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(54) **Laundry bag**

(57) The present invention provides a water permeable laundry bag comprising a detergent composition.  
The invention also provides a process of washing laundry using a laundry bag comprising a detergent

composition, whereby the laundry is inserted within at least one laundry bag in a first step, the laundry bag containing laundry being inserted in a washing machine in a second step, the wash taking place in a third step.

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**Description**

## Technical Field

5 **[0001]** The present invention relates to a product for the washing of laundry.

## Background of the Invention

10 **[0002]** Laundry wash products are widely used and exist in various forms. These forms traditionally include detergent granules or liquids. These products are typically used in laundry wash processes, which normally consist in sorting the laundry deposited in a laundry basket, transporting a selected part of the laundry to a washing machine, inserting the appropriate laundry wash product in the machine and wash the selected part of the laundry. This normal laundry wash process has both advantages and disadvantages. In the past, attempts have been made to improve these traditional product forms by facilitating handling and dosing of the product. This resulted in the introduction of other product forms

15 such as detergent tablets or sheets impregnated with detergent powder.

**[0003]** Among the advantages of product forms such as tablets or impregnated sheets is their ease of dosing, which results in reducing the possibility of over-dosage or of non-sufficient dosage as can be the case with the fluid products such as granules, liquids, or even gels. Further, product forms such as tablets or impregnated sheets allows the suppression of the messiness due to spilling of fluid products.

20 **[0004]** While having these and other advantages, use of product forms such as tablets or impregnated sheets in a laundry process has disadvantages. For example, the use of such product forms requires manipulation of soiled laundry during sorting, during transport of the soiled laundry prior to the wash, or during transport of clean laundry after the wash.

**[0005]** The invention seeks to provide a laundry product which will provide ease of dosing, reduced messiness, and a reduction of the manipulation of soiled laundry.

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## Summary of the Invention

**[0006]** In accordance with the invention, this object is accomplished in a water permeable laundry bag comprising a detergent composition.

30 **[0007]** In another aspect, the invention provides a process of washing laundry using a laundry bag comprising a detergent composition, whereby the laundry is inserted within at least one laundry bag in a first step, the laundry bag containing laundry being inserted in a washing machine in a second step, the wash taking place in a third step.

## Detailed Description of the Invention

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**[0008]** The invention relates to a laundry bag. By laundry bag it should be understood a bag suitable for containing laundry such as for example clothes, bed sheets, towels or the like. Such a bag would typically define an inner volume of the order of 5 to 60 litres, depending on the particular application sought. For example, a laundry bag suitable for professional applications such as in hospitals or hotels for example would have a large inner volume, whereas a laundry bag suitable for the washing of delicate laundry such as woollen jumpers for example would have a smaller volume. Typically, the laundry bag may be used to store clothes prior to a wash. It may for example be fitted into a traditional laundry basket.

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**[0009]** The laundry bag comprises a detergent composition. By a detergent composition, it should be understood a composition comprising at least surfactants. Other components mentioned below may also be comprised in the detergent composition.

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**[0010]** It was also found that the size of the laundry bag was an important feature. Indeed, it was found that a laundry bag used in the drum of a washing machine and having a size smaller to that of the drum of the washing machine would produce stability problems when the drum is rotating, in some cases leading to an interruption of the wash cycle, particularly in the case of machines equipped with stability detectors. Therefore, in a most preferred embodiment, the bag has, when filled, a volume as close as possible to the volume of the drum of a typical washing machine. It was found particularly suitable to use a bag having a maximum volume which fills the internal volume of a drum for a typical washing machine. In the case of typical European washing machines, a drum was found to be typically a cylinder having a length of from about 240 mm and up to about 300 mm and having a diameter of from about 400 mm and up to about 500 mm. Even more typical dimensions for a drum are a cylinder having a length of from about 251 mm and up to about 290 mm and having a diameter of from about 438 mm and up to about 478 mm. Most typical dimensions for a drum are a cylinder having a length of about 261 mm and having a diameter of about 465 mm. Consequently, a bag according to the invention would preferably have dimensions allowing to fill the volume of such drums to reduce instability particularly when the drum of the washing machine is rotating at high speed. Of course, numbers are given

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for typical European washing machines but other numbers may apply to washing machines of other types in case dimensions are different.

**[0011]** Further, it is preferred that the bag should be relatively easy to insert into the washing machine. Therefore, the bag should have dimensions prior to being inserted into the washing machine which allow it to be inserted easily within the drum aperture or within the porthole of the washing machine. Therefore, it is preferred that the bag prior to being inserted into the washing machine has a section which does not exceed the maximum dimensions of the porthole of the washing machine. Typical European washing machines were found to have a porthole of from about 200 mm up to about 300 mm diameter, even more typically of from about 235 up to about 283 mm diameter, and most typically of about 248 mm diameter. Therefore, it is preferred that the bag according to the invention has a section smaller than such dimensions prior to being inserted into a washing machine. Of course, numbers are given for typical European washing machines but other numbers may apply to washing machines of other types in case dimensions are different.

