Note: Within nine months of the publication of the mention of the grant of the European patent in the European Patent Bulletin, any person may give notice to the European Patent Office of opposition to that patent, in accordance with the Implementing Regulations. Notice of opposition shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European Patent Convention).
Field of the Invention

[0001] The present invention relates to benefit agent (such as fragrance) delivery particles and compositions (such as laundry treatment compositions) comprising them.

Background and Prior Art

[0002] In laundry treatment compositions such as laundry detergents, the fragrance experienced by consumers is one of the most important attributes. Efficient delivery of the right fragrances to the fabric during the laundry process and release of that fragrance at key consumer moments is critical to the delivery of clean and fresh laundry.

[0003] The delivery of fragrance at key moments is a difficult task since laundry detergents are usually designed to carry oily materials or particulate solids away from the laundered fabric. Fragrances, however, are also typically oily materials.

[0004] Encapsulation of fragrance allows for improved deposition of fragrance to fabric, as well as delaying the release of fragrance when the consumer garment is being worn. However, another important moment to the consumer is when the laundry is in the "damp" phase, which extends from when the garments are being removed from the washing machine, to when they are almost dry. There is a need for a composition that delivers a good fragrance experience during this phase without significant compromise of fragrance performance at other stages such as in the packaged composition before use and when the laundered garments are dry.

[0005] The present invention addresses this problem.

[0006] US 2018/0009996 describes microcapsules that have a core composition encapsulated within a polymer wall, and an inorganic shell connected to an exterior surface of the polymer wall by a surfactant.

Summary of the Invention

[0007] The invention provides a benefit agent delivery particle according to claim 1.

[0008] The invention also provides a laundry treatment composition comprising a benefit agent delivery particle as defined above.

Detailed Description and Preferred Embodiments

[0009] The benefit agent delivery particle of the invention has a core-shell structure in which a porous shell of polymeric material entraps a core containing the benefit agent.

[0010] The core is typically formed in an inner region of the particle and provides a sink for the benefit agent. The shell generally protects the benefit agent from the external environment and regulates the flow of benefit agent into and out of the core.

[0011] Particles with a core-shell structure (hereinafter termed "core-shell particles") which are suitable for use in the invention may be prepared using methods known to those skilled in the art such as coacervation, interfacial polymerization, and polycondensation.

[0012] Interfacial polymerisation typically proceeds with the formation of a fine dispersion of oil droplets (the oil droplets containing the core material) in an aqueous continuous phase.

[0013] The process of coacervation typically involves encapsulation of a generally water-insoluble core material by the precipitation of colloidal material(s) onto the surface of droplets of the material. Coacervation may be simple e.g. using one colloid such as gelatin, or complex where two or possibly more colloids of opposite charge, such as gelatin and gum arabic or gelatin and carboxymethyl cellulose, are used under carefully controlled conditions of pH, temperature and concentration.

[0014] Interfacial polymerisation typically proceeds with the formation of a fine dispersion of oil droplets (the oil droplets containing the core material) in an aqueous continuous phase.

[0015] The dispersed droplets form the core of the future core-shell particle and the dimensions of the dispersed droplets directly determine the size of the subsequent core-shell particles. Shell-forming materials (monomers or oligomers) are contained in both the dispersed phase (oil droplets) and the aqueous continuous phase and they react together at the phase interface to build a polymeric wall around the oil droplets thereby to encapsulate the droplets and form core-shell particles. An example of a core-shell particle produced by this method is a polyurea core-shell particle with a shell formed by reaction of diisocyanates or polyisocyanates with diamines or polyamines.

[0016] Polycondensation involves forming a dispersion or emulsion of the core material in an aqueous solution of precondensate of polymeric materials under appropriate conditions of agitation to produce dispersed core material of a desired particle size, and adjusting the reaction conditions to cause condensation of the precondensate by acid catalysis, resulting in the condensate separating from solution and surrounding the dispersed core material to produce a coherent
Deposition aids for use in the invention will generally have a weight average molecular weight (Mw) in the range of from about 5 kDa to about 500 kDa, preferably from about 10 kDa to about 500 kDa and more preferably from about 20 kDa to about 300 kDa.

