylic acid and phthalimidocaproic acid, wherein phthalimidocaproic acid represents the most preferred organic peroxyacid.

[0017] The non-ionic surfactant used in the present invention is represented by the general formula (II),

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[0018] Therein  $R^1$  represents a linear or branched alkyl or alkenyl group containing 7 to 20 carbon atoms. Examples for the group used as  $R^1$  are  $C_9 - C_{15}$  alkyl or alkenyl groups, preferably  $C_{13}-C_{15}$  alkyl or alkenyl groups

5 [0019] The sum of the mean degree of ethoxylation  $n$  and the mean degree of propoxylation  $m$  ranges from 0,5 to 7. Preferably it is between 1 and 5, and more preferably between 1 and 3.

[0020] Preferably an ethoxylated  $C_{14-15}$  alcohol is used wherein  $n=4$ ,  $m=0$  and  
10  $R^1$  is  $C_{14-15}$  and/or an ethoxylated  $C_{13-15}$  alcohol wherein  $n=4$ ,  $m=0$  and  $R^1=C_{13-15}$ . The amount of non-ionic surfactant in the product is 1 to 5 wt-%..

[0021] In one embodiment of the present invention the disinfective composition is contained in a detergent, said detergent especially being used as laundry  
15 detergent for washing laundry and/or as cleanser and/or disinfectant for cleansing and/or disinfecting purposes. The content of organic peroxiacid of the total detergent preferably lies in the range of 3 to 30 percent by weight, more preferably 5 to 20 percent by weight. The detergent containing the disinfective composition according to the present invention may be manufactured in the form of an aqueous solution, gel,  
20 emulsion, paste, dispersion, powder, granules, scales, pearls, tablets, solid block form, extrudates and other forms known in the art, but preferably represents a powder. The inventive disinfective composition may be incorporated into the detergent either as such or in combination with further additives, for example boric acid, sulfate, phosphate, carbonate, zeolite, carboxymethylcellulose or filmbuilding  
25 agents like fatty acids, fatty acid amides or esters etc. in the forms above mentioned for the detergent or agglomerated. In a preferred embodiment the disinfective composition is added to the other ingredients of the detergent without further additives in form of a powder.

30 [0022] The detergent of the present invention may be used as a laundry detergent, preferably as a textile detergent, and is not only suitable for generally washing laundry, but as well for disinfecting and at the same time mildly washing all kinds of fabrics and textiles commonly used. The laundry detergent is especially

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appropriate for washing delicate textiles like, for example, ones containing or consisting of wool, silk, polyacryl, rayon, polyamide, acetate.

[0023] Since the phthalimidoperoxiacids mainly exhibit their bleaching activity  
5 with respect to contaminations like blood, tea or red wine while not attacking the color of the textiles, the detergent containing the disinfective composition of the present invention is as well appropriate for washing colored textiles without excessively bleaching the color of the textile.

10 [0024] Since the phthalimidoperoxiacids launch into disinfecting as well as into bleaching activity at temperatures below 60°C, preferably the detergent of the present invention is applied at temperatures below 60°C, more preferably below 50°C and most preferably below 45°C. This reduction in washing temperature results in saving energy but as well prevents the laundry from rapidly being overstressed by  
15 repeated washing applications.

[0025] Besides, the detergent according to the present application may be used as cleanser and/or disinfectant for cleansing and disinfecting various kinds of hard surfaces like, for example, in the medicinal or institutional field, in the food  
20 preparing, processing and/or selling industry, in agriculture, in hotel business, catering trade and/or in public buildings and/or institutions. It may as well be useful in further applications in which a disinfected surface is required or desired and which are not explicitly mentioned herein. The surfaces supposed to become disinfected may be made of common materials mentioned in the state of the art like, for  
25 example, metal, glass, ceramic, plastic, (coated) wood.

[0026] Before being used in a washing cycle or in the cleansing and/or disinfecting process the detergent according to the present invention will be diluted with water. Preferably, the concentration of the organic peroxiicid in the diluted  
30 detergent should be 0.7 g/L or more.