**[0012]** As explained above, it is preferred that the bag passes easily through the porthole, and it is also preferred that the maximal bag volume fills the whole drum. These two requirements may seem contradictory in some cases. In order to resolve this apparent contradiction, the following preferred embodiment of a bag according to the invention is proposed: a bag comprising at least a pleated portion, the pleated portion being retained pleated by non-permanent pleating means. Indeed, by comprising such a pleated portion, the bag has a smaller maximum volume when the pleated portion is retained pleated, and a bigger maximum volume when the pleated portion is not retained pleated. In this manner, typically the pleated portion will be retained pleated prior to insertion into the washing machine in order for the bag to have a shape allowing it to be easily inserted into a washing machine, while the pleated portion should not be retained pleated when the bag is into the drum of the washing machine during the wash, particularly when the drum rotates at high speed. The non-permanent pleating means may be of various types. A first and simple example would be to use buttons, the buttons being either removed by the user or being removed due to the mechanical forces exerted onto the bag during the wash cycle. In such a case, the user may obtain re-usability by replacing the buttons ready for another use. Other non-permanent pleating means include for example water soluble seals or threads which would be removed during the wash cycle for example.

**[0013]** It was also found that bags which restricts the movement of the laundry load contained within the bag during the wash, specifically by inhibiting the equal distribution of the load weight across the central axis the drum so that the drum is unbalanced during high-speed spinning, also gave rise to stability problems. Therefore a preferred embodiment of the bag allows movement of the load within the bag and consequently more even distribution of the load weight within the drum during spinning. This can be achieved by restricting the dimensions of the bag when it is being filled prior to insertion into the washing machine and increasing the dimensions of the bag after insertion into the washing machine during the wash cycle thus providing additional free volume within bag to facilitate movement and equal distribution of the load within the drum. This is obtained in a bag comprising at least a pleated portion, the pleated portion being retained pleated by non-permanent pleating means.

**[0014]** One possibility is to utilise liquid, paste, gel or tablets with the bag, the detergent composition being for example provided in a packet attached to the bag.

#### Detersive surfactants

**[0015]** Nonlimiting examples of surfactants useful herein typically at levels from about 1% to about 55%, by weight of the detergent composition, include the conventional C<sub>11</sub>-C<sub>18</sub> alkyl benzene sulfonates ("LAS") and primary, branched-chain and random C<sub>10</sub>-C<sub>20</sub> alkyl sulfates ("AS"), the C<sub>10</sub>-C<sub>18</sub> secondary (2,3) alkyl sulfates of the formula CH<sub>3</sub>(CH<sub>2</sub>)<sub>x</sub>(CHOSO<sub>3</sub>-M<sup>+</sup>) CH<sub>3</sub> and CH<sub>3</sub>(CH<sub>2</sub>)<sub>y</sub>(CHOSO<sub>3</sub>-M<sup>+</sup>) CH<sub>2</sub>CH<sub>3</sub> where x and (y + 1) are integers of at least about 7, preferably at least about 9, and M is a water-solubilizing cation, especially sodium, unsaturated sulfates such as oleyl sulfate, the C<sub>10</sub>-C<sub>18</sub> alkyl alkoxy sulfates ("AE<sub>x</sub>S"; especially EO 1-7 ethoxy sulfates), C<sub>10</sub>-C<sub>18</sub> alkyl alkoxy carboxylates (especially the EO 1-5 ethoxycarboxylates), the C<sub>10</sub>-18 glycerol ethers, the C<sub>10</sub>-C<sub>18</sub> alkyl polyglycosides and their corresponding sulfated polyglycosides, and C<sub>12</sub>-C<sub>18</sub> alpha-sulfonated fatty acid esters. If desired, the conventional nonionic and amphoteric surfactants such as the C<sub>12</sub>-C<sub>18</sub> alkyl ethoxylates ("AE") including the so-called narrow peaked alkyl ethoxylates and C<sub>6</sub>-C<sub>12</sub> alkyl phenol alkoxyates (especially ethoxylates and mixed ethoxy/propoxy), C<sub>12</sub>-C<sub>18</sub> betaines and sulfobetaines ("sultaines"), C<sub>10</sub>-C<sub>18</sub> amine oxides, and the like, can also be included in the detergent composition. The C<sub>10</sub>-C<sub>18</sub> N-alkyl polyhydroxy fatty acid amides can also be used. Typical examples include the C<sub>12</sub>-C<sub>18</sub> N-methylglucamides. See WO 9,206,154. Other sugar-derived surfactants include the N-alkoxy polyhydroxy fatty acid amides, such as C<sub>10</sub>-C<sub>18</sub> N-(3-methoxypropyl) glucamide. The N-propyl through N-hexyl C<sub>12</sub>-C<sub>18</sub> glucamides can be used for low sudsing. C<sub>10</sub>-C<sub>20</sub> conventional soaps may also be used. If high sudsing is desired, the branched-chain C<sub>10</sub>-C<sub>16</sub> soaps may be used. Mixtures of anionic and nonionic surfactants are especially useful. Other conventional useful surfactants are listed in standard texts.

## Builders

**[0016]** Detergent builders can optionally be included in the detergent composition herein to assist in controlling mineral hardness. Inorganic as well as organic builders can be used. Builders are typically used in fabric laundering compositions to assist in the removal of particulate soils.

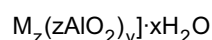
The level of builder can vary widely depending upon the end use of the composition.

