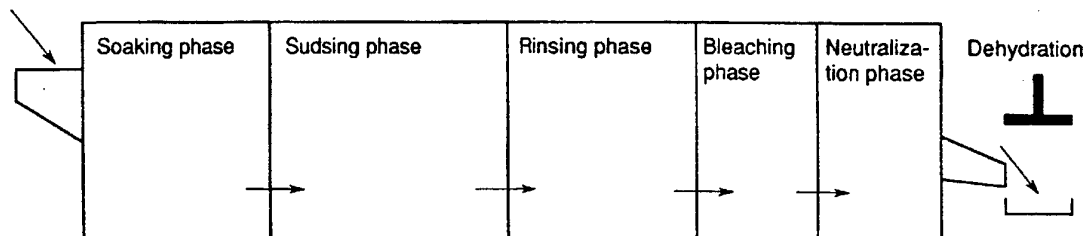




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(54) Title: PEROXY ACIDS OR PRECURSORS THEREOF FOR USE IN THE CLEANING OF TEXTILE, AND PROCESSES FOR CLEANING TEXTILE BY MEANS OF SUCH PEROXY ACIDS OR PRECURSORS



(57) Abstract

The invention provides processes for the cleaning of textile by means of wet cleaning processes, in particular carried out in washing tubes. The present invention comprises a process for cleaning textile by means of wet cleaning in at least five phases, comprising a soaking phase, at least one sudsing phase, a rinsing phase, a bleaching phase, and a neutralization phase, in which in a second sudsing phase or in the rinsing phase a peroxy acid having at least 6 carbon atoms or a compound converted in situ into such a peroxy acid is added. The invention further comprises the use of peroxy acid having at least six carbon atoms or a compound giving in situ a peroxy acid having at least six carbon atoms for use as a disinfectant or bacteriostatic agent and/or as a bleaching agent in such a process.

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Title: Peroxy acids or precursors thereof for use in the cleaning of textile, and processes for cleaning textile by means of such peroxy acids or precursors.

The present invention relates to the cleaning of textile by means of wet cleaning processes, in particular industrial laundering processes.

The object of wet cleaning is to remove dirt and stains
5 and to clear the laundry of microorganisms and materials giving the laundry an unpleasant smell.

The kinds of dirt occurring in textile can be subdivided into water-soluble dirt and water-insoluble dirt that partly consists of suspendable or emulsifiable dirt.

10 Water-soluble dirt comprises, e.g., sugars, acids, salts, and urea; water-insoluble dirt comprises, e.g., sand, clay, proteins, fats, oils, soot, dyes, and microorganisms.

Suspendable and emulsifiable dirt comprises, inter alia, proteins, starch, foods, fats, oils, and blood constituents.

15 The invention particularly relates to wet cleaning processes carried out in a so-called washing tube or washing line. A washing tube is a (semi)continuous washing equipment comprising a number of successive chambers. In the different chambers different phases of the washing process are carried
20 out, of which a phase can extend over more than one chamber. The phases (see Fig. 1) of such a wet cleaning process mostly comprise a soaking phase, one or more sudsing phases, a rinsing phase, a bleaching phase, and a neutralization phase. In the soaking phase the dirty laundry is contacted with water
25 and a detergent so that the dirt can swell. The actual washing

step takes place in the sudsing phase in which washing is carried out at a temperature of about 85°C in the presence of a washing agent. In the subsequent rinsing phase washing agent and detached dirt are rinsed out. Bleaching agent is added in the bleaching phase in order to oxidize and/or discolor soils that cannot be washed out. Finally, in the neutralization phase residues of washing agent and bleaching agent are neutralized and rinsed out.

In general, the different phases of the washing process are spatially separated in a washing tube (see Fig. 2). The figure shows a conventional washing tube. In chambers 1 through 3 soaking takes place. The sudsing phase is carried out in chambers 4 through 8. In this phase it is possible to supply steam at different places to increase the sudsing temperature.

In the sudsing phase the process is carried out partly in countercurrent. The waste water is discharged into chamber 4.

The sudsing phase is followed by the rinsing phase which is generally also carried out in countercurrent.

The rinsing phase is followed by the bleaching phase in which hitherto hypochlorite solutions are generally used, in particular in processes for cleaning white laundry and wash-fast and chlorine-fast colored laundry.

The last phase is the neutralization phase in which basic washing agent residues and hypochlorite are mostly neutralized by means of sodium hydrogen sulfite (bisulfite).

In an alternative process, the hydrogen peroxide process, peroxide, instead of hypochlorite, is added in a second

sudsing phase. In this case there is no separate bleaching phase.

The bleaching agents and/or disinfecting agents hitherto used, particularly in combination with the conventional
5 neutralization by means of sulfite, have a number of drawbacks.

Firstly, different textile fibers are poorly resistant to sodium hypochlorite and/or peroxide; the fibers are attacked by them. This attack results in a reduction of the strength of
10 the textile. Thus, cellulose fibers are damaged by sodium hypochlorite and hydrogen peroxide, particularly at the relatively high washing temperatures. Proteinic fibers are poorly resistant to hypochlorite. However, e.g. polyamide is poorly resistant to compounds containing active oxygen, such
15 as perborate and hydrogen peroxide. For this reason the use of these processes is actually limited to cotton and white laundry.