[0016] One example of a preferred core-shell particle for use in the invention is an aminoplast core-shell particle with a shell formed from the polycondensation product of melamine and formaldehyde. Suitable cross-linking agents (e.g., toluene diisocyanate, divinyl benzene, butanediol diacylate) may also be used and secondary wall polymers may also be used as appropriate, e.g. anhydrides and their derivatives, particularly polymers and co-polymers of maleic anhydride.

[0017] The shell is preferably of a generally spherical shape; and will typically comprise at most 20% by weight based on the total weight of the core-shell particle.

[0018] Core-shell particles suitable for use in the invention will generally have an average particle size between 100 nanometers and 50 microns. Particles larger than this are entering the visible range. Examples of particles in the sub-micron range include latexes and mini-emulsions with an average particle size ranging from 100 to 600 nanometers. Core-shell particles suitable for use in the invention preferably have an average size of from 0.6 to 50 microns, more preferably from 2 to 30 microns and most preferably from 5 to 25 microns. The particle size distribution can be narrow, broad or multimodal. If necessary, the core-shell particles as initially produced may be filtered or screened to produce a product of greater size uniformity.

[0019] “Size” as used herein refers to diameter unless otherwise stated. For samples with particle diameter no greater than 1 micron, diameter means the z-average particle size measured, for example, using dynamic light scattering (as set out in an international standard ISO 13321) with an instrument such as a Zetasizer Nano™ ZS90 (Malvern Instruments Ltd, UK). For samples with particle diameter greater than 1 micron, diameter means the apparent volume median diameter (D50), measurable for example, by laser diffraction (as set out in an international standard ISO 13320) with an instrument such as a Mastersizer™ 2000 (Malvern Instruments Ltd, UK).

[0020] Core-shell particles suitable for use in the invention may be provided with a deposition aid at the outer surface of the particle. Deposition aids serve to modify the properties of the exterior of the particle, for example to make the particle more substantive to a desired substrate. Desired substrates include cellulosics (including cotton) and polyesters (including those employed in polyester fabrics).

[0021] The deposition aid may suitably be provided at the outer surface of the particle by means of covalent bonding, entanglement or strong adsorption. Examples include core-shell particles (such as those further described above) in which a deposition aid is attached to the outside of the shell, preferably by means of covalent bonding. While it is preferred that the deposition aid is attached directly to the outside of the shell, it may also be attached via a linking species.

[0022] Deposition aids for use in the invention may suitably be selected from polysaccharides having an affinity for cellulose. Such polysaccharides may be naturally occurring or synthetic and may have an intrinsic affinity for cellulose or may have been derivatised or otherwise modified to have an affinity for cellulose. Suitable polysaccharides have a 1-4 linked β glucan (generalised sugar) backbone structure with at least 4, and preferably at least 10 backbone residues which are β(1-4) linked, such as a glucan backbone (consisting of β(1-4) linked glucose residues), a mannan backbone (consisting of β(1-4 linked mannose residues) or a xylan backbone (consisting of β(1-4 linked xylose residues). Examples of such β(1-4 linked polysaccharides include xyloglucans, glucomannans, mannans, galactomannans, β(1-3),(1-4) glucan and the xylan family incorporating glucurono-, arabin-o- and glucuronorabinoylans. Preferred β(1-4 linked polysaccharides for use in the invention may be selected from xyloglucans of plant origin, such as pea xyloglucan and tamarind seed xyloglucan (TXG) (which has a β(1-4 linked glucan backbone with side chains of α-D xylopyranose and β-D-galactopyranosyl-(1-2)-α-D-xylo-pyranose, both 1-6 linked to the backbone); and galactomannans of plant origin such as locust bean gum (LBG) (which has a mannan backbone of β(1-4 linked mannose residues, with single unit galactose side chains linked α-1-6 to the backbone).