Inorganic or P-containing detergent builders include, but are not limited to, the alkali metal, ammonium and alkanolammonium salts of polyphosphates (exemplified by the triphosphates, pyrophosphates, and glassy polymeric metaphosphates), phosphonates, phytic acid, silicates, carbonates (including bicarbonates and sesquicarbonates), sulphates, and aluminosilicates. However, non-phosphate builders are required in some locales. The composition herein functions also in the presence of the so-called "weak" builders (as compared with phosphates) such as citrate, or in the so-called "underbuilt" situation that may occur with zeolite or layered silicate builders. Examples of silicate builders are the alkali metal silicates, particularly those having a  $\text{SiO}_2:\text{Na}_2\text{O}$  ratio in the range 1.6:1 to 3.2:1 and layered silicates, such as the layered sodium silicates described in U.S. Patent 4,664,839, issued May 12, 1987 to H. P. Rieck. NaSKS-6 is the trademark for a crystalline layered silicate marketed by Hoechst (commonly abbreviated herein as "SKS-6"). Unlike zeolite builders, the Na SKS-6 silicate builder does not contain

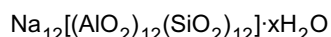
aluminum. NaSKS-6 has the delta- $\text{Na}_2\text{SiO}_5$  morphology form of layered silicate. It can be prepared by methods such as those described in German DE-A-3,417,649 and DE-A-3,742,043. SKS-6 is a highly preferred layered silicate for use herein, but other such layered silicates, such as those having the general formula  $\text{NaMSi}_x\text{O}_{2x+1} \cdot y\text{H}_2\text{O}$  wherein M is sodium or hydrogen, x is a number from 1.9 to 4, preferably 2, and y is a number from 0 to 20, preferably 0 can be used herein. Various other layered silicates from Hoechst include NaSKS-5, NaSKS-7 and NaSKS-11, as the alpha, beta and gamma forms. As noted above, the delta- $\text{Na}_2\text{SiO}_5$  (NaSKS-6 form) is most preferred for use herein. Other silicates may also be useful, such as for example magnesium silicate, as a stabilizing agent for oxygen bleaches, and as a component of suds control systems.

Examples of carbonate builders are the alkaline earth and alkali metal carbonates as disclosed in German Patent Application No. 2,321,001 published on November 15, 1973.

Aluminosilicate builders are useful in the detergent composition. Aluminosilicate builders include those having the empirical formula:



wherein z and y are integers of at least 6, the molar ratio of z to y is in the range from 1.0 to about 0.5, and x is an integer from about 15 to about 264. Useful aluminosilicate ion exchange materials are commercially available. These aluminosilicates can be crystalline or amorphous in structure and can be naturally-occurring aluminosilicates or synthetically derived. A method for producing aluminosilicate ion exchange materials is disclosed in U.S. Patent 3,985,669, Krummel, et al, issued October 12, 1976. Preferred synthetic crystalline aluminosilicate ion exchange materials useful herein are available under the designations Zeolite A, Zeolite P (B), Zeolite MAP and Zeolite X. In an especially preferred embodiment, the crystalline aluminosilicate ion exchange material has the formula:



wherein x is from about 20 to about 30, especially about 27. This material is known as Zeolite A. Dehydrated zeolites (x = 0 - 10) may also be used herein. Preferably, the aluminosilicate has a particle size of about 0.1-10 microns in diameter.

Organic detergent builders include a wide variety of polycarboxylate compounds. As used herein, "polycarboxylate" refers to compounds having a

plurality of carboxylate groups, preferably at least 3 carboxylates. Polycarboxylate builder can generally be added to the composition in acid form, but can also be added in the form of a neutralized salt. When utilized in salt form, alkali metals, such as sodium, potassium, and lithium, or alkanolammonium salts are preferred.

Included among the polycarboxylate builders are a variety of categories of useful materials. One important category of polycarboxylate builders encompasses the ether polycarboxylates, including oxydisuccinate, as disclosed in Berg, U.S. Patent 3,128,287, issued April 7, 1964, and Lamberti et al, U.S. Patent 3,635,830, issued January 18, 1972. See also "TMS/TDS" builders of U.S. Patent 4,663,071, issued to Bush et al, on May 5, 1987. Suitable ether polycarboxylates also include cyclic compounds, particularly alicyclic compounds, such as those described in U.S. Patents 3,923,679; 3,835,163; 4,158,635; 4,120,874 and 4,102,903.

Other useful detergency builders include the ether hydroxypolycarboxylates, copolymers of maleic anhydride with eth-

ylene or vinyl methyl ether, 1, 3, 5-trihydroxy benzene-2, 4, 6-trisulphonic acid, and carboxymethyloxysuccinic acid, the various alkali metal, ammonium and substituted ammonium salts of polyacetic acids such as ethylenediamine tetraacetic acid and nitrilotriacetic acid, as well as polycarboxylates such as mellitic acid, succinic acid, oxydisuccinic acid, polymaleic acid, benzene 1,3,5-tricarboxylic acid, carboxymethyloxysuccinic acid, and soluble salts thereof.

Citrate builders, e.g., citric acid and soluble salts thereof (particularly sodium salt), are polycarboxylate builders of particular importance due to their availability from renewable resources and their biodegradability. Citrates can also be used in the detergent composition, especially in combination with zeolite and/or layered silicate builders. Oxydisuccinates are also especially useful in such a composition and combinations.