Because certain kinds of dirt are hard, if at all, to remove with a washing agent, a bleaching process is often
20 necessary. Dye stains and burned-in proteinic stains can only be removed by means of a bleaching treatment or a treatment with hot caustic soda.

In general, bleaching is carried out with a sodium hypochlorite solution at a pH of about 9.5-11 and at a
25 temperature of 25°C. The active chlorine concentration is about 0.25 g/l at a bleaching time of about 10 minutes. A higher temperature gives too much chemical wear.

The use of perborate and/or hydrogen peroxide requires a higher temperature ($>60^{\circ}\text{C}$) in order to obtain a somewhat bleaching action.

Moreover, the environment for these bleaching agents must
5 be strongly basic. For this reason they are mostly added in a second sudsing phase.

The above-described bleaching agents also have a somewhat disinfecting action, although the disinfecting action of peroxide is not great.

10 The procedures according to the prior art, however, cannot prevent the reinfection of the textile with microorganisms in the last phases of the washing process because the disinfecting agent must be completely neutralized. Particularly in the case of hypochlorite complete
15 neutralization is necessary because strong chemical wear occurs in the presence of residues of active hypochlorite in the laundry or the water to be fed back to the process.

In the industrial wet cleaning treatment it is of great importance that water and energy be treated efficiently for
20 the purposes of cost control and reduction of the amount of waste water.

The water consumption of a washing tube is no less than 13 l (including steam) per kg of laundry.

In waste water from laundries, inter alia detergents,
25 soda, silicate, sodium sulfite, and dirt occurs. It is therefore of great importance for laundries to limit the amount of waste water.

A good possibility of saving water and energy is to feed back (purified) process water to other parts of the process.

In the hypochlorite process (see Fig. 2) this can be done with water after the neutralization phase, which may be reused
5 in the soaking phase; and with water after the sudsing phase which can be used again in the soaking phase and/or sudsing phase. In the hydrogen peroxide process (see Fig. 3) water after the first sudsing phase can be added again to the beginning of the first sudsing phase. Without the present
10 invention this is the most feasible reuse of process water.

Moreover, in processes in which hypochlorite or hydrogen peroxide is used process water must be added again with care because, e.g., the water to be fed back to the soaking bath is warmer than is conventional in the soaking phase and that in
15 the presence of residual hydrogen peroxide fixation of proteinic stains occurs, while in the case of hypochlorite a strong bleaching action and therefore chemical damage to the textile occurs owing to the increased temperature.

The present invention provides a process, compositions,
20 uses, and a device using a special peroxide compound, in which reinfection by microorganisms in the last washing phases - either through a bactericidal action or through a bacteriostatic (germicidal) action - does not occur, a high degree of reuse of the process water is possible, and yet a
25 sufficient bleaching action is obtained.

The present invention comprises a process for wet cleaning textile in at least five phases comprising a soaking phase, at least one sudsing phase, a rinsing phase, a bleaching phase,

and a neutralization phase, in which in a second sudsing phase or in the rinsing phase a peroxy acid having at least 6 carbon atoms or a compound converted in situ into such a peroxy acid is added. In fact, in the process according to the invention
5 the bleaching step is thus physically combined with a second sudsing phase or the rinsing phase. In the process according to the invention the same washing result can be obtained using a washing line having a lower capacity, or the overcapacity of the washing line can be utilized for other purposes.

10 A report from the Instituut voor Reinigingstechnieken TNO (Institute for Cleaning Techniques) summarily describes a comparable process in so-called "open end" washing machines [M332 CO]. According to the report, the washing processes described therein did not even satisfy the hygiene
15 requirements to be imposed on washing processes, certainly in the wet cleaning industry, whereas DPDDA in the process described in this report is used in a concentration of 100 mg of active oxygen per liter, or 4.1 g DPDDA per kg of fabric, which concentration is high and largely falls outside economic
20 feasibility.

The addition of a much shorter peroxy acid in the last phase of the washing process is known per se. The international patent application 91/03590 illustrates the use of peracetic acid in combination with acetic acid as a
25 disinfectant. Furthermore, the possible use of performic acid and perpropionic acid is suggested. It is not used as a bleaching agent, nor can it be used als a disinfectant of prolonged action, since it does not properly adhere to the

laundry. Besides, the short percarboxylic acids, e.g. peracetic acid, have a good many practical drawbacks. They are corrosive, mordant and cause irritation of skin, eyes and bronchial tubes. In fact, only in fully automatized dosing
5 devices can it be processed safely.

Besides, it is known from Belgian patent 860,743 that aqueous suspensions of alkyl peroxy-carboxylic acids having a water solubility of less than 1% have an antimicrobial action. Furthermore, EP-A-0 386 566 describes solid peroxy-carboxylic
10 acid suspensions which include a specific non-ionic tenside. The problem underlying this publication is how to provide a percarboxylic acid composition that is both chemically stable and stable during storage. Finally, reference is made to U.S. patent 4,147,720, describing a process for preparing diperoxy
15 dicarboxylic acids capable of being used in the process according to the invention. None of the publications, however, describes the process according to the invention or suggests the advantages of this process. In particular, the prolonged disinfecting action and the bacteriostatic activity of such
20 compounds in washing tubes are neither described nor suggested.

By using in the process according to the invention a peroxy acid having a somewhat longer hydrocarbon residue, or a compound converted into it during the washing process, a
25 surprisingly better disinfection and a good bacteriostatic action is obtained because at least part of the peroxy acid adheres to the fibers of the textile so that peroxy acid remains present in the laundry after washing and thus the

disinfecting action of that peroxy acid also remains present after the neutralization phase.