[0027] Apart from the disinfecting composition according to the present invention the detergent may contain any additive or active ingredient commonly used

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in corresponding washing, cleansing and/or disinfecting agents like builders, surfactants, soaps, zeolites, hydrotropic agents, corrosion inhibitors, enzymes, optical brighteners, stabilizers, abrasives, perfumes, coloring agents.

- 5 [0028] In the following the disinfective composition and its disinfective activity in laundry detergents will be exemplified without being restricted to these examples.

### EXAMPLES

- 10 [0029] The inventive disinfecting composition was incorporated into a washing detergent and the disinfective activity determined according to the guidelines of DGHM (Deutsche Gesellschaft für Hygiene und Mikrobiologie), published in: Hyg. Med., 23 (1998), p. 127-129. In accordance with this guideline the testing-germs *Enterococcus faecium*, DSM 2146 (K3330), and *Mycobacterium terrae*, DSM 43227  
15 (K3686) were used to determine the disinfecting activity in the following examples. The results obtained therewith are regarded as being transferable to any microbe supposed to be killed in disinfecting measures.

- [0030] A chemothermic washing method is to be regarded as disinfecting if a  
20 reduction of testing-germs on the germ-carrier of greater than 6.78 log-steps within a determined time period at a specific dosage and a prescribed bath ratio of 1:5 is obtained. Moreover, any testing germ must not be detectable in 100 ml washing bath. The laundry was loaded with 12,5 ml defibrinated sheep blood per kg laundry. The contaminated germ-carriers were dried for 3 hours at 37°C before the starting the  
25 testing.

- [0031] The composition of the tested washing compositions according to the present invention as well as the ones commonly used in the art used as comparative examples are presented in table 1. The tests were carried out using a Frista washing  
30 machine with a washing bath of 37,5 L, a washing stock of 7,5 kg prewashed, disinfected, dried kitchen towels, thus leading to a bath ratio of 1:5.

- [0032] In the following examples a product concentration of 5 g/L was applied.

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[0033] As basic surfactant the following composition is used:

Compound	amount in wt-%
Na-Al-silicate	35.0
Caustic soda	0.51
Hydroxyethandiphosphonic acid, Na salt	0.5
Sulfinic acid, Na salt	9.12
Stearic/palmitic acid	1.3
Maleic acid/acrylic acid copolymer, Na-salt	4.98
C <sub>13-15</sub> Oxoalcohol with 7 EO Einheiten/Mol	3.5
Water-glass	4.0
Na-sulfate	31.5
Water	9.59

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As phthalimidoperoxicarboxylic acid PAP EURECO (phthalimidopercaproic acid), obtainable from Solvay, Ausimont.; as non-ionic surfactant according to the present invention a combination of Neodol 45-4, obtainable from Shell, and Lutensol AO4, obtainable from BASF, as comparative bleaching compounds either a combination of Na-perborate • 1H<sub>2</sub>O, and TAED or Sodium-2-phenylphenolate x 4H<sub>2</sub>O were used.

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[0034] All values indicated in table 1 refer to percent by weight. The remaining substances adding to 100 percent by weight represent common additives used in washing detergents.

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Table 1

Ingredients	Ex. 1	Ex. 2	CE 1	CE 2	CE 3	CE 4	CE 5
Basic surfactant	70,20	59,70	65,55	62,80	66,05	68,7	55,7
Non-ionic Surfactant	3,50	3,50	3,50	3,50	3,50	3,50	3,50
PAP	20,00	30,00	-	-	-	-	-
Na-perborate • 1H <sub>2</sub> O	-	-	15,00	15,00	15,00	-	10,00

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TAED	-	-	8,15	10,90	8,15	-	3,00
Preventol	-	-	-	-	-	25,00	25,00
Citric Acid	4,00	4,00	4,00	4,00	4,00	-	-
Enzyme	0,20 <sup>1</sup>	0,70 <sup>2</sup>	0,50 <sup>1</sup>	0,50 <sup>1</sup>	-	0,70 <sup>2</sup>	0,70 <sup>2</sup>
Others	2,10	2,10	3,30	3,30	3,30	2,10	2,10