Also suitable in the detergent composition are the 3,3-dicarboxy-4-oxa-1,6-hexanedioates and the related compounds disclosed in U.S. Patent 4,566,984, Bush, issued January 28, 1986. Useful succinic acid builders include the C<sub>5</sub>-C<sub>20</sub> alkyl and alkenyl succinic acids and salts thereof. A particularly preferred compound of this type is dodecenylsuccinic acid. Specific examples of succinate builders include: laurysuccinate, myristylsuccinate, palmitylsuccinate, 2-dodecenylsuccinate (preferred), 2-pentadecenylsuccinate, and the like. Laurysuccinates are the preferred builders of this group, and are described in European Patent Application 86200690.5/0,200,263, published November 5, 1986.

Other suitable polycarboxylates are disclosed in U.S. Patent 4,144,226, Crutchfield et al, issued March 13, 1979 and in U.S. Patent 3,308,067, Diehl, issued March 7, 1967. See also Diehl U.S. Patent 3,723,322.

Fatty acids, e.g., C<sub>12</sub>-C<sub>18</sub> monocarboxylic acids, can also be incorporated into the composition alone, or in combination with the aforesaid builders, especially citrate and/or the succinate builders, to provide additional builder activity. Such use of fatty acids will generally result in a diminution of sudsing, which should be taken into account by the formulator.

In situations where phosphorus-based builders can be used, the various alkali metal phosphates such as the well-known sodium triphosphates, sodium pyrophosphate and sodium orthophosphate can be used. Phosphonate builders such as ethane-1-hydroxy-1,1-diphosphonate and other known phosphonates (see, for example, U.S. Patents 3,159,581; 3,213,030; 3,422,021; 3,400,148 and 3,422,137) can also be used.

## Bleach

**[0017]** The detergent composition herein 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 the detergent composition in textile cleaning, hard surface cleaning, or other cleaning purposes that are now known or become known. These include oxygen bleaches as well as other bleaching agents. Perborate bleaches, e.g., sodium perborate (e.g., mono- or tetrahydrate) can be used herein.

Another category of bleaching agent that can be used without restriction encompasses percarboxylic acid bleaching agents and salts thereof. 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-oxoperoxydecanoic acid as described in U.S. Patent 4,634,551, issued January 6, 1987 to Burns et al.

Peroxygen bleaching agents can also be used. Suitable peroxygen bleaching compounds include sodium carbonate peroxyhydrate and equivalent "percarbonate" bleaches, sodium pyrophosphate peroxyhydrate, urea peroxyhydrate, and sodium peroxide. Persulfate bleach (e.g., OXONE, manufactured commercially by DuPont) can also be used.

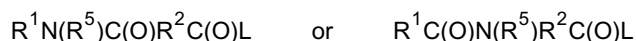
A preferred percarbonate bleach comprises dry particles having an average particle size in the range from about 500 micrometers to about 1,000 micrometers, not more than about 10% by weight of said particles being smaller than about 200 micrometers and not more than about 10% by weight of said particles 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.

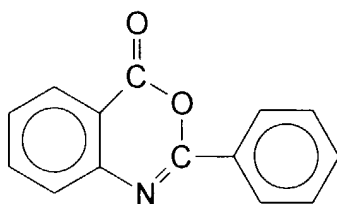
4,634,551 for other typical bleaches and activators useful herein.

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

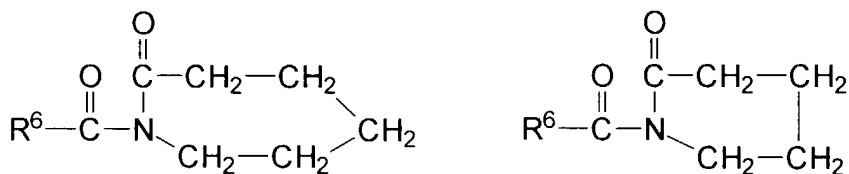


wherein  $R^1$  is an alkyl group containing from about 6 to about 12 carbon atoms,  $R^2$  is an alkylene containing from 1 to about 6 carbon atoms,  $R^5$  is H or alkyl, aryl, or alkaryl containing from about 1 to about 10 carbon atoms, and L is any suitable leaving group. A leaving group is any group 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)oxybenzene-sulfonate, (6-decanamido-caproyl)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:



**[0018]** 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 photoactivated 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. The detergent composition may 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.

## Enzymes

**[0019]** Enzymes can be included in the composition herein for a wide variety of fabric laundering purposes, including removal of protein-based, carbohydrate-based, or triglyceride-based stains, for example, and for the prevention of refugee dye transfer, and for fabric restoration. The enzymes to be incorporated include proteases, amylases, lipases, cellulases, and peroxidases, as well as mixtures thereof. Other types of enzymes may also be included. They may be of any suitable origin, such as vegetable, animal, bacterial, fungal and yeast origin. However, their choice is governed by several factors such as pH-activity and/or stability optima, thermostability, stability versus active detergents, builders and so on. In this respect bacterial or fungal enzymes are preferred, such as bacterial amylases and proteases, and fungal cellulases.

Enzymes are normally incorporated at levels sufficient to provide up to about 5 mg by weight, more typically about 0.01 mg to about 3 mg, of active enzyme per gram of the composition. Stated otherwise, the compositions herein may typically comprise from about 0.001% to about 5%, preferably 0.01%-1% by weight of a commercial enzyme preparation. Protease enzymes are usually present in such commercial preparations at levels sufficient to provide from 0.005 to 0.1 Anson units (AU) of activity per gram of composition.