More in detail, it has been found when carrying out the process according to the invention that the use of the percarboxylic acids having at least 6 carbon atoms gives a clear bacteriostatic action, in particular with respect to bacillus spores. Spores of Bacillus cereus and Bacillus subtilis form part of the normal soiling of many kinds of laundry. In the spore form these microorganisms can even withstand conventional washing processes, in spite of the fact that these washing processes comprise a thermic disinfection step in which microorganisms are killed. By the presence of the peroxy acid according to the invention these spores do not germinate in the last phase of the washing process so that no vegetative cells that can multiply are formed in the laundry. Besides, the spores can be easily rinsed out.

The peroxy acid used according to the invention also remains active during storage of the moist laundry until the drying process so that then the spore-forming microorganisms do not multiply either.

During drying at higher temperatures (e.g. 110-150°C) the peroxy acids adhering to the laundry decompose. This decomposition provides that microorganisms and spores deactivate. This means an additional improvement over known washing processes. A problem frequently occurring in the known washing processes is that laundry in moist condition is going to develop an unpleasant smell owing to germination of the above spores. In fact, it has been found that the short-chain

peroxy acids used in the known washing processes evaporate or hydrolyze rapidly to form acids and the volatile hydrogen peroxide.

Peroxy acids for use in the process according to the invention are compounds satisfying the formula $R-(C=O)-OOH$ in which R is a carbon chain or substituted carbon chain having at least 5 carbon atoms. Also, compounds satisfying the formula $HOO(C=O)-R_1-(C=O)OOH$ in which R_1 contains at least 4 carbon atoms in the main chain, which main chain may or may not be substituted with substituents conventional in this field of the art, can be used for the invention. Particularly suitable substituents are, e.g., sulfonyl groups and nonylamino groups.

A number of peroxy acids to be used in the washing process is described in, e.g., European patent application No. 0 376 360, but also other peroxy acids, as described in European application No. 0 458 327, e.g. N-carbamoyl-11-aminoperoxyundecanoic acid can be used according to the invention. Because of the commercial availability, preference is given to the use of diperoxyl-dodecanedioic acid (DPDDA).

In general, the above-mentioned peroxy acids are readily biodegradable. Processes are further known for formulating the above peroxy acids to fully safe products. Safe products can be in the form of granules or aqueous suspensions. For use in wet cleaning processes preference is given to suspensions.

Compositions of insoluble peroxycarboxylic acids containing alkyl groups and suspended in water are, as stated above, extensively described in the prior art. A feature of

such suspensions is that they contain additives preventing the sagging or creaming of the peroxy compounds. Known stabilizing agents are described in GB-A-153 504, EP-A-0 160 342, EP-A-0 176 124, EP-A-0 188 025, EP-A-0 201 958, 5 EP-A-0 283 791, EP-A-0 283 792, EP-A-0 347 988, and EP-A-0 386 566.

These compositions further comprise additives for ensuring or at least improving chemical stability. Known possibilities of influencing chemical stability comprise the addition of 10 specific sequestering agents and the limitation of the acidity to a pH in the range of 3 to 5.

It is not necessary for the process according to the present invention that because of security aspects compounds like triethylene glycol are used, as taught in EP-A-0 412 599.

15 Although, in practice, many compositions containing percarboxylic acid can be used, the process according to the invention preferably makes use of a suspension free of surface active compounds. This suspension can be dosed into the washing tube in the final phase of the washing process. A 20 suspension with which excellent results are obtained in the process according to the invention comprises 20-35%, preferably 25-30%, most preferably 27% DPDDA; 2-5%, preferably 3-4% sodium sulfate; about 0.2% xanthane gum; and about 0,2% hydroxyethyl cellulose in water having a pH adjusted to a 25 value in the range of 3 to 4, preferably 3.7. In such a composition the percentage of active oxygen is about 3%. The specific composition is readily pumpable and phase-stable.

Although the amount of peroxy acid required per kg of laundry and/or per liter of washing liquid is not directly critical and is substantially determined by the degree of pollution of the laundry, the amount of peroxy acid will
5 mostly range between 10 and 50 mmol per kg of dry laundry, which corresponds to 2 to 10 mmol per liter of washing liquid.

Instead of the conventional neutralization step with bisulfite a neutralization with an acid is carried out for the present invention. This acid can be both an inorganic acid,
10 e.g. phosphoric acid, and an organic acid. If preference is given to the use of an organic acid, in particular acetic or formic acid is used.

By selecting this neutralization step, the disinfecting action of the peroxy acid is further enhanced, while
15 detergents and other washing agent ingredients are readily neutralized.

The acid is preferably added in such an amount that a pH of 7.5 to 5, preferably between 7 and 6, is obtained in the laundry, which for formic acid corresponds to, e.g., 1 g per
20 kg of dry laundry.

In contrast to the prior art washing processes a thermic disinfection is not necessary because the disinfection of the peroxy acid in combination with the activation thereof by the acid is sufficient. For this reason the washing step can be
25 carried out at a much lower temperature, which leads to a considerable saving of energy and, moreover, gives fewer problems when the process water is fed back to the soaking phase. Preferably, the washing process according to the

invention is therefore carried out at a temperature between 25 and 75°C, in particular at a temperature between 45 and 65°C.