[0023] Also suitable are polysaccharides which may gain an affinity for cellulose upon hydrolysis, such as cellulose mono-acetate; or modified polysaccharides with an affinity for cellulose such as hydroxypropyl cellulose, hydroxypropyl methylcellulose, hydroxyethyl methylcellulose, hydroxypropyl guar, hydroxyethyl ethylcellulose and methylcellulose.

[0024] Deposition aids for use in the invention may also be selected from phthalate containing polymers having an affinity for polyester. Such phthalate containing polymers may have one or more nonionic hydrophilic segments comprising oxyalkylene groups (such as oxyethylene, polyoxyethylene, oxypropylene or polyoxypropylene groups), and one or more hydrophobic segments comprising terephthalate groups. Typically, the oxyalkylene groups will have a degree of polymerization of from 1 to about 400, preferably from 100 to about 350, more preferably from 200 to about 300. A suitable example of a phthalate containing polymer of this type is a copolymer having random blocks of ethylene terephthalate and polyethylene oxide terephthalate.

[0025] Mixtures of any of the above described materials may also be suitable.

[0026] Deposition aids for use in the invention will generally have a weight average molecular weight (Mw) in the range of from about 5 kDa to about 500 kDa, preferably from about 10 kDa to about 500 kDa and more preferably from about 20 kDa to about 300 kDa.

[0027] Core-shell particles suitable for use in the invention may be positively or negatively charged. However, it is
preferred that the core-shell particles are negatively charged and have a zeta potential of from -0.1 meV to -100 meV, more preferably from -10 meV to -80 meV, and most preferably from -20 meV to -75 meV. The zeta potential is suitably measured by a dynamic light scattering (DLS) method using a Zetasizer Nano™ ZS90 (Malvern Instruments Ltd, UK) at 25°C. A dispersion of the core-shell particles in deionised water with a solids content of around 500 ppm and a pH adjusted to about 7 is used for the measurement.

[0028] In core-shell particles suitable for use in the invention, openings in the shell are at least partially occluded by a wash-removable coating which is provided at the exterior surface of the shell. The presence of the wash-removable coating serves to reduce the leakage of the entrapped benefit agent through the pores in the shell. Removal of the coating during a washing operation facilitates release of the entrapped benefit agent.

[0029] The term "washing operation" as used herein generally denotes a method of laundering fabric using a laundry treatment composition according to the invention.

[0030] The wash-removable coating is formed from deposited particles of alkaline earth metal salt. Alkaline earth metal salts which are used to form the wash-removable coating have a solubility in distilled water (at 25°C and at atmospheric pressure) of less than 10 mg/L, preferably less than about 1 mg/L, to prevent the coating being removed too quickly in the wash.

[0031] Examples of suitable alkaline earth metal salts which may be used to form the wash-removable coating may be selected from calcium and magnesium salts such as calcium carbonate, magnesium carbonate, calcium bicarbonate, magnesium bicarbonate, calcium sulfate, magnesium sulfate, calcium phosphate, magnesium phosphate, calcium hydroxide, magnesium hydroxide, calcium citrate, magnesium citrate, calcium tartrate and magnesium tartrate. Preferred alkaline earth metal salts which may be used to form the wash-removable coating may be selected from calcium and magnesium hydroxides, carbonates and citrates such as calcium carbonate, magnesium carbonate, magnesium hydroxide and calcium citrate.

[0032] Mixtures of any of the above described materials may also be suitable. Most preferably the alkaline earth metal salt used to form the wash-removable coating is calcium carbonate or magnesium carbonate or a mixture thereof.

[0033] In a preferred process used to form the wash-removable, aqueous solutions of the constituent anions and cations respectively of the alkaline earth metal salt are separately prepared and then added (preferably sequentially) to a slurry of pre-formed core-shell particles. The anions and cations combine to form particles of the alkaline earth metal salt which deposit by precipitation onto the exterior shell surface of the pre-formed core-shell particles. Preferred sources of constituent anions include aqueous solutions of water soluble materials such as sodium carbonate, sodium hydroxide and citric acid. Preferred sources of constituent cations include aqueous solutions of water soluble materials such as calcium chloride and magnesium chloride. The term "water soluble" in the context of this invention generally denotes a solubility in water at ambient temperature (about 20°C) of at least 100 mg/L.