<sup>1</sup>Duozym A 5 (mixture of protease and amylase), <sup>2</sup>Savinase 16T (Novozyme)

[0033] In table 2 the results obtained from the determination of the disinfecting effect of the disinfective laundry detergent according to the present invention (Ex. 1 and 2) in comparison with the comparative detergents commonly used in the art (CE 1 to 5) are presented. In each of the testings a first contact time was 5 minutes at 30°C. The duration of the second contact time at 40°C is listed separately in table 2 for each testing. The disinfective effect is determined in form of the reduction factors (RF) obtained as the average of 10 measurements. Moreover, 6 sterile germ-carriers were added to each washing cycle and the germ-growth was determined after an incubation period of 21 days at a temperature of 37°C.

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[0034] In none of the testings germs were detectable in 100 ml washing bath.

Table 2

	2 <sup>nd</sup> Contact- time [min]	Myobacterium terrae DSM 43227			Enterococcus faecium DSM 2146		
		Germ-count / Germ- carrier	RF	Germ-growth on sterile washed germ- carriers	Germ-count / Germ- carrier	RF	Germ-growth on sterile washed germ- carriers
Ex. 1	20	3 x 10 <sup>7</sup>	>6,78	negative <sup>1</sup>	4,37 x 10 <sup>7</sup>	>6,91	negative <sup>2</sup>
	40	3 x 10 <sup>7</sup>	>6,78	negative <sup>1</sup>	4,37 x 10 <sup>7</sup>	>6,91	negative <sup>2</sup>
Ex. 2	40	5,17 x 10 <sup>7</sup>	>7,01	negative <sup>3</sup>	9,57 x 10 <sup>7</sup>	>7,28	negative <sup>2</sup>
CE 1	20	4,00 x 10 <sup>7</sup>	<1,90	positive <sup>3</sup>	7,60 x 10 <sup>7</sup>	5,71	positive <sup>2</sup>
CE 2	20	4,00 x 10 <sup>7</sup>	<1,90	positive <sup>3</sup>	7,60 x 10 <sup>7</sup>	4,88	negative <sup>2</sup>
CE 3	20	4,00 x 10 <sup>7</sup>	<1,90	positive <sup>3</sup>	7,60 x 10 <sup>7</sup>	4,03	positive <sup>2,4</sup>
CE 4	40	5,17 x 10 <sup>8</sup>	3,79	positive <sup>3</sup>	1,42 x 10 <sup>8</sup>	>7,45	negative <sup>2</sup>
CE 5	40	5,17 x 10 <sup>7</sup>	<3,53	positive <sup>3,5</sup>	1,42 x 10 <sup>8</sup>	5,95	positive <sup>2</sup>

<sup>1</sup>Middlebrook-Bouillon, <sup>2</sup>TLH-Thio-Brain-Heart-Bouillon, <sup>3</sup>TLH-Thio-Middlebrook-Bouillon, <sup>4</sup>Low growth on 1 of 6 germ-carriers and on subculture on Kanamycin-agar <sup>5</sup>Low growth on 4 of 6 germ-carriers and on subculture on Middlebrook-agar

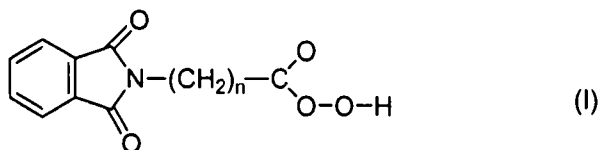
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[0035] The above results clearly demonstrate that, in contrast to a combination of non-ionic surfactant and bleaching agent commonly used as laundry detergent, the combination of non-ionic surfactant and organic peroxyacid according to the present invention shows a disinfective activity if used as a laundry detergent with 20 as well as 40 minutes contacting time. Thus, it is no longer necessary to use a disinfective agent additionally to a bleaching agent in a detergent composition, but in the inventive composition one ingredient exhibits both properties. Only examples 1 and 2 according to the invention show a disinfective effect on both germs, namely *Myobacterium terrae* and *Enterococcus faecium*. In contrast thereto examples CE 1 and CE 5 show nodisinfecive effect and the comparative examples CE 2-CE 4 only show an effect on *Enterococcus faecium*.