The processes according to the invention can be carried out within broad limits for the pH. In the neutralization
5 phase the process is carried out with acid, hence the pH is lower then, also for the purpose of better activating the peroxy acids.

An important advantage of the invention over the prior art processes is that a much larger amount of process water can be
10 reused in the washing process. The temperature of the water from the sudsing phase is lower than the temperature of the preceding phase(s) and can therefore more easily be fed back to the soaking phase in which the temperature must not be too high because of the possible burning in of stains. In the
15 prior art processes the temperature of the sudsing phase cannot be lowered because that high temperature is necessary for thermic disinfection. Fig. 4 shows a washing process according to the invention in which at different places process water is fed back into the washing process.

20 Optionally, before feeding back to the process the process water to be fed back, it is subjected to a purification step. In this step factors that may disturb the washing process are removed from the water as much as possible, by means of known separation techniques, e.g., membrane separation techniques.
25 By selecting the separation technique in such a manner that it can be used in the process, heat losses can be limited. The use of this method results in a more efficient energy economy and a reduced consumption of water and washing agent, while it

is possible to reduce the degree of pollution of the waste water to be discharged. The presence of peroxy acids as used according to the invention in these purification steps prevents the occurrence of pollution by the germination and
5 growth of microorganisms and, consequently, of a reinfection of the laundry as a result of reuse of the water to be recycled.

The lower washing temperature which can be obtained because of the better chemical disinfection of the laundry by
10 the peroxy acids according to the invention enables a much more intensive reuse of the water.

The peroxy acids for use in the invention can be added in the washing process in many ways, e.g. in a solution with conventional solvents, as a granulate with the conventional
15 fillers, as a suspension, or as a paste. They can also be added together with the washing agent in the (or the first or second) sudsing phase.

The peroxy acids according to the invention and the processes according to the invention can be combined with all
20 conventional further treatments of the laundry. They can be used in processes with the conventional steps and with the conventional agents, particularly in the so-called industrial wet cleaning processes in which washing tubes or washing lines are used.

25 The industrial wet cleaning process is generally carried out with the following agents.

Soap and/or detergents

In the industrial wet cleaning process soaps are still being used regularly, particularly in combination with synthetic detergents. Soaps are in general sodium and/or
5 potassium salts of fatty acids. The sodium salts generally give hard soaps, whereas the potassium salts give the soft soaps.

As synthetic detergents which, in structure, often resemble soaps, anionic, non-ionic, cationic or amphoteric
10 detergents are used.

The anionic washing agents include, inter alia, known alkylaryl sulfates, alkyl sulfonates, alkyl sulfates, sulfated alkylene oxide condensates, etc.

Non-ionic washing agents are, inter alia, alkyl polyglycol
15 ethers, amine oxides, polyalkyl saccharides, etc.

Cationic compounds are in general quaternary ammonium compounds in which two substituents of the nitrogen atom are alkyl groups having 16 or more carbon atoms.

A frequently used additive to washing agents is, e.g.,
20 sodium carboxymethyl cellulose. Also, trinitriloacetic acid is often used. Besides, optical brightener, washing alkalis, soda, sodium metasilicate, sodium hydroxide, etc., are often used.

The composition of the washing agent can influence the pH,
25 the bleaching action of the peroxy acid being optimal. This optimum pH, however, can be readily determined by a skilled man.

In industrial plants the constituents of washing agents having different functions, in particular the detergents, the basic additives, and the bleaching agents, are often added in the washing process at different places in the correct concentration. In such a situation a suspension of a peroxy acid according to the invention is preferred because of the ability of being dosed.

Specific examples of compositions suitable for use in the process according to the invention are the following.

10 A first combination consists of a detergent mixture to be used in the soaking phase and the sudsing phase, comprising 0-60% fatty acid soap, 5-70% non-ionic detergent, 0-5% of a conventional isotropic aid, and water; a basic builder, comprising 0-60% soda, 0-80% sodium metasilicate, 0.1-2% sodium carboxymethyl cellulose, 0-1% optical brightener, 0-20% sodium triphosphate, and 0-2% NTA.

A second composition is formed by a complete powder to be used both in the soaking bath and in the sudsing phase, comprising at least 5% surfactant, 0-20% soda, 1-60% sodium metasilicate, 0-10% sodium hydroxide, 0.1-2% sodium carboxymethyl cellulose, 0-1% optical brightener, 0-40% sodium triphosphate, and 0-1% NTA.

The above list is far from being complete and, therefore, cannot be construed as limitative to the present invention.

25

Description of the figures

Fig. 1 gives an example of a washing process in five phases. 1 is the soaking phase, 2 is the sudsing phase, 3 is

the rinsing phase, 4 is the bleaching phase, and 5 represents the neutralization phase.

Fig. 2 shows a washing tube suitable for carrying out the classical hypochlorite process in which the temperatures of the process water in the different phases can be expressed in °C. The full arrows represent the water streams; the broken arrows represent the water streams to be fed back; and the numerals represent the amount of water to be discharged.

Fig. 3 shows a hydrogen peroxide process with bisulfite neutralization in which the temperatures of the process water in the different phases are expressed in °C; the full arrows represent water streams; the discontinuous arrows represent the water to be fed back; and the numerals at the arrows express the amount of water to be discharged in units of l/kg of laundry.