Suitable examples of proteases are the subtilisins which are obtained from particular strains of *B. subtilis* and *B. licheniformis*. Another suitable protease is obtained from a strain of *Bacillus*, having maximum activity throughout the pH range of 8-12, developed and sold by Novo Industries A/S under the registered trade name ESPERASE. The preparation of this enzyme and analogous enzymes is described in British Patent Specification No. 1,243,784 of Novo. Proteolytic enzymes suitable for removing protein-based stains that are commercially available include those sold under the tradenames ALCALASE and SAVINASE by Novo Industries A/S (Denmark) and MAXATASE by International Bio-Synthetics, Inc. (The Netherlands). Other proteases include Protease A (see European Patent Application 130,756, published January 9, 1985) and Protease B (see European Patent Application Serial No. 87303761.8, filed April 28, 1987, and European Patent Application 130,756, Bott et al, published January 9, 1985).

Amylases include, for example,  $\alpha$ -amylases described in British Patent Specification No. 1,296,839 (Novo), RAPIDASE, International Bio-Synthetics, Inc. and TERMAMYL, Novo Industries.

The cellulase usable in the detergent composition include both bacterial or fungal cellulase. Preferably, they will have a pH optimum of between 5 and 9.5. Suitable cellulases are disclosed in U.S. Patent 4,435,307, Barbesgaard et al, issued March 6, 1984, which discloses fungal cellulase produced from *Humicola insolens* and *Humicola* strain DSM1800 or a cellulase 212-producing fungus belonging to the genus *Aeromonas*, and cellulase extracted from the hepatopancreas of a marine mollusk (*Dolabella Auricula Solander*). suitable cellulases are also disclosed in GB-A-2.075.028; GB-A-2.095.275 and DE-OS-2.247.832. CAREZYME (Novo) is especially useful.

Suitable lipase enzymes for detergent usage include those produced by microorganisms of the *Pseudomonas* group, such as *Pseudomonas stutzeri* ATCC 19.154, as disclosed in British Patent 1,372,034. See also lipases in Japanese Patent Application 53,20487, laid open to public inspection on February 24, 1978. This lipase is available from Amano Pharmaceutical Co. Ltd., Nagoya, Japan, under the trade name Lipase P "Amano," hereinafter referred to as "Amano-P." Other commercial lipases include Amano-CES, lipases ex *Chromobacter viscosum*, e.g. *Chromobacter viscosum* var. *lipolyticum* NRRLB 3673, commercially available from Toyo Jozo Co., Tagata, Japan; and further *Chromobacter viscosum* lipases from U.S. Biochemical Corp., U.S.A. and Disoynth Co., The Netherlands, and lipases ex *Pseudomonas gladioli*. The LIPOLASE enzyme derived from *Humicola lanuginosa* and commercially available from Novo (see also EPO 341,947) is a preferred lipase for use herein.

Peroxidase enzymes are used in combination with oxygen sources, e.g., percarbonate, perborate, persulfate, hydrogen peroxide, etc. They are used for "solution bleaching," i.e. to prevent transfer of dyes or pigments removed from substrates during wash operations to other substrates in the wash solution. Peroxidase enzymes are known in the art, and include, for example, horseradish peroxidase, ligninase, and haloperoxidase such as chloro- and bromo-peroxidase. Peroxidase-containing detergent compositions are disclosed, for example, in PCT International Application WO 89/099813, published October 19, 1989, by O. Kirk, assigned to Novo Industries A/S.

A wide range of enzyme materials and means for their incorporation into synthetic detergent composition are also disclosed in U.S. Patent 3,553,139, issued January 5, 1971 to McCarty et al. Enzymes are further disclosed in U.S. Patent 4,101,457, Place et al, issued July 18, 1978, and in U.S. Patent 4,507,219, Hughes, issued March 26, 1985, both. Enzyme materials are disclosed in U.S. Patent 4,261,868, Hora et al, issued April 14, 1981. Enzymes for use in the detergent composition can be stabilized by various techniques. Enzyme stabilization techniques are disclosed and

exemplified in U.S. Patent 3,600,319, issued August 17, 1971 to Gedge, et al, and European Patent Application Publication No. 0 199 405, Application No. 86200586.5, published October 29, 1986, Venegas. Enzyme stabilization systems are also described, for example, in U.S. Patent 3,519,570.

**[0020]** Other components which are commonly used in the detergent composition and which may be incorporated into the detergent composition include chelating agents, soil release agents, soil antiredeposition agents, dispersing agents, brighteners, suds suppressors, fabric softeners, dye transfer inhibition agents and perfumes.

**[0021]** In a preferred embodiment, the laundry bag is made of a material impregnated with the detergent composition. A method for impregnating a material which could then be used to form the laundry bag is described for example in US-5,053,157 by William D. Lloyd. Another method would consist in having the bag made of material having at least two layers, a detergent composition being located between these two layers, for example by means of a double sided adhesive tape. This would allow to include the composition in the bag while avoiding direct contact between the detergent and the laundry during storage for example. A further advantage of such a detergent "layer" is that the surface activity of the detergent is rendered higher than when the detergent is provided in a block for example. Indeed, in such embodiments, the detergent is provided in a thin layer, and thus may have improved dissolution characteristics.

