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(54) **LAUNDRY DETERGENT COMPOSITIONS COMPRISING POLYALKOXYLATED POLYETHYLENEIMINE**

WASCHMITTELZUSAMMENSETZUNGEN MIT POLYALKOXYLIERTEM POLYETHYLENIMIN

COMPOSITIONS DÉTERGENTES DE LESSIVE COMPRENANT UN POLYÉTHYLÈNE-IMINE POLYALCOXYLÉ

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Description

TECHNICAL FIELD

[0001] This invention relates to laundry detergent compositions comprising an alkoxylated polyethyleneimine anti-redeposition polymer (ARP) and detergency surfactants, particularly anionic and nonionic detergency surfactants.

BACKGROUND

[0002] Ethoxylated PEI (PEI = polyethylene imine) is known as an anti redeposition polymer from CA 121 0009. The PEI(600)20EO material with all primary and secondary amino groups fully substituted by EO_{20} polyalkoxylation is not a good ARP for laundry detergents. These alkoxylated PEIs are usually formed by direct reaction of ethylene oxide, and/or propylene oxide, and PEI as described in CA 1210009.

[0003] EP 2050792 (DIC Corp) discloses the preparation of a PEI plus tosylated PEG monomethyl ether as an intermediate in the preparation of a PEG-PEI-epoxy resin structure. This preparation is repeated in EP 2147733.

[0004] JP 2007/099929 (Dainippon Ink & Chem.) also discloses the addition of tosylated PEG monomethyl ether to PEI followed by the addition of a styrene monomer.

[0005] S. Xu et al. (Macromolecular Bioscience Vol 7 p 968-74, 2007) uses tosylated mono-methyl ether PEG as an intermediate to making an aromatically substituted PEI with PEG groups attached to the benzyl ring.

[0006] In the above documents, the molar ratio of mPEG to PEI used is at least 3:1 which should give an average of at least 3 polyalkoxyl chains attached to each PEI.

[0007] Zhang & Lonnie (Chinese J. Chem., Vol 21 p 460-5, 2003) discusses the preparation of PEI-PEO block copolymers and their clay dispersancy. The polymers are triblock polymers formed from divalently modified PEG (dimesyl). This forms a PEO crosslink between two PEI groups. Such crosslinked PEI is not desirable due to its lower weight efficiency.

[0008] Non-ionic containing formulations are widely used in laundry, especially for low suds formulations suitable for front loading automatic washing machines.

[0009] PEI tends to deposit soil onto nylon elastane based fabrics. EPEI does not suffer from the same nylon- elastane negatives as PEI and has consequently been widely used in laundry compositions. However, it would be desirable to improve the performance of EPEI as a soil suspending polymer to solve the problem of redeposition over the full range of fabrics found in a typical laundry load: cotton, polycotton, polyester and nylon-elastane.

SUMMARY OF THE INVENTION

[0010] According to a first aspect of the present invention there is provided a laundry detergent composition containing 5 to 30 wt% detersive surfactant selected from non-ionic and anionic surfactant and 0.05 to 4 wt%, preferably 0.1 to 2 wt%, of polyalkoxylated polyethylene imine polymer wherein the polymer is a PEI which has a molar ratio of polyalkoxyl chains to PEI of less than or equal to 3 resulting in 3 or fewer nitrogens, preferably 2 or fewer nitrogens, most preferably 1 nitrogen, bound to polyalkoxyl chains and wherein the PEI has a Mw of at least 500, preferably 1000 to 2000, more preferably less than 1500 and even about 1300. Mw is the weight average molecular weight The molecular weights are preferably determined by dynamic light scattering using a Zetasizer Nano (Malvern).

[0011] Suitably when there Is more than one polyalkoxyl chain per PEI, there is only one polyalkoxyl chain per PEI nitrogen.

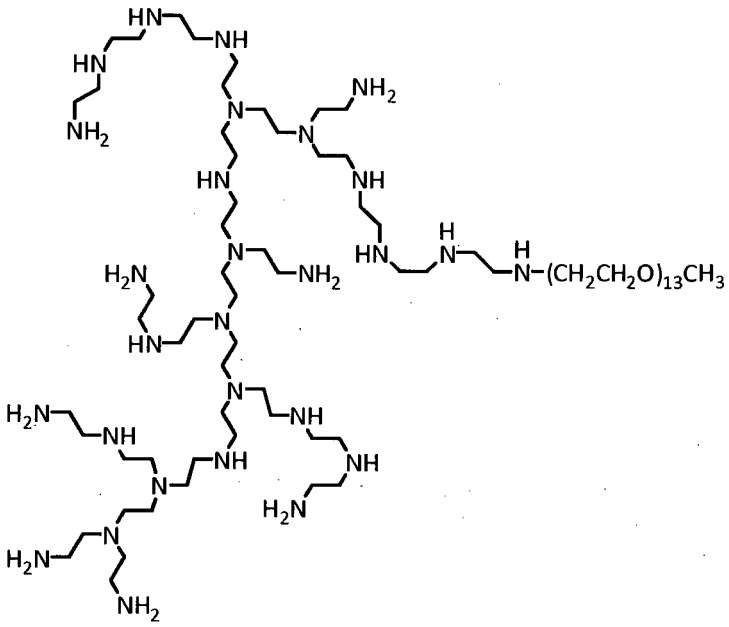
[0012] Preferably the fraction of (wt% non-ionic)/(wt% anionic surfactant) is from 0.6 to 2.0, preferably from 0.90 to 1.2.