Fig. 4 shows an embodiment of a washing tube and a washing process according to the invention in which the temperatures of the process water in the different phases are expressed in °C; the full arrows represent water streams; the broken arrows represent the water to be fed back; and the numerals represent the amount of water to be discharged.

The invention will be explained in more detail with reference to the following examples.

25 Example 1

Charged into a washing tube according to the invention, as shown in Fig. 4, are 1200 kg of laundry (per hour), together with patches provided with standard dirt (KWIJOVE (quartz,

iron oxide, and fat), VEKOPROP (fats, carbohydrates, and proteins), and SUNAK (blackcurrant juice), obtainable from IR-TNO, The Netherlands; and EMPA 111 (pig's blood), obtainable from EMPA, Switzerland).

- 5 The soaking phase comprises a treatment lasting 9 minutes with 200 ml of washing agent at an average temperature of 40°C and an average pH of 10.5.

 The laundry is then subjected to a sudsing phase for 12 minutes. The sudsing phase comprises 330 ml of washing agent
10 and is carried out at an average temperature of 66°C and an average pH of 10.

 The laundry is then subjected to a second sudsing phase, comprising no washing agent but DPDDA (1.3 g/kg of laundry). The laundry is then rinsed for 6 minutes and neutralized with
15 2.5 g/kg of laundry acetic acid. The dosage of the acid was so selected that in the neutralization phase a pH in the range of 8 to 4, preferably of 7 to 5, was obtained. If the pH attains a value above 8, the laundry turns yellow; whereas a pH below 4 can lead to corrosion at the plants.

- 20 In the rinsing phase 80% of the water is discharged, purified and fed back to the soaking phase. In the neutralization phase 10% of the water is discharged, and 90% is fed back to the second sudsing phase and to the soaking phase. Of the water released during neutralization and
25 pressing of the laundry, everything is fed back to the soaking phase.

 After neutralization the test material is judged by the removal of the model dirt by measuring the (blue) light

remission in a manner known to the skilled man. The hygiene is tested by subjecting water and textile samples to conventional microbiological studies.

The process conditions and a number of results of the
5 determinations are listed in Table 1.

Table 1

Chamber (Fig. 4)	T(°C; $\pm 1^\circ\text{C}$)	pH (± 0.2)	[DPDDA] *
10 1	32	10.4	0
5	67	11.3	0
7	64	10.2	6
8	-	8.0	27
9	55	8.4	12
15 11	35	8.4	5
14	29	7.2	0
Consumption of water and energy per ton of laundry:		water: 6.4 m ³ energy: 1058 MJ	
Co-washed 20 model soils:		Measured blue light remission after washing	
KWIJOVE		68	
VEKOPROP		69	
SUNAK		64	
EMPA 111		73	

25

* mg of active oxygen per liter

Example 2

In this example a standard hypochlorite process is described for the purpose of comparison.

Charged into a washing tube according to the invention are
5 1200 kg of laundry (per hour), together with patches with standard soils (VEKOPROP, KWIJOVE, SUNAK, and EMPA 111).

The soaking phase comprises a treatment lasting 9 minutes with 60 ml of washing agent at an average temperature of 39°C and an average pH of 10.6.

10 The laundry is then subjected to a sudsing phase for 12 minutes. The sudsing phase comprises 2.5 l of washing agent and is carried out at an average temperature of 82°C and an average pH of 11.5.

Then the laundry is subjected to a bleaching phase,
15 comprising hypochlorite (20 ml/kg of laundry). The laundry is then rinsed for 6 minutes and neutralized with 2.5 g/kg of laundry bisulfite.

In the rinsing phase 67% of the water supplied is discharged, purified and fed back to the sudsing and soaking
20 phase. Of the water released during neutralization and pressing of the laundry, everything is fed back to the soaking phase.

After neutralization the test material is judged by light remission. Hygiene is tested by taking bacteriological
25 samples.

The results are listed in Table 2.

Table 2

	Chamber(Fig. 2)	T(°C; $\pm 1^\circ\text{C}$)	pH (± 0.2)	[hypochlorite] *
5	1	32	10.5	0
	6	89	11.1	0
	10	44	9.7	0
	11	34	9.4	600
	12	36	9.0	400
10	Consumption of water and energy per ton of laundry:		water: 7.7 m ³ energy: 1590 MJ	
	Co-washed remission model soils:		measured blue light after washing:	
15	KWIJOVE		73	
	VEKOPROP		80	
	SUNAK		74	
	EMPA 111		80	

* concentration of hypochlorite as mg of active chlorine per
20 liter

A comparison of the processes described in Examples 1 and
2 shows that the process according to the invention gives a
similar result with respect to the washing efficiency, while
25 much less water and energy are required than in the very heavy
prior art bleaching process. Although the bleaching results in
case of using the process according to the invention (Table 1)

are somewhat lower than those in case of using the much heavier bleaching process described in Example 2 (Table 2), all bleaching results on test soils clearly satisfy the standards set in this field of the art.

5

Example 3

Table 3 shows the results of the bacteriological studies to which reference is made in Examples 1 and 2. More in particular, it has been determined how many spore-forming
10 bacteria are present per ml of suds for reuse and per ml of liquid from the press.

Table 3

15			number of spore-forming bacteria per ml of sample	
	Process the	bleaching agent	sudsing phase	liquid from press
20	Ex. 1	DPDDA	145	450
	Ex. 2	NaOCl	3000	3000

In the process according to the invention the number of spore-forming bacteria is so much lower in the processed
25 washing liquids that they are very suitable for reuse.