**[0022]** In another preferred embodiment, the detergent composition is formed from at least two non-compatible components being segregated. It should be noted that it may also be chosen to segregate components which are compatible. Non-compatible components should be understood as components which react with each-other, so that at least one of them becomes non-functional, or the activity of at least one of them is reduced. Segregation may be achieved by various means, including placing the non-compatible components in different layers if the bag is made from a multi-layer material, or by placing the non-compatible components onto different parts of the same layer, or by placing the non-compatible components in separate pockets formed from a surface of the bag or impermeable cells attached to the bag material. This allows to render the wash effective, while maintaining a low complexity: for example, in a traditional laundry process, bleach is stored and added separately from the rest of the detergent composition, due to the non-compatibility between bleach and other components present in the detergent composition, whereas use of the present preferred embodiment of the invention allows to benefit from the bleach while suppressing the separate storage and the separate addition. It should also be noted that in a most preferred embodiment, the release of different components of the detergent composition may be made at different stages during the wash, for example when using a multi-layer bag by placing the component to be dissolved first in a layer which is closer to the laundry contained in the bag, or when using pockets or using impermeable cells attached to the bag material controlling the rate and time of release of components by utilising differently water permeable materials or selectively soluble material e.g.

**[0023]** The laundry bag of the invention is water permeable. By water permeable, it should be understood that the bag has a porous structure, or comprises one or more openings such that liquid water ingress or egress into or out of the laundry bag is possible. In order to allow for good washing and/or rinsing of laundry, the wash water readily enters the bag so that a wash solution is generated. It is preferred that the bag itself allows ingress or egress of at least 1 litre of liquid water per minute, more preferably 5 litres per minute, even more preferably 10 litres per minute and most preferably 15 litres per minute when immersed in water. This allows to obtain fast dissolution of the components forming the detergent composition, allows the avoidance of detergent or soil residues in the bag and provides for efficient rinsing of the laundry in the bag during the rinsing phase of the machine wash cycle. The degree of permeability of the bag can be controlled by altering the porosity or perforation of the material, by changing the size of the holes in the material or the concentration of holes on the surface of the material. This allows to control the rate of dissolution of the detergent composition, avoidance of residues of soil or insoluble detergent composition in the bag, and efficient rinsing of the laundry by the washing machine.

**[0024]** In another preferred embodiment the bag comprises a pocket. The pocket can be made of water permeable material, or of water soluble material. The detergent composition, in granular, tablet, gel or liquid form, can be provided into the pocket. This allows for localised release of the detergent directly around the laundry at the start of the machine wash process, and selection of different detergents suitable for specific load compositions (whites, colours, delicates).

**[0025]** In another preferred embodiment the bag comprises rupturable impermeable cells containing the detergent composition. The impermeable cells can be ruptured prior to the wash via bursting, peeling, ripping or bending to release the detergent composition. The cells could be one or multiple cells, inside or outside the bag. The rupturing mechanism could be linked to a closure device such a drawstrings such that when the bag is closed prior to inserting into the washing machine the cells are ruptured. This provides for ease of dosing and localised release of the detergent.

**[0026]** In another preferred embodiment the bag comprises a detergent composition within compartments of the bag such as pockets or pleats in the bag material which may be opened with mechanisms responsive to conditions in the machine wash solution, such as heat, mechanical agitation, change in solution pH, heat or water. Examples would include pleats containing the detergent composition formed by sealing folds of the bag material with a water soluble binding agent; when the water soluble binding agent dissolves in the wash water the pleats unfold and release the detergent.

**[0027]** In another preferred embodiment the bag is made of a material which is suitable to adsorb a spray of a



suspension of detergent, preferably suspended in a glue, liquid polymeric, organic solvent or aqueous carrier.

**[0028]** In another preferred embodiment the bag is made of an elastic or extensible, or elastic and extensible material such that its size can be easily adapted to facilitate insertion of different volumes of laundry, and to facilitate insertion and securing of the bag into a laundry basket or other holder.

**[0029]** In an additional preferred embodiment, the bag is made of a material solvable in water, such as Poly-Vinyl-Alcohol for example. This allows to avoid residues as the bag dissolves during wash.

**[0030]** In yet another preferred embodiment, the bag comprises a pocket, the pocket containing the detergent composition. This may be an alternative to the having the bag made of an impregnated material. It should be noted that the pocket may be made of water-soluble material, or may be punctured or opened prior to the wash. The pocket may also be partially or completely porous and may contain granules for example. In another most preferred embodiment, several pockets may be available, which may be used partially or totally depending on the type of wash or on the quantity of laundry to wash. It should be noted that a laundry sheet as disclosed in US-5,053,157 could equally be placed in the bag instead of a pocket.

**[0031]** In another embodiment, a plurality of such bags are provided in a roll, for example in the same way as bin bags. This allows easy dispensing of a plurality of laundry bags.

**[0032]** In another embodiment, a plurality of such bags are provided in a roll, for example in the same way as bin bags, with two bags dispensed simultaneously side by side. The bags together can fit side by side in a laundry basket, and can be used separately for white items, coloured items or delicate items. They may be separated or kept together during the wash in the washing machine. This would allow easier sorting and laundering of mixed composition laundry loads.

**[0033]** A process of washing laundry using a laundry bag comprising a detergent composition is also provided whereby the laundry is inserted within at least one laundry bag in a first step, the laundry bag containing laundry being inserted in a washing machine in a second step, the wash taking place in a third step.