[0013] Also according to the present invention there is provided a wash method wherein the composition according to the first aspect is diluted to a level of 0.3 to 1g/L surfactant and 5 to 150 ppm, preferably 10 to 80 ppm polymer according to the first aspect and used to launder fabrics.

[0014] Each polyalkoxyl chain is preferably built from ethoxy and/or propoxy groups. Most preferably it is a polyethoxyl chain. Preferably the polyalkoxyl chain contains 5 to 60 alkoxyl repeat units, more preferably 8 to 20, most preferably 10 to 14. Chains may be alkyl capped, preferably methyl capped. To facilitate the bonding of the capped polyalkoxyl chain with the PEI the chain is preferably provided with a reactive group at the end to be linked to the PEI. Suitable reactive groups may be selected from epoxides, alkenes, a sulfooxyethylsulfonyl reactive group ($-SO_2CH_2CH_2OSO_3Na$), heterocyclic reactive groups and leaving groups such as tosylate. The heterocyclic reactive groups are preferably nitrogen containing aromatic rings bound to a halogen or an ammonium group, which react with NH_2 or NH groups to form a covalent bond. To avoid cross-linking reactions preferably the preformed alkoxy chain contains only 1 reactive group, the other chain end is typically alkyl capped. Each chain has a terminal group with molecular weight less than 100. The terminal group on the polyalkoxyl chain may be a C_{1-4} alkyl group, preferably a methyl group.

[0015] An example structure of the polyalkoxylated PEI Polymer where the alkoxylation is ethoxylation, the end cap

is methyl and the number of EO units is 13, is structure (I):



(I)

DETAILED DESCRIPTION OF THE INVENTION

[0016] The detergent compositions may take any suitable form. For example they may be powders, tablets, liquids or gels and in the case of liquids they may be contained in a water soluble capsule to allow for ease of use. Preferred compositions are liquids due to the compatibility of the polyalkoxylated PEI ARP materials with ingredients typically found in liquid detergents.

Surfactants

[0017] Surfactants assist in removing soil from the textile materials and also assist in maintaining removed soil in solution or suspension in the wash liquor. Blends of anionic and nonionic surfactants are a preferred feature of the compositions. The amount of anionic surfactant is preferably at least 5 wt%, more preferably at least 10wt%.

Anionic

[0018] Preferred anionic surfactants are alkyl sulphonates especially alkylbenzene sulphonates, particularly linear alkylbenzene sulphonates having an alkyl chain length of C_8-C_{15}. The counter ion for the anionic surfactants is may be an alkali metal, typically sodium, or another counter-ion for example MEA, TEA or ammonium can be used.

[0019] Suitable linear alkyl benzene sulphonate surfactants include Detal LAS with an alkyl chain length of from 8 to 15, more preferably 12 to 14.

[0020] It is further desirable that the composition comprises an alkyl polyethoxylate sulphate anionic surfactant of the formula (II):

$$RO(C_2H_4O)_xSO_3^-M^+ \qquad (II)$$

where R is an alkyl chain having from 10 to 22 carbon atoms, saturated or unsaturated, M is a cation which makes the compound water-soluble, especially an alkali metal, ammonium or substituted ammonium cation, and x averages from 1 to 15.

[0021] Preferably R is an alkyl chain having from 12 to 16 carbon atoms, M is Sodium and x averages from 1 to 3, preferably x is 3; This is the anionic surfactant sodium lauryl ether sulphate (SLES). It is the sodium salt of lauryl ether sulphonic acid in which the predominantly C_{12} lauryl alkyl group has been ethoxylated with an average of 3 moles of ethylene oxide per mole.