CLAIMS

1. A process for cleaning textile by means of wet cleaning in at least five phases, comprising a soaking phase, at least one sudsing phase, a rinsing phase, a bleaching phase, and a neutralization phase, in which in a second sudsing phase or in
5 the rinsing phase a peroxy acid having at least 6 carbon atoms or a compound converted in situ into such a peroxy acid is added.
2. A process according to claim 1, in which the peroxy acid is diperoxydodecanedioic acid.
- 10 3. A process according to claim 1 or 2, in which the peroxy acid is present in an amount of 0.1-10 g/kg of dry laundry.
4. A process according to claim 1, 2 or 3, in which an acid is added in the neutralization phase.
5. A process according to claim 4, in which the acid used
15 is acetic or formic acid in such an amount that this leads to a pH in the range of 8 to 4 in the neutralization phase.
6. A process according to claim 5, in which the pH of the washing liquid in the neutralization phase is in the range of 5 to 7.
- 20 7. A process according to any of the preceding claims, in which the water from the bleaching phase, the water from the sudsing phase and/or the water from the rinsing phase and/or the water from the pressing phase is at least partly reused in the washing process.
- 25 8. A process according to claim 7, in which the water to be reused is subjected to a purification step, followed by

reusing the water in the soaking phase and/or in the sudsing phase.

9. A peroxy acid having at least 6 carbon atoms or a compound giving in situ a peroxy acid having at least 6 carbon atoms for use in a washing process for cleaning textile by means of wet cleaning in at least five phases, comprising a soaking phase, at least one sudsing phase, a rinsing phase, a bleaching phase, and a neutralization phase.

10. A peroxy acid having at least 6 carbon atoms or a compound giving in situ a peroxy acid having at least 6 carbon atoms for use as a disinfectant or bacteriostatic agent and/or as a bleaching agent in a washing process for cleaning textile by means of wet cleaning in at least five phases, comprising a soaking phase, at least one sudsing phase, a rinsing phase, a bleaching phase, and a neutralization phase.

11. A washing agent for use in a wet cleaning process, comprising, in addition to the conventional ingredients, a peroxy acid having at least 6 carbon atoms or a compound giving in situ a peroxy acid having at least 6 carbon atoms.

12. An aqueous suspension without surfactants for use in the process according to the invention according to claim 11, comprising 20-35%, preferably 25-30%, most preferably 27% DPDDA; 2-5%, preferably 3-4% sodium sulfate; about 0.2% xanthane gum; and about 0.2% hydroxyethyl cellulose in water having a pH adjusted to a value in the range of 3 to 4.

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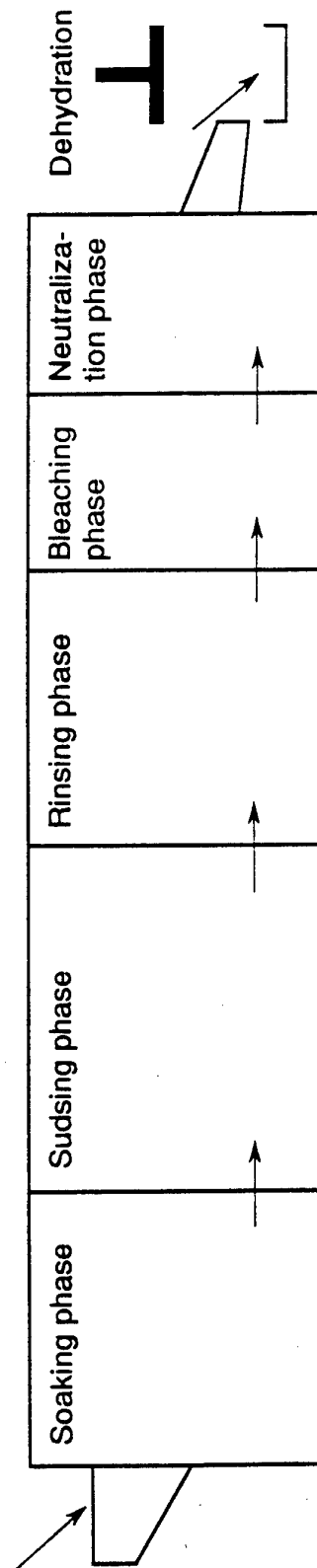