**[0034]** Preferably, laundry may be divided in more than one portions, and be inserted within more than one laundry bag in the first step, the plurality of laundry bags containing laundry being inserted together in a washing machine in the second step, the wash taking place in the third step. This last process using a plurality of bags is particularly suited for use in conjunction with a preferred embodiment of the laundry bag whereby it comprises a dye transfer inhibitor. Indeed, this allows to wash simultaneously non-compatible fabrics while avoiding dye transfer. Instead of washing separately items which are likely to involve dye transfer as is the case traditionally, such items may be placed in a separate bag containing the dye transfer inhibitor. Use of a plurality of bags also allows use of a plurality of detergent combinations, i.e. one per bag, such that different types of laundry items requiring different types of detergent composition may be washed simultaneously in different bags in the same washing machine. This would incur a significant reduction of the number of washes, thus reducing water consumption and energy consumption due to water heating, thus having a beneficial effect on the environment.

**[0035]** The bag according to the invention may be used to obtain an homogeneous dissolution and distribution of the detergent composition. Indeed, for example when the bag is made of a material impregnated with the detergent composition, the detergent composition can be located all around the load of laundry during the wash, thus allowing homogeneous distribution of the detergent composition in the heart of the wash. Indeed, the detergent composition is in this case precisely surrounding the load.

**[0036]** The bag according to the invention will also protect the laundry load from mechanical abrasion due to direct contact with parts of the washing machine. This is particularly true when using washing machines equipped with a tumble. It is also particularly applicable to the wash of delicate laundry such as silk or wool for example.

**[0037]** In a preferred embodiment, the detergent composition comprised in the bag may be customised. This may be achieved for example by providing the detergent composition in a plurality of pockets fixed to the bag, or with a plurality of sheets fixed to the bag, such that more or less of the detergent composition may be used, or such that some components of the detergent composition may be removed depending on the type of fabric to wash, by optionally removing one or more of the pockets or sheets fixed to the bag and comprising the detergent composition.

**[0038]** Another manner to customise would be to provide the user with different bags, each bag being more particularly suited for a particular laundry, for example a first type of bag suited for high temperature wash of white items which would be made of a material sustaining high temperature and would contain a detergent composition containing a bleaching agent, or a second type of bags more suited to coloured delicate fabrics comprising a detergent composition which does not comprise a bleaching agent. Other types of suitable bags may be provided depending on the particular laundry to wash. Different bags may be provided in different colours to allow easy identification. In a preferred embodiment, a layer of the material forming the bag is a rough layer which is not smooth in order to increase the mechanical action on the laundry, thus participating to the cleaning effect.

**[0039]** Another preferred embodiment provides a bag comprising means for being closed or re-closed, such as a string, zip or a Velcro wrap for example. In a preferred embodiment of the process according to claim 8, the bag is closed prior to the third step. This is particularly useful if the bag comprises a dye transfer inhibitor or soil anti-redepo-

sition agents, whereby the dye or soils from the laundry contained in the bag it retained by the bag itself, thus avoiding or reducing contamination outside of the bag. This effect would also be partially obtained when the bag is not closed. Indeed, it may be preferred not to close the bag in order to allow faster ingress of water in the bag through the opening.

**[0040]** In a further preferred embodiment, the bag comprises a region which is free of the detergent composition, so as to allow the user to hold or handle the bag while avoiding direct contact between the detergent composition and the skin. This may be provided by means of a handle, which could also serve as means for closing the bag. It should be noted that it is preferred to avoid use of handling mechanisms which would be likely to get caught in the mechanism of a washing machine.

**[0041]** It is preferred that the bag according to the invention is suitable for being submitted to high temperature, such as 100°C, in order to sustain drying. This may be achieved using polyolefins such as polypropylene films or polyethylene films. It is also possible to provide the bag with heat-released component such as high-residuality perfumes, softener or easy-iron finish to be dispensed during the drying stage. It should be noted that the protection from abrasion provided by the bag is more particularly suited for tumble drying of the laundry.

**[0042]** As the laundry bag according to the invention comprises the detergent composition, and as the laundry is normally inserted in the bag, the concentration of detergent composition is normally higher within the bag than outside of the bag, as the bag is surrounding the laundry, so that less amount of the detergent composition may be used than for a traditional wash to obtain the same result, whereby a greater amount of detergent composition in gram per litre may be obtained around the laundry when using the bag.

**[0043]** The bag according to the invention may also comprise softening agents, either for providing softening through the wash or being dispensed during rinsing. Other agents which may also be comprised include: a pre-treatment composition which could act during storage of the laundry and which may be present on the inner side of the bag, or even anti-crease, anti-shrink or antistatic products typically to be delivered in a tumble dryer. Other agents include agents allowing malodour control during storage of soiled laundry prior to wash.

**[0044]** It should be noted that the bag according to the invention is preferably made of a multi-layer material, thus allowing for example to avoid direct contact between the detergent composition and the laundry prior to the wash, or to avoid direct contact between skin and the detergent composition, this being obtainable by sandwiching one or more layers containing the detergent composition between layers which do not comprise it. A multi-layer structure also allows to locate non compatible components in different layers, or allows to place different components in different layers to obtain diffusion of each of these different components at a different stage of the wash.

**[0045]** If the bag is not water-soluble and does not comprise detergent composition anymore, such as after the wash, the bag may be used as a waste bag disposal, or for other purposes. It may be preferred to use a partially water soluble bag (i.e. for example comprising water soluble stripes leaving gaps after the wash, or a water soluble layer covering a non-water soluble net), for example in order to avoid confusion between a used bag and a non-used bag.