Nonionic

[0022] Nonionic surfactants include primary and secondary alcohol ethoxylates, especially C_8-C_{20} aliphatic alcohol ethoxylated with an average of from 1 to 20 moles of ethylene oxide per mole of alcohol, and more especially the C_{10}-C_{15} primary and secondary aliphatic alcohols ethoxylated with an average of from 1 to 10 moles of ethylene oxide per mole of alcohol. Non-ethoxylated nonionic surfactants include alkyl polyglycosides, glycerol monoethers and polyhydroxy amides (glucamide). Mixtures of nonionic surfactant may be used. When included therein the composition contains from 0.1 to 20 wt% preferably 1 wt% to 15 wt%, more preferably 5 to 15 wt% of a non-ionic surfactant, for example alcohol ethoxylate, nonylphenol ethoxylate, alkylpolyglycoside, alkyldimethylamineoxide, ethoxylated fatty acid monoethanolamide, fatty acid monoethanolamide, polyhydroxy alkyl fatty acid amide, or N-acyl N-alkyl derivatives of glucosamine ("glucamides").

[0023] Nonionic surfactants that may be used include the primary and secondary alcohol ethoxylates, especially the C_8-C_{20} aliphatic alcohols ethoxylated with an average of from 1 to 35 moles of ethylene oxide per mole of alcohol, and more especially the C_{10}-C_{15} primary and secondary aliphatic alcohols ethoxylated with an average of from 1 to 10 moles of ethylene oxide per mole of alcohol.

Amine Oxide

[0024] The composition may comprise up to 10 wt% of an amine oxide of the formula (III):

$$R^1N(O)(CH_2R^2)_2 \qquad (III)$$

[0025] In which R^1 is a long chain moiety each CH_2R^2 are short chain moieties. R^2 is preferably selected from hydrogen, methyl and -CH_2OH. In general R^1 is a primary or branched hydrocarbyl moiety which can be saturated or unsaturated, preferably, R^1 is a primary alkyl moiety. R^1 is a hydrocarbyl moiety having chain length of from about 8 to about 18.

[0026] Preferred amine oxides have R^1 is C_8-C_{18} alkyl, and R^2 is H. These amine oxides are illustrated by C_{12}-$_{14}$ alkyldimethyl amine oxide, hexadecyl dimethylamine oxide, octadecylamine oxide.

[0027] A preferred amine oxide material is Lauryl dimethylamine oxide, also known as dodecyldimethylamine oxide or DDAO. Such an amine oxide material is commercially available from Huntsman under the trade name Empigen® OB.

[0028] Amine oxides suitable for use herein are also available from Akzo Chemie and Ethyl Corp. See McCutcheon's compilation and Kirk-Othmer review article for alternate amine oxide manufacturers.

[0029] Whereas in preferred embodiments R^2 is H, it is possible to have R^2 slightly larger than H. Specifically, R^2 may be CH_2OH, for example: hexadecylbis(2-hydroxyethyl)amine oxide, tallowbis(2-hydroxyethyl)amine oxide, stearylbis(2-hydroxyethyl)amine oxide and oleylbis(2- hydroxyethyl)amine oxide.

[0030] Preferred amine oxides have the formula (IV):

$$O^- - N^+(Me)_2R^1 \qquad (IV)$$

where R^1 is $C_{12\text{-}16}$ alkyl, preferably $C_{12\text{-}14}$ alkyl; Me is a methyl group.

Zwitterionic

[0031] A preferred zwitterionic material is a carbobetaine available from Huntsman under the name Empigen® BB. Betaines and / or amine oxides, improve particulate soil detergency in the compositions.

Additional surfactants

[0032] Other surfactants than the preferred LAS, SLES, nonionic and amine oxide/ carbobetaine) may be added to the mixture of detersive surfactants. However cationic surfactants are preferably substantially absent.

[0033] Although less preferred, some alkyl sulphate surfactant (PAS) may be used, especially the non-ethoxylated $C_{12\text{-}15}$ primary and secondary alkyl sulphates. A particularly preferred material, commercially available from BASF, is Sulfopon 1214G.

Polymers

Polyester soil release polymer

[0034] The compositions may include 0.5 wt% or more of a soil release polymer which is substantive to polyester

fabric. Such polymers typically have a fabric substantive midblock formed from propylene terephthalate repeat units and one or two end blocks of capped polyalkylene oxide, typically PEG 750 to 2000 with methyl end capping.

Other Polymer types

[0035] In addition to a polyester soil release polymer there may be used dye transfer inhibition polymers, and cotton soil release polymers, especially those based on modified cellulosic materials.

Hydrotrope

[0036] A hydrotrope is a solvent that is neither water nor conventional surfactant that aids the solubilisation of the surfactants and other components in the aqueous liquid to render it isotropic. Among suitable hydrotropes there may be mentioned as preferred: MPG (monopropylene glycol), glycerol, sodium cumene sulphonate, ethanol, other glycols, e.g. di propylene glycol, diethers and urea.