FIG. 1

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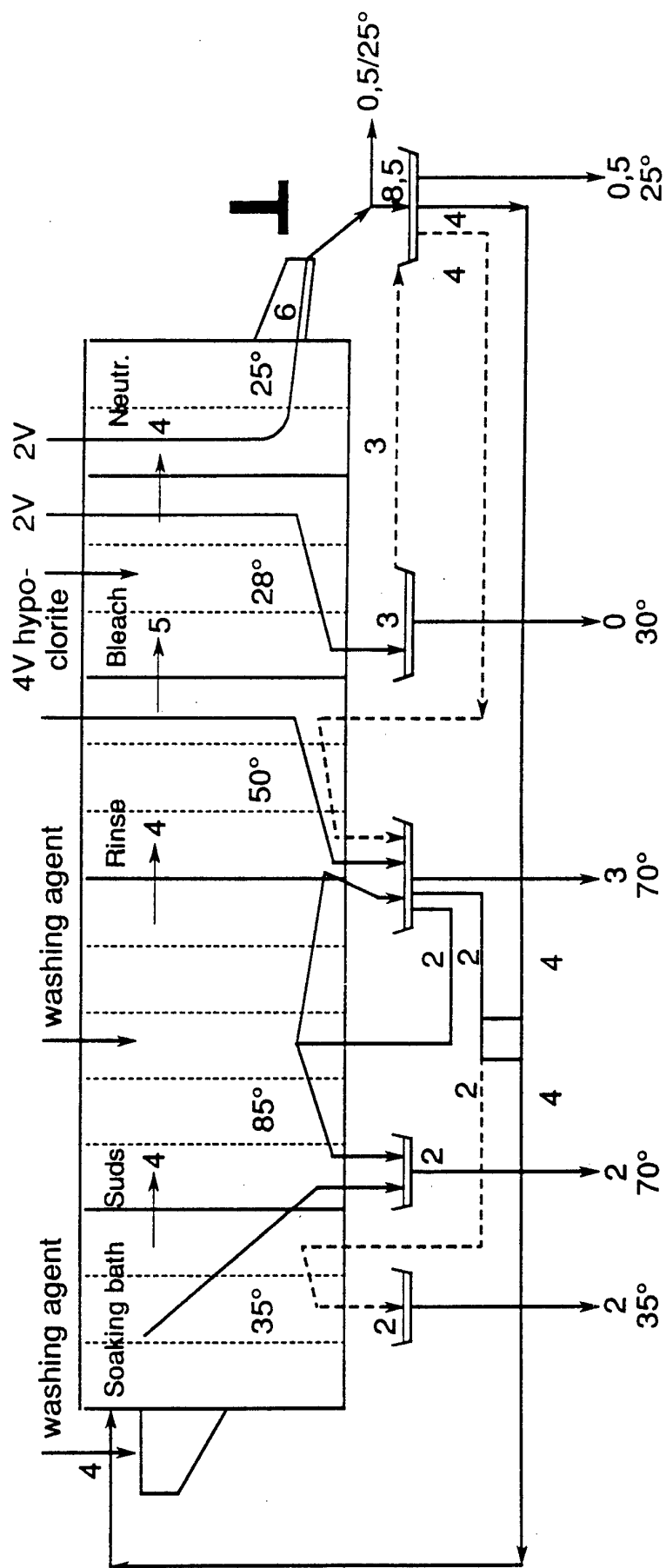


FIG. 2

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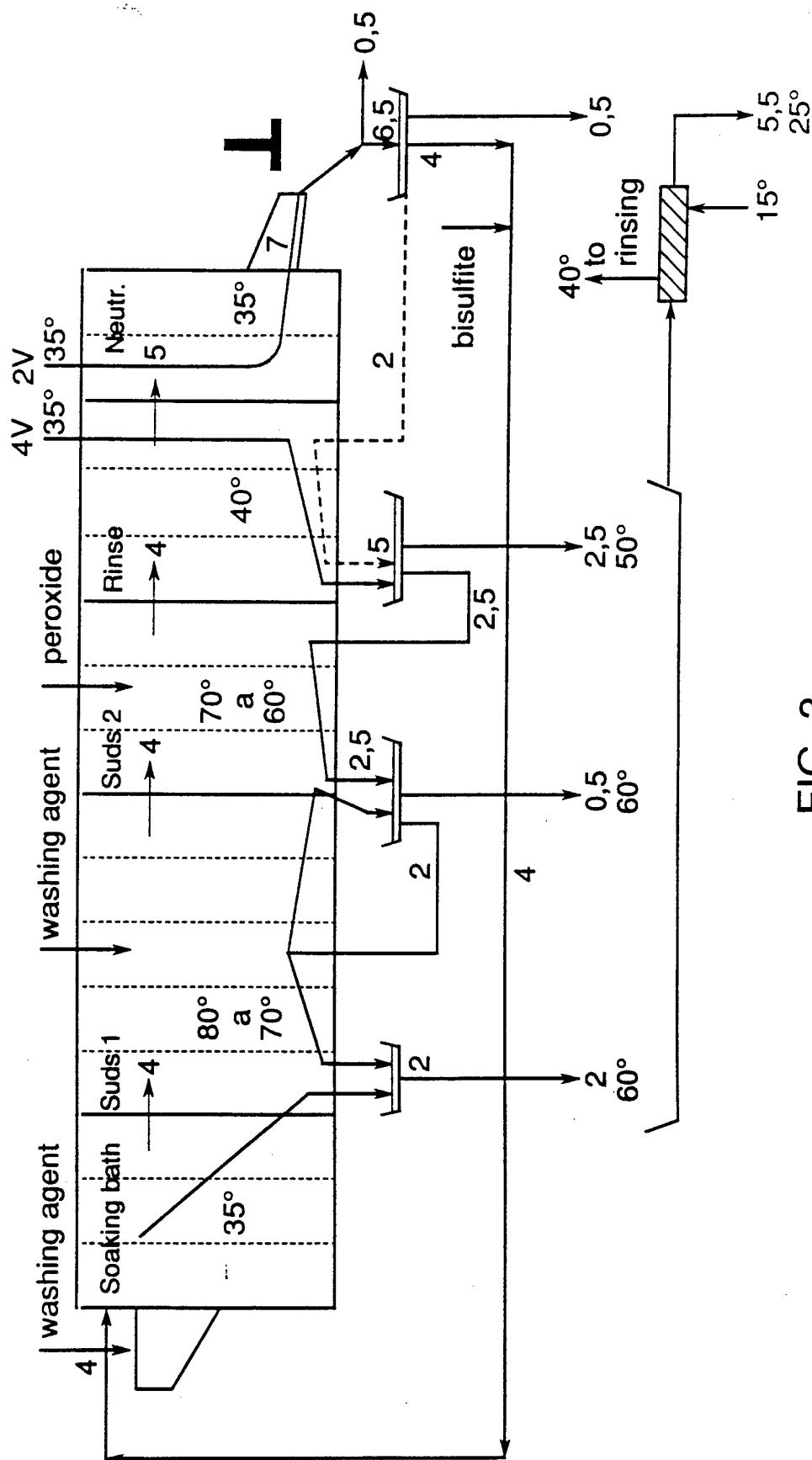