[0034] In core-shell particles suitable for use in the invention, the core contains a benefit agent. Preferred benefit agents in the context of fabric laundering include fragrance formulations, clays, enzymes, anti-foams, fluorocarbons, bleaching agents and precursors thereof (including photo-bleach), dyes and/or pigments, conditioning agents (for example cationic surfactants including water-insoluble quaternary ammonium materials, fatty alcohols and/or silicones), lubricants (e.g. sugar polyesters), colour and photo-protective agents (including sunscreens), antioxidants, ceramides, reducing agents, sequestrants, colour care additives (including dye fixing agents), unsaturated oil, emollients, moisturizers, insect repellents and/or pheromones, drape modifiers (e.g. polymer latex particles such as PVAc) and antimicrobial or microbe control agents.

[0035] Mixtures of any of the above described materials may also be suitable. The most preferred benefit agents in the context of this invention are fragrance formulations.

[0036] Fragrance formulations for use in the invention will typically contain a blend of selected fragrant components, optionally mixed with one or more excipients. The combined odours of the various fragrant components produce a pleasant or desired fragrance.

[0037] The term "fragrant component" in the context of this invention denotes a material which is used essentially for its ability to impart a pleasant odour to a composition (into which it is incorporated), and/or a surface (to which it is applied), either on its own or in admixture with other such materials. Materials having these characteristics are generally small, lipophilic molecules of sufficient volatility to be transported to the olfactory system in the upper part of the nose.

[0038] Fragrant components for use in the invention will typically have molecular weights of less than 325 atomic mass units, preferably less than 300 atomic mass units and more preferably less than 275 atomic mass units. The molecular weight is preferably greater than 100 atomic mass units and more preferably greater than 125 atomic mass units, since lower masses may be too volatile and/or insufficiently lipophilic to be effective.

[0039] Fragrant components for use in the invention will preferably have a molecular structure which does not contain halogen atoms and/or strongly ionizing functional groups such as sulfonates, sulfates, or quaternary ammonium ions.

[0040] Fragrant components for use in the invention will more preferably have a molecular structure containing only atoms from among, but not necessarily all, of the following: hydrogen, carbon, oxygen, nitrogen and sulphur. Most preferably the fragrant components will have a molecular structure containing only atoms from among, but not necessarily
all, of the following: hydrogen, carbon and oxygen.

[0041] Examples of fragrant components include aromatic, aliphatic and araliphatic hydrocarbons having molecular weights from about 90 to about 250; aromatic, aliphatic and araliphatic esters having molecular weights from about 130 to about 250; aromatic, aliphatic and araliphatic nitriles having molecular weights from about 90 to about 250; aromatic, aliphatic and araliphatic ketones having molecular weights from about 150 to about 270; aromatic, aliphatic and araliphatic lactones having molecular weights from about 130 to about 290; aromatic, aliphatic and araliphatic aldehydes having molecular weights from about 90 to about 230; aromatic, aliphatic and araliphatic ethers having molecular weights from about 150 to about 270; and condensation products of aldehydes and amines having molecular weights from about 180 to about 320.

[0042] Specific examples of fragrant components for use in the invention include:

i) hydrocarbons, such as, for example, D-limonene, 3-carene, α-pinene, β-pinene, α-terpinene, γ-terpinene, p-cymene, bisabolene, camphene, caryophyllene, cedrene, - farnesene, longifolene, myrcene, ocimene, valencene, (E,Z)-1,3,5-undecatriene, styrene, and diphenylmethane;