Enzymes

[0037] It is preferable that at least one or more enzymes may be present in the compositions. Preferably at least two, more preferably at least three different classes of enzymes are used in combination. Preferred enzyme cocktails are selected from the group comprising: lipase, Phospholipase, protease, Cutinase, Amylase, Cellulase, Peroxidases/oxidase, Pectate Lyase, and Mannanase.

[0038] Any enzyme present in the composition may be stabilized using conventional stabilizing agents, e.g., a polyol for example propylene glycol or glycerol, a sugar or sugar alcohol, lactic acid, boric acid, or a boric acid derivative, e.g., an aromatic borate ester, or a phenyl boronic acid derivative for example 4-formylphenyl boronic acid, and the composition may be formulated as described in e.g. WO 92/19709 and WO 92/19708. Alternatively, or additionally, the enzymes may be protected by encapsulation.

[0039] When a lipase enzyme is included a lignin compound may be used in the composition. Preferably the lignin compound comprises a lignin polymer and more preferably it is a modified lignin polymer. A modified lignin polymer as used herein is lignin that has been subjected to a chemical reaction to attach chemical moieties to the lignin covalently. The attached chemical moieties are preferably randomly substituted.

Fluorescent Agents

[0040] It may be advantageous to include fluorescer in the compositions. Usually, these fluorescent agents are supplied and used in the form of their alkali metal salts, for example, the sodium salts. The total amount of the fluorescent agent or agents used in the composition is generally from 0.005 to 2 wt %, more preferably 0.01 to 0.5 wt%.

[0041] Preferred classes of fluorescer are: DI-styryl biphenyl compounds, e.g. Tinopal (Trade Mark) CBS-X, Di-amine stilbene di-sulphonic acid compounds, e.g. Tinopal DMS pure Xtra, Tinopal 5BMGX, and Blankophor (Trade Mark) HRH, and Pyrazoline compounds, e.g. Blankophor SN.

[0042] Preferred fluoroscers are: sodium 2 (4-styry)-3-sulfophenyl)-2H-napthol[1,2-d]triazole, disodium 4,4'-bis{[(4-anillino-6-(N methyl-N-2 hydroxyethyl)amino 1,3,5-triazin-2-yl)]amino}stilbene-2-2'disulfonate, disodium 4,4'-bis{[(4-anilino-6-morpholino-1,3,5-triazin-2-yl)]amino}stilbene-2-2'disulfonate, and disodium 4,4'-bis(2-sulfoslyryl)biphenyl.

Bleach Catalyst

[0043] Compositions may comprise a weight efficient bleach system. Such systems typically do not utilise the conventional percarbonate and bleach activator approach. An air bleach catalyst system is preferred. Suitable complexes and organic molecule (ligand) precursors for forming complexes are available to the skilled worker, for example, from: WO 98/39098; WO 98/39406, WO 97/48787, WO 00/29537; WO 00/52124, and WO00/60045. An example of a preferred catalyst is a transition metal complex of MeN4 Py ligand (N,N- bis(pyridin-2-yl-metyl)-1,1-bis (pyridin-2-yl)-1 aminoethane). Suitable bispidon catalyst materials and their action are described in WO 02/48301. The bleach catalyst may be encapsulated to reduce interaction with other components of the liquid during storage.

[0044] Photobleaches may also be employed. A "photobleach" is any chemical species that forms a reactive bleaching species on exposure to sunlight, and preferably is not permanently consumed in the reaction. Preferred photo-bleaches include singlet oxygen photo-bleaches and radical photo-bleaches. Suitable singlet oxygen photo-bleaches may be selected from, water soluble phthalocyanine compounds, particularly metallated phthalocyanine compounds where the metal is Zn or Al-Z1 where Z1 is a halide, sulphate, nitrate, carboxylate, alkanolate or hydroxyl ion. Preferably the phthalocyanin has 1-4 SO_3X groups covalently bonded to it where X is an alkali metal or ammonium ion. Such compounds

are described in WO2005/014769 (Ciba).

[0045] When present, the bleach catalyst is typically incorporated at a level of about 0.0001 to about 10 wt%, preferably about 0.001 to about 5 wt%.

Perfume

[0046] The composition will normally include one of more perfume components. Free oil and encapsulated perfumes may be used, and mixtures thereof.

[0047] A particularly preferred way of ensuring that perfume is employed efficiently is to use an encapsulated perfume. Use of a perfume that is encapsulated reduces the amount of perfume vapour that is produced by the composition before it is diluted. This is important when the perfume concentration is increased to allow the amount of perfume per wash to be kept at a reasonably high level.