FIG. 3

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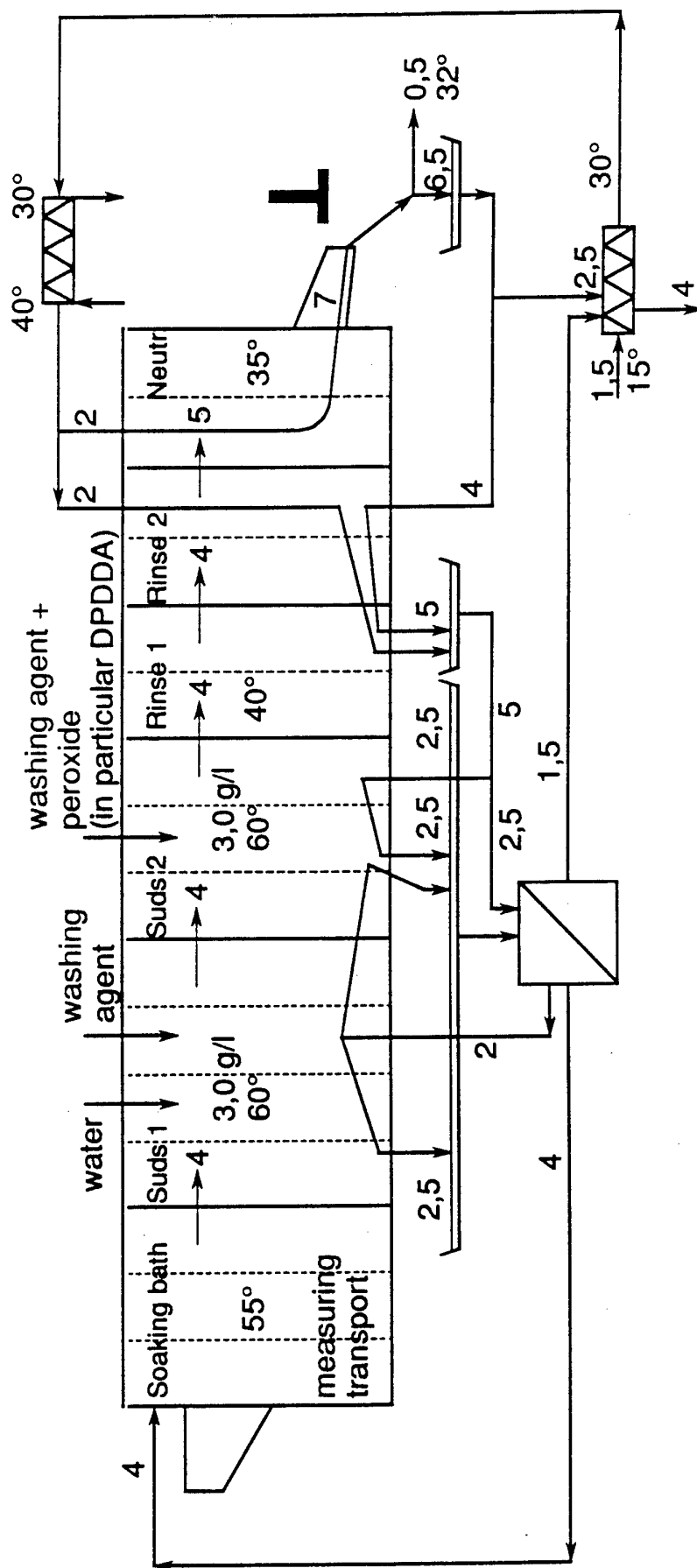


FIG. 4

INTERNATIONAL SEARCH REPORT

Inter. nat. Application No

PCT/NL 94/00177

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 C11D11/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 C11D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO,A,91 03590 (HENKEL) 21 March 1991 see the whole document & DE,A,39 29 335 (HENKEL) cited in the application ---	1,3-8
A	DE,A,25 54 592 (CHEMISCHE WERKE HULS AG ET AL.) 16 June 1977 see claims 1-6,9,13,14; examples ---	1,3-6
A	DE,A,25 47 494 (BOCO WÄSCHEDIENST) 5 May 1977 see claims 1-10; figures; examples ---	1
A	FR,A,2 032 430 (STEINER CO.) 27 November 1970 see page 10, line 14 - line 32; claims 1-10 ---	1
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☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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Date of the actual completion of the international search

2 December 1994

Date of mailing of the international search report

15.12.94

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Grittern, A

INTERNATIONAL SEARCH REPORT

International Application No
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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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