ii) aliphatic and araliphatic alcohols, such as, for example, benzyl alcohol, 1-phenylethyl alcohol, 2-phenylethyl alcohol, 3-phenylpropanol, 2-phenylpropanol, 2-phenoxyethanol, 2,2-dimethyl-3-phenylpropanol, 2,2-dimethyl-3-(3-methylphenyl)propanol, 1,1-dimethyl-2-phenylethyl alcohol, 1,1-dimethyl-3-phenylpropanol, 1-ethyl-1-methyl-3-phenylpropanol, 2-methyl-5-phenylpentanol, 3-methyl-5-phenylpentanol, 3-phenyl-2-propen-1-ol, 4-methoxybenzyl alcohol, 1-(4-isopropylphenoxy)ethanol, hexanol, octanol, 3-octanol, 2,6-dimethylethanol, 2-methyl-2-heptanol, 2-methyl-2-octanol, (E)-2-hexenol, (E) and (Z)-3-hexenol, 1-octen-3-ol, a mixture of 3,4,5,6,6-pentamethyl-3(E)-hepten-2-ol and 3,5,6,6-tetramethyl-4-methyleneheptan-2-ol, (E,Z)-2,6-nonadienol, 3,7-dimethyl-7-methoxyoctan-2-ol, 9-decenol, 10-undecenol, and 4-methyl-3-decen-5-ol;

iii) cyclic and cycloaliphatic alcohols, such as, for example, 4-tert-butylcyclohexanol, 3,3,5-trimethylcyclohexanol, 3-isocyclohexylmethylcyclohexanol, 2,6,9-trimethyl-2Z,2S,5E9-cyclododecatrien-1-ol, 2-isobutyl-4-methyltetrahydro-2H- pyran-4-ol, alpha, 3,3-trimethylcyclo-hexylmethanol, 2-methyl-4-(2,2,3,3-trimethyl-3-cyclopent-1-yl)butan-2-ol, 2-methyl-4-(2,2,3,3-trimethyl-3-cyclopent-1-yl)-2-buten-1-ol, 2-ethyl-4-(2,2,3,3-trimethyl-3-cyclopent-1-yl)-2-buten-1-ol, 3-methyl-5-(2,2,3,3-trimethyl-3-cyclopent-1-yl)-pentan-2-ol, 3-methyl-5-(2,2,3,3-trimethyl-3-cyclopent-1-yl)-pentan-2-ol, 3,3-dimethyl-5-(2,2,3,3-trimethyl-3-cyclopent-1-yl)-4-penten-2-ol, 1-(2,2,6-trimethylcyclohexyl)pentan-3-ol, and 1-(2,2,6-trimethylcyclohexyl)hexan-3-ol;

iv) aliphatic aldehydes and their acetals, such as, for example, hexanal, heptanal, octanal, nonanal, decanal, undecanal, dodecanal, tridecanal, 2-methyloctanal, 2-methylnonanal, 2-methylundecanal, (E)-2-hexenal, (Z)-4-hepten-2-ol, 2,6-dimethyl-5-heptenal, 10-undecenal, (E)-4-decanal, 2-dodecanal, 2,6,10-trimethyl-5,9-undecadienal, heptanal-diethylacetel, 1,1-dimethoxy-2,2,5-trimethyl-4-hexene, and citronellol oxyacetaldehyde;

v) aliphatic ketones and oximes thereof, such as, for example, 2-heptanone, 2-octanone, 3-octanone, 2-nonanone, 5-methyl-3-heptanone, 5-methyl-3-heptanone oxime, and 2,4,4,7-tetramethyl-6-octen-3-one;

vi) aliphatic sulfur-containing compounds, such as, for example, 3-methylthiohexanol, 3-methylthiohexyl acetate, 3-mercaptophexanol, 3-mercaptophexyl acetate, 3-mercaptotetrahydrofuran, 3-mercaptotetrahydrofuran acetic acid, 2-acetoxyvinyl acetate, and 1-methene-8-thiol;

vii) aliphatic nitriles, such as, for example, 2-nonenenitrile, 2-tridecenenitrile, 2,12-tridecenenitrile, 3,7-dimethyl-2,6-octadienitrile, and 3,7-dimethyl-6-octadienitrile;

viii) aliphatic carboxylic acids and esters thereof, such as, for example, (E)- and (Z)-3-hexenylformate, ethyl acetoacetate, isoamyl acetate, hexyl acetate, 3,5,5-trimethylhexyl acetate, 3-methyl-2-butenyl acetate, (E)-2-hexenyl acetate, (E)- and (Z)-3-hexenyl acetate, octyl acetate, 3-octyl acetate, 1-octen-3-yl acetate, butyl butyrate, isoamyl butyrate, hexylbutyrate, (E)- and (Z)-3-hexenyl isobutyrate, hexyl crotonate, ethylisovalerate, ethyl-2-methyl pentanoate, ethyl hexanoate, allyl hexanoate, ethyl heptanoate, ethyl octanoate, ethyl-(E,Z)-2,4-decadienoate, methyl-2-ocitrate, methyl-2-nonate, allyl-2-isooamyl oxyacetate, and methyl-3,7-dimethyldodecadienoate;

ix) acrylic terpene alcohols, such as, for example, citronellol; geraniol; nerol; linalool; lavandulol; nerolidol; farnesol; tetrahydrofarnesol; tetrahydrogeraniol; 2,6-dimethyl-7-octen-2-ol; 2,6-dimethyloctan-2-ol; 2-methyl-6-methylene-7-octen-2-ol; 2,6-dimethyl-5,7-octadien-2-ol; 2,6-dimethyl-3,5-octadien-2-ol; 3,7-dimethyl-4,6-octadien-3-ol; 3,7-
dimethyl-1,5,7-octatrien-3-ol, 2,6-dimethyl-2,5,7-octatrien-1-ol, as well as formates, acetates, propionates, isobutyrates, butyrates, isovalerates, pentanoates, hexanoates, crotonates, tiglates and 3-methyl-2-butenoates thereof.

x) acyclic terpene aldehydes and ketones, such as, for example, geranial, neral, citronellal, 7-hydroxy-3,7-dimethyloctanal, 7-methoxy-3,7-dimethyloctanal, 2,6,10-trimethyl-9-undecenal, α-sinensal, β-sinensal, geranylacetone, as well as the dimethyl- and diethylacetalts of geranial, neral and 7-hydroxy-3,7-dimethyloctanal;

xi) cyclic terpene aldehydes and ketones, such as, for example, menthone, isomenthone, 8-mercaptomenthan-3-one, carvone, camphor, fenchone, α-ionone, β-ionone, α-n-methylionone, β-n-methylionone, α-isomethylionone, β-isomethylionone, α-damascone, β-damascone, δ-damascone, γ-damascone, 1-(2,4,4-trimethyl-2-cyclohexen-1-yl)-2-buten-1-one, 1,3,4,6,7,8a-hexahydro-1,1,5,5-tetramethyl-2H-2,4a-methanonaphthalen-8(5H)-one, nootkatone, dihydronootkatone and cedryl methyl ketone;

xii) cyclic ketones, such as, for example, 4-tert-butylcyclohexanone, 2,2,5-trimethyl-5-pentylcyclopentanone, 2-heptylcyclopentanone, 2-pentylcyclopentanone, 2-hydroxy-3-methyl-2-cyclopenten-1-one, 3-methyl-cis-2-penten-1-yl-2-cyclopenten-1-one, 3-methyl-2-pentyl-2-cyclopenten-1-one, 3-methyl-4-cyclopentadecenone, 3-methyl-5-cyclopentadecenone, 3-methylcyclopentadecanone, 4-(1-ethoxyvinyl)-3,3,5,5-tetramethylcyclohexanone, 4-tert-pentylcyclohexanone, 5-cyclohexadecen-1-one, 6,7-dihydro-1,1,2,3,3-pentamethyl-4(5H)-indanone, 5-cyclohexadecen-1-one, 9-cyclohexadecen-1-one and cyclopentadecanone;

xv) cycloaliphatic aldehydes and ketones, such as, for example, menthone, isomenthone, 8-mercaptomenthan-3-one, carvone, camphor, fenchone, α-ionone, β-ionone, α-n-methylionone, β-n-methylionone, α-isomethylionone, β-isomethylionone, α-damascone, β-damascone, δ-damascone, γ-damascone, 1-(2,4,4-trimethyl-2-cyclohexen-1-yl)-2-buten-1-one, 1,3,4,6,7,8a-hexahydro-1,1,5,5-tetramethyl-2H-2,4a-methanonaphthalen-8(5H)-one, nootkatone, dihydronootkatone and cedryl methyl ketone;

xvi) esters of cyclic alcohols, such as, for example, 2-tert-butylcyclohexyl acetate, 4-tert-butylcyclohexyl acetate, 2-tert-pentylcyclohexyl acetate, 4-tert-pentylcyclohexyl acetate, decahydro-2-naphthy acetate, 3-pentyltetrahydro-2H-pyran-4-yl acetate, decachydro-2,5,8a-tetramethyl-2-naphthy acetate, 4,7-methano-3a,4,5,6,7,7a-hexahydro-5 or 6-indenyl acetate, 4,7-methano-3a,4,5,6,7,7a-hexahydro-5 or 6-indenyl propionate, 4,7-methano-3a,4,5,6,7,7a-hexahydro-5 or 6-indenyl isobutyrate and 4,7-methanoctahydro-5 or 6-indenyl acetate;
Naturally occurring exudates such as essential oils extracted from plants may also be used as fragrant components in the invention. Essential oils are understood by those skilled in the art to be complex mixtures which generally consist of several tens or hundreds of constituents. Most of these constituents possess an isoprenoid skeleton with 10 atoms of carbon (monoterpenes), 15 atoms of carbon (sesquiterpenes) or 20 atoms of carbon (diterpenes). Lesser quantities of other constituents can also be found, such as alcohols, aldehydes, esters and phenols. However, an individual essential oil is usually considered as a single ingredient in the context of practical fragrance formulation. Therefore, an individual essential oil may be considered as a single fragrant component for the purposes of this invention.

Specific examples of essential oils for use as fragrant components in the invention include cedarwood oil, juniper oil, cumin oil, cinnamon bark oil, camphor oil, rosewood oil, ginger oil, basil oil, eucalyptus oil, lemongrass oil, and essential oils from the families Asteraceae, Myrtaceae, Lauraceae, Lamiaceae, Myrtaceae, Rutaceae and Zingiberaceae. The oil is "essential" in the sense that it carries a distinctive scent, or essence, of the plant.
The term "laundry detergent" in the context of this invention denotes formulated compositions intended for and

Typically, no single fragrant component will comprise more than 70% by weight of the total weight of the fragrance formulation. Preferably no single fragrant component will comprise more than 60% by weight of the total weight of the fragrance formulation and more preferably no single fragrant component will comprise more than 50% by weight of the total weight of the fragrance formulation.

The term "fragrance formulation" in the context of this invention denotes the fragrant components as defined above, plus any optional excipients. Excipients may be included within fragrance formulations for various purposes, for example as solvents for insoluble or poorly-soluble components, as diluents for the more potent components or to control the vapour pressure and evaporation characteristics of the fragrance formulation. Excipients may have many of the characteristics of fragrant components but they do not have strong odours in themselves. Accordingly, excipients may be distinguished from fragrant components because they can be added to fragrance formulations in high proportions such as 30% or even 50% by weight of the total weight of the fragrance formulation without significantly changing the odour quality of the fragrance formulation. Some examples of suitable excipients include ethanol, isopropanol, diethylene glycol monoethyl ether, dipropylene glycol, diethyl phthalate and triethyl citrate. Mixtures of any of the above described materials may also be suitable.

A suitable fragrance formulation for use in the invention comprises a blend of at least 10 fragrant components selected from hydrocarbons i); aliphatic and araliphatic alcohols ii); aliphatic aldehydes and their acetals iv); aliphatic carboxylic acids and esters thereof viii); acyclic terpene alcohols ix); cyclic and cycloaliphatic ethers xii); esters of cyclic alcohols xvi); esters of aliphatic alcohols and aliphatic carboxylic acids xviii); araliphatic ethers and their acetals xix); aromatic and araliphatic aldehydes and ketones xx) and aromatic and araliphatic carboxylic acids and esters thereof xxi); as are