**[0046]** Other means may also be employed for this purpose including use of stripes or other visual indicators changing colour after the wash. These types of indicator may also change colour progressively after a number of washes, for example when the bag is re-usable. This may particularly apply to a bag containing for example 5 doses of detergents in rupturable cells, such that the bag may be reused up to 5 times.

**[0047]** The bag of the invention facilitates transport of soiled clothes prior to the wash, and may contain actives allowing to reduce malodours during storage prior to the wash, or to protect from contamination, as would be preferred for wash of hospital laundry for example.

**[0048]** In a preferred embodiment, the bag comprises a fill level in order to allow the user to estimate when laundry washing should take place. This may simply be achieved by providing the bag with one or more lines indicating for example a half load or a full load.

**[0049]** The laundry bag may also be provided with prints or may be coloured to be rendered aesthetically more acceptable.

**[0050]** It may also be preferred to use a transparent or semi-transparent bag to allow a check of the filling level or of the type of laundry in the bag. This may for example be provided by means of a transparent window or strip, or by using a semi-transparent/ semi-opaque material for the bag, or for example by having a full side of the bag made of a transparent material.

**[0051]** A dedicated holder for the laundry bag may also be provided, allowing to hold the bag during storage of the soiled laundry prior to the wash. A tubular structure could for example be used for this purpose.

Examples:

Several bags (Type A, B and C) were manufactured and are detailed below:

Type A:

**[0052]** Bag A is made from a porous external strong layer of a formed film with a thickness of 500µm, made of low density polyethylene (LDPE), the porosity being obtained by holes, the hole size being about 1000 micron in diameter, the number of holes being 335/sq.in.

The internal side of the bag is made of a layer of a soft hydrophilic

Polypropylene spunbonded nonwoven with a thickness of 0.2 mm, basis weight 18g/sq.m.

The detergent was sandwiched between above layers into three rectangular loading area of 0.4m by 0.15m. 2 areas containing 20g of detergent composition, the third area containing 50g of detergent composition.

To keep in place the detergents a double side Transfer adhesive 3M is used with the same dimension as each loading area and applied on each above layer.

Type B:

**[0053]** Bag B is made of a double layer of soft hydrophilic Polypropylene spunbonded nonwoven with a thickness of 0.2 mm, basis weight 18g/sq.m (both internal and external side of the bag). The detergent being placed between the above two layers in a square of 0.24x0.24m. To keep in place the detergents a double side Transfer adhesive 3M is used.

Type C

**[0054]** Bag C was formed by only one transparent layer of perforated (39 holes/sq.in with an average of 0.7 mm in diameter) polypropylene material with a thickness of 20micron (about 20g/sq.m). The detergent was enclosed in small pouches (4 rows each containing 5 pouch) attached inside the bag by a double side Transfer adhesive 3M. Each pouch was made of a water soluble film (PVOH or Poly-vynil-alcool) of 20g/sq.m so as to make the detergent available only the bag is wet. Each of the 20 pouches contains 2.5g of detergent composition.

**[0055]** For bags A, B and C, the layers above were made in a rectangular shape of 1.72mx0.6m. Each of these rectangles was then folded in a "W" shape, the 3 folding lines being along the 0.6m long direction, so that the double central part of the "W" is 0.16 m high, each of the right and left side parts of the "W" being 0.7 m long ( $= [1.72 - 2 \times 0.16] / 2$ ). The double central part of the "W" is aimed at forming a bottom to the bag once opened.

Furthermore, an external flap of 0.1m was also folded along the same folding direction as the "W" folding on each end of the right and left side parts of the "W", and turned towards the inside, the bag being thereafter hot sealed the each side along a direction perpendicular to the folding lines to obtain the bag. A string may be passed around the external flap after making an opening in the external flap in order to allow closure of the bag.

## Claims

1. A water permeable laundry bag comprising a detergent composition.
2. The laundry bag according to claim 1, whereby the bag is made of a material impregnated with the detergent composition.
3. The laundry bag according to claims 1 or 2, whereby the detergent composition is formed from at least two non-compatible components being segregated.
4. The laundry bag according to claim 1 or 2, whereby the bag comprises a pocket, the pocket containing the detergent composition.
5. The laundry bag according to any of the above claims, whereby a plurality of such bags are provided in a roll.
6. A process of washing laundry using a laundry bag comprising a detergent composition, whereby the laundry is inserted within at least one laundry bag in a first step, the laundry bag containing laundry being inserted in a washing machine in a second step, the wash taking place in a third step.

7. A process as in claim 6, whereby the laundry is inserted within more than one laundry bag in the first step, the plurality of laundry bags containing laundry being inserted together in a washing machine in the second step, the wash taking place in the third step.

5 8. A process as in claim 7, whereby the laundry bag comprises a dye transfer inhibitor.

9. A process as in claim 8, whereby the laundry bag is as in any of claims 1 to 6.

10 10. The laundry bag as in any of claims 1 to 6, whereby the laundry bag comprises at least a pleated portion, the pleated portion being retained pleated by non-permanent pleating means.

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European Patent  
Office

# EUROPEAN SEARCH REPORT

Application Number  
EP 99 87 0164

| DOCUMENTS CONSIDERED TO BE RELEVANT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                            |                                  |                                              |
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