[0048] It is even more preferable that the perfume is not only encapsulated but also that the encapsulated perfume is provided with a deposition aid to increase the efficiency of perfume deposition and retention on fabrics. The deposition aid is preferably attached to the encapsulate by means of a covalent bond, entanglement or strong adsorption.

Further Optional Ingredients

[0049] The compositions may contain one or more other ingredients. Such ingredients include viscosity modifiers, foam boosting agents, preservatives (e.g. bactericides), pH buffering agents, polyelectrolytes, anti-shrinking agents, anti-wrinkle agents, anti-oxidants, sunscreens, anti-corrosion agents, drape imparting agents, anti-static agents and ironing aids. The compositions may further comprise colorants, pearlisers and/or opacifiers, and shading dye.

Shading dyes

[0050] Shading dye can be used to improve the performance of the compositions. Preferred dyes are violet or blue. It is believed that the deposition on fabrics of a low level of a dye of these shades, masks yellowing of fabrics. A further advantage of shading dyes is that they can be used to mask any yellow tint in the composition itself. Examples of shading dyes are alkoxylated thiophene dyes, acid violet 50, direct violet 35, direct violet 99, direct violet 9, solvent violet 13, disperse violet 28, disperse blue 165.

[0051] Shading dye can be used in the absence of fluorescer, but it is especially preferred to use a shading dye in combination with a fluorescer, for example in order to reduce yellowing due to chemical changes in adsorbed fluorescer.

Builders and sequestrants

[0052] The detergent compositions may also optionally contain relatively low levels of organic detergent builder or sequestrant material. Examples include the alkali metal, citrates, succinates, malonates, carboxymethyl succinates, carboxylates, polycarboxylates and polyacetyl carboxylates. Specific examples include sodium, potassium and lithium salts of oxydisuccinic acid, mellitic acid, benzene polycarboxylic acids, and citric acid. Other examples are DEQUEST™, organic phosphonate type sequestering agents sold by Monsanto and alkanehydroxy phosphonates.

[0053] Other suitable organic builders include the higher molecular weight polymers and copolymers known to have builder properties. For example, such materials include appropriate polyacrylic acid, polymaleic acid, and polyacrylic/polymaleic acid copolymers and their salts, for example those sold by BASF under the name SOKALAN™.

[0054] If utilized, the organic builder materials may comprise from about 0.5% to 20 wt%, preferably from 1 wt% to 10 wt%, of the composition. The preferred builder level is less than 10 wt% and preferably less than 5 wt% of the composition. A preferred sequestrant is HEDP (1-Hydroxyethylidene -1,1,-diphosphonic acid), for example sold as Dequest 2010. Also suitable but less preferred as it gives inferior cleaning results is Dequest® 2066 (Diethylenetriamine penta(methylene phosphonic acid or Heptasodium DTPMP).

Buffers

[0055] The presence of some buffer is preferred for pH control; preferred buffers are MEA, and TEA. If present they are preferably used in the composition at levels of from 1 to 15 wt%.

External Structurants

[0056] The compositions may have their rheology modified by use of a material or materials that form a structuring network within the composition. Suitable structurants include hydrogenated castor oil, microfibrous cellulose and natural

based structurants for example citrus pulp fibre. Citrus pulp fibre is particularly preferred especially if lipase enzyme is included in the composition.

Visual Cues

[0057] The compositions may comprise visual cues of solid material that is not dissolved in the composition. Preferably they are used in combination with an external structurant to ensure that they remain in suspension. Preferred visual cues are lamellar cues formed from polymer film and possibly comprising functional ingredients that may not be as stable if exposed to the alkaline liquid. Enzymes and bleach catalysts are examples of such ingredients. Also perfume, particularly microencapsulated perfume.

[0058] The invention will now be further described with reference to the following nonlimiting examples.

EXAMPLES

Polymer Synthesis

Step (a): Tosylation of methyl terminated polyethylene glycol

[0059]

Materials	Amounts used
$CH_3(O\text{-}CH_2CH_2)_nOH$ (Mn=550)	110 g
Tosyl chloride	38 g
Triethylamine	20.2 ml
Dichloromethane	150 ml

[0060] Tosyl chloride was added, over 45 min, to a stirred mixture of poly(ethylene glycol) methyl ether and triethylamine in dichloromethane at 0 to 5°C. The mixture was then allowed to warm to ambient temperature and was stirred at room temperature for 16 hr. after which essentially all of the tosyl chloride had been consumed, as judged by thin layer chromatography. The reaction yielded a suspension (192 g) of Tosylated PEG.

Step (b): "Polyethoxylation" of Polyethyleneimine

[0061] The Tosylated PEG suspension from step (a) was mixed with a 50 wt% solution of Polyethyleneimine (Mw=1300) at pH 10.5. The molar ratio of Tosylated PEG to Polyethyleneimine was 1:1. The mixture was stirred overnight (16 hr) at room temperature, after which the formation of para-toluene sulphonic acid was completed as measured by TLC, the pH was then adjusted to 7.0 with conc. hydrochloric acid and bottled. The synthesis was repeated with different molar ratios of Tosylated PEG to Polyethyleneimine to give a series of polymers as detailed in Table 1. P10 and P30 are labelled comparative because they resemble the alkoxylated polyethylene imines of the prior art.

Table 1

Polymer Code	Molar ratio Tosylated PEG:Polyethyleneimine
P1	1:1
P2	2:1
P3	3:1
P10 (reference)	10:1
P30 (reference)	30:1

Wash testing

[0062] The base laundry detergent composition used for wash testing is given in Table 2.

Table 2

	wt% (solids)
NaLAS	4.9
NI(7EO)	7.3
SLES(3EO)	2.4
Alkyl Betaine	0.9
1,2-propanediol	15.0
Triethanolamine	2.0
Free oil perfume	1.4
Water	to 100

NaLAS is sodium C_{11-15} alkyl benzene sulphonate.
NI(7EO) is R-$(OCH_2CH_2)_nOH$, where R is C_{12-15} alkyl, and n is 7.
SLES(3EO) is sodium lauryl ether sulphate with an average of 3 ethoxy groups.

Alkyl Betaine is Empigen® BB (ex Huntsman).

[0063] The composition was used to wash a mixture of white fabrics: woven cotton, micro-fibre polyester, woven polycotton and knitted nylon-elastane with a liquor to cloth ratio of 10:1 in a Linitester. The fabrics were of equal area. 26° French Hard water was used. Each wash lasted 20 minutes and was followed by 2 rinses in 75 ml water. This procedure was repeated twice in the base composition given in Table 2 (i.e. without any polymer) and then the fabric was then dried.

[0064] The wash procedure was then repeated three more times, now with the addition of soil strips to each wash to simulate soiling. The weight ratio of soil strips to the white fabrics was 8.6:1. The soil strips used were SBL 2004 Soil Ballast Fabrics (ex wfk Testgewebe GmbH) and a Stanley Clay strip (ex Warwick Equest UK) in the weight ratio of 1:1. For each of these 3 repeats 3.5 wt% of polymer was also included in the composition - the water balance being correspondingly reduced. The compositions were all used at 2.3 g/L.

[0065] The cloths were removed, dried and the reflectance spectrum measured using a reflectometer. The enhancement in cleaning was measured via • R460 which is given by:

- R460 = R460(polymer) - R460(control)

[0066] The cleaner the cloth the higher the reflectance, therefore the larger • R460 is the greater the increase in cleanliness of the cloth versus the control. The results are given in Table 3.

Table 3

	• R460			
	cotton	polycotton	polyester	nylon-elastane
PEI(1300) (reference)	7.6	2.4	9.8	-9.1
P1	6.5	4.6	11.1	-2.1
P2	3.4	1.7	6.9	-3.1
P3	3.4	1.4	1.6	-2.6
P10 (reference)	1.3	1.1	3.4	0.8
P30 (reference)	0.9	1.6	2.5	1.4
PEI(1300) is the non-ethoxylated PEI.				

[0067] The polymers P1 (with 1 ethoxylated chain) and P2 (with 2 ethoxylated chains) show the best performance overall performance, with good effects on cotton, polycotton and polyester, without a large negative on nylon-elastane as seen from the totally unalkoxylated PEI.

[0068] Note that in the following examples 2 and 4 the data for P1 and P30 is the sum of data from this test and not repeat data.

Example 2

[0069] The synthesis and experiments of example 1, was repeated for the Mol ratio 1:1 for the Tosylated PEG:Polyethyleneimine. The Poly(ethylene glycol) methyl ether used was changed to:

$CH_3(O\text{-}CH_2CH_2)_nO$ (Mn=750), and the resultant Alkoxylated PEI polymer coded P1-750; and
$CH_3(O\text{-}CH_2CH_2)_nOH$ (Mn=2000), and the resultant Alkoxylated PEI polymer coded P1-2000.

[0070] The wash results are given in Table 4.

Table 4

	• • R460
P1	20.1
P1-750	15.9
P1-2000	12.3
PEI(1300) (reference)	10.7
P30 (reference)	6.4
• • R_{460} is the sum of the • R_{460} for each of the fabrics.	

[0071] P1, P1-750 and P1-2000, provided improved results over the P30 and the PEI(1300) reference polymer. The shorter chain alkoxylated PEI provided the best results.

Example 3

[0072] The wash experiments of example 1 were repeated for P1 at a level of 0.4377 wt% (10 ppm in wash solution). The results are given in Table 5.

Table 5

	• • R_{460}
P1 (10ppm)	15.9

[0073] The polymers of the invention provide benefits at low levels.

Example 4

[0074] The synthesis and experiments of example 1, was repeated for the Mol ratio 1:1 for the Tosylated PEG:Polyethyleneimine. The Polyethyleneimine was changed to Polyethyleneimine (Mw=800) and coded Q1. The wash results are given in Table 6.

Table 6

	• • R460
P1	20.1
Q1	15.3

Example 5

[0075] Table 7 is a further detergent composition according to the invention.

Table 7

	wt% (solids)
NaLAS	4.9
NI(7EO)	7.3
SLES(3EO)	2.4
Alkyl Betaine	0.9
1,2-propanediol	15.0
Triethanolamine	2.0
Free oil perfume	1.4
P1	0.3
Lipase	0.002
Cellulase	0.002
Amylase	0.002
Acid Violet 50	0.002
Fluorescer	0.1
Water	to 100

[0076] Enzyme levels are expressed as pure protein. The lipase used was Lipoclean™ (Novozymes); the cellulose used was Celluclean™ (Novozymes); the amylase used was Stainzyme™ (Novozymes).

Claims

1. A laundry detergent composition containing 5 to 30 wt% detersive surfactant selected from non-ionic and anionic surfactant and 0.05 to 4 wt% of polyalkoxylated polyethylene imine polymer where the polyalkoxyl chains are directly linked to the nitrogens in the PEI and each chain has a terminal group with molecular weight less than 100 and wherein the polymer is a PEI which has a molar ratio of polyalkoxyl chains, including the terminal group, to PEI of less than or equal to 3 resulting in 3 or fewer, preferably 2 or fewer, most preferably 1 nitrogens bound to polyalkoxyl chains and wherein the PEI has a Mw of at least 500, preferably 1000 to 2000, more preferably less than 1500 and even about 1300.

2. A composition according to claim 1 wherein the fraction of (wt% non-ionic)/(wt% anionic surfactant) is from 0.6 to 2.0.

3. A composition according to claim 2 wherein the fraction of (wt% non-ionic)/(wt% anionic surfactant) is from 0.90 to 1.2.

4. A composition according to any preceding claim that is a liquid.

5. A composition according to any one of claims 1 to 3 that is a solid.

6. A composition according to any preceding claim further comprising perfume.

7. A composition according to any preceding claim wherein the terminal group on the polyalkoxyl chain is a C_{1-4} alkyl group, preferably a methyl group.

8. A composition according to any preceding claim wherein the polyalkoxylation consists of polyethoxylation.

9. A composition according to claim 8 in which the average number of ethylene oxide units in the polyethoxylated PEI is from 5 to 50, preferably from 8 to 20, more preferably from 10 to 14.

10. A composition according to any preceding claim comprising ethoxylate nonionic surfactant.

11. A laundry washing process wherein a composition according to any one of claims 1 to 10 is diluted to a level of 0.3 to 1 g/L detersive surfactant and 5 to 150 ppm, preferably 10 to 80 ppm polyalkoxylated polyethylene imine polymer and used to launder a mixed load of fabrics comprising nylon-elastane and at least one further fabric selected from the group comprising cotton, polycotton and polyester.

Patentansprüche

1. Waschmittelzusammensetzung enthaltend:

5 bis 30 Gew.-% Waschtensid, das aus nicht-ionischen und anionischen Tensiden ausgewählt ist, und 0,05 bis 4 Gew.-% eines polyalkoxylierten Polyethylenimin-Polymers, wobei die Polyalkoxylketten direkt an die Stickstoffatome im PEI gebunden sind und jede Kette eine terminale Gruppe mit einem Molekulargewicht von weniger als 100 aufweist und es sich beim Polymer um ein PEI mit einem Molverhältnis von Polyalkoxylketten, einschließlich der terminalen Gruppe, zu PEI von 3 oder weniger handelt, was ergibt, dass 3 oder weniger Stickstoffatome, vorzugsweise 2 oder weniger Stickstoffatome und insbesondere 1 Stickstoffatom an Polyalkoxylketten gebunden sind und wobei das PEI ein Molekulargewicht (Mw) von mindestens 500, vorzugsweise von 1000 bis 2000, insbesondere von weniger 1500 und sogar von etwa 1300 aufweist.

2. Zusammensetzung nach Anspruch 1, wobei das Verhältnis von (Gew.-% nicht-ionisches Tensid)/(Gew.-% anionisches Tensid) 0,6 bis 2,0 beträgt.

3. Zusammensetzung nach Anspruch 2, wobei das Verhältnis (Gew.-% nicht-ionisches Tensid)/(Gew.-% anionisches Tensid) 0,90 bis 1,2 beträgt.

4. Zusammensetzung nach einem der vorstehenden Ansprüche, bei der es sich um eine Flüssigkeit handelt.

5. Zusammensetzung nach einem der Ansprüche 1 bis 3, bei der es sich um einen Feststoff handelt.

6. Zusammensetzung nach einem der vorstehenden Ansprüche, ferner umfassend einen Duftstoff.

7. Zusammensetzung nach einem der vorstehenden Ansprüche, wobei die terminale Gruppe an der Polyalkoxylkette eine C_{1-4}-Alkylgruppe und vorzugsweise eine Methylgruppe ist.

8. Zusammensetzung nach einem der vorstehenden Ansprüche, wobei die Polyalkoxylierung aus einer Polyethoxylierung besteht.

9. Zusammensetzung nach Anspruch 8, wobei die durchschnittliche Anzahl an Ethylenoxideinheiten im polyethoxylierten PEI 5 bis 50, vorzugsweise 8 bis 20 und insbesondere 10 bis 14 beträgt.

10. Zusammensetzung nach einem der vorstehenden Ansprüche, umfassend ein nicht-ionisches Ethoxylat-Tensid.

11. Waschverfahren, wobei die Zusammensetzung nach einem der Ansprüche 1 bis 10 auf eine Konzentration von 0,3 bis 1 g/Liter Waschtensid und 5 bis 150 ppm und vorzugsweise 10 bis 80 ppm polyalkoxyliertes Polyethylenimin-Polymer verdünnt wird und zum Waschen einer gemischten Ladung von Textilien, die Nylon-Elastan und mindestens einen weiteren textilen Werkstoff, der aus der Gruppe, die Baumwolle, Baumwoll-Polyester-Mischgewebe und Polyester umfasst, ausgewählt ist, verwendet wird.

Revendications

1. Composition détergente pour le linge contenant 5 à 30 % en poids de tensloactif détersif choisi parmi les tensioactifs non-ioniques et anioniques et 0,05 à 4 % en poids d'un polymère de polyéthylène-imine polyalcoxylée dont les chaînes polyalcoxy sont directement liées aux azotes dans la PEI et chaque chaîne a un groupe terminal ayant une masse moléculaire inférieure à 100, et dans laquelle le polymère est une PEI qui a un rapport molaire des chaînes polyalcoxy, y compris le groupe terminal, à la PEI, inférieur ou égal à 3, ayant pour résultat 3 ou moins, de préférence

2 ou moins, tout spécialement 1, azotes liés à des chaînes polyalcoxy, et dans laquelle la PEI a une Mw d'au moins 500, de préférence de 1000 à 2000, mieux encore inférieure à 1500 et même d'environ 1300.

2. Composition selon la revendication 1, dans laquelle la fraction (% en poids de tensioactif non-ionique)/(% en poids de tensioactif anionique) est de 0,6 à 2,0.

3. Composition selon la revendication 2, dans laquelle la fraction (% en poids de tensioactif non-ionique)/(% en poids de tensioactif anionique) est de 0,90 à 1,2.

4. Composition selon l'une quelconque des revendications précédentes, qui est un liquide.

5. Composition selon l'une quelconque des revendications 1 à 3, qui est un solide.

6. Composition selon l'une quelconque des revendications précédentes, comprenant en outre un parfum.

7. Composition selon l'une quelconque des revendications précédentes, dans laquelle le groupe terminal sur la chaîne polyalcoxy est un groupe alkyle en Ci à C_4, de préférence un groupe méthyle.

8. Composition selon l'une quelconque des revendications précédentes, dans laquelle la polyalcoxylation consiste en une polyéthoxylation.

9. Composition selon la revendication 8, dans laquelle le nombre moyen de motifs oxyde d'éthylène dans la PEI polyéthoxylée est de 5 à 50, de préférence de 8 à 20, mieux encore de 10 à 14.

10. Composition selon l'une quelconque des revendications précédentes, comprenant un tensioactif non-ionique éthoxylé.

11. Procédé de lavage du linge dans lequel une composition selon l'une quelconque des revendications 1 à 10 est diluée à un niveau de 0,3 à 1 g/l de tensioactif détersif et de 5 à 150 ppm, de préférence de 10 à 80 ppm de polymère de polyéthylène-imine polyalcoxylée et est utilisée pour laver une charge mixte de tissus comprenant du nylon-élastane et au moins un autre tissu choisi dans le groupe comprenant le coton, le polycoton et le polyester.

REFERENCES CITED IN THE DESCRIPTION

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