The claims defining the invention are as follows:

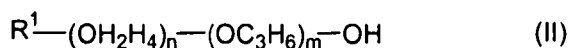
1. A disinfecting composition consisting only of an organic peroxiacid and a surfactant wherein

the organic peroxiacid is selected from phthalimidopercarboxylic acids of the general formula (I)



wherein n is an integer of from 1 to 5,

and the surfactant is selected from at least one non-ionic surfactant of the general formula (II)



wherein  $\text{R}^1$  represents a linear or branched alkyl or alkenyl group containing 7 to 20 carbon atoms, the sum of the mean degree of ethoxylation n and the mean degree of propoxylation m lies between 0.5 and 7 and having a disinfecting activity when used as a laundry detergent with 20 or 40 min contacting time.

2. The composition according to claim 1, wherein the weight ratio of peroxiacid to surfactant is between 20:1 and 1:1, preferably between 10:1 and 4:1.

3. The composition according to any one of claims 1 or 2, wherein the sum of the mean degree of ethoxylation n and the mean degree of propoxylation m of the non-ionic surfactant according to formula (II) is between 1 and 5, preferably between 1 and 3.

4. A detergent containing the disinfecting composition according to any one of claims 1 to 3, wherein the content of organic peroxiacid of the total detergent is between 3 and 30 percent by weight, preferably between 5 and 20 percent by weight.

5. The detergent according to claim 4, wherein the detergent is in the form of a powder.

6. The detergent according any one of claims 4 or 5, wherein the detergent is a textile detergent.

7. Use of a detergent according to any one of claims 4 to 6 for washing laundry.
8. Use of a detergent according to claim 7 for washing colored laundry.
9. Use of the laundry detergent according to any one of claims 7 or 8 for  
5 disinfecting washing.
10. Use of the laundry detergent according to any one of claims 7 to 9 for mild washing.
11. Use of the laundry detergent according to any one of claims 7 to 10 for disinfecting washing of delicate textiles.
- 10 12. Use of the laundry detergent according to any one of claims 6 to 11 at temperatures below 60°C, preferably below 50°C and more preferred below 45°C.
13. Use of the laundry detergent according to any one of claims 6 to 12, wherein said detergent is diluted during the washing process to a concentration of 1 to 10 g/L, preferably 4 to 8 g/L.
- 15 14. The detergent according to any one of claims 4 or 5, wherein the detergent is a cleanser and/or a disinfectant.
15. Use of the detergent according to any one of claims 4, 5 or 14 to cleanse and/or disinfect.
16. Use of the cleaner and/or disinfectant according to claim 14 for  
20 cleansing and/or disinfecting surfaces in the medicinal or institutional field, in the food preparing, processing and/or selling industry, in agriculture, in hotel business, in catering trade and/or in public buildings and/or institutions.
17. Use of the cleaner and/or disinfectant according to any one of claims 15 or 16, wherein said cleanser and/or disinfectant are diluted before use.
- 25 18. Use of the laundry detergent, cleanser and/or disinfectant according to any one of claims 13 to 17, wherein the diluting agent is water and/or one or more common diluents and/or auxiliaries.

19. A method of disinfecting laundry comprising applying to laundry a disinfecting composition according to any one of claims 1 to 3, wherein the contact time of the laundry with the disinfecting composition is 20 or 40 minutes.

5 20. A disinfecting composition comprising an organic peroxyacid and a surfactant as defined in claim 1 and substantially as hereinbefore described with reference to Example 1 or 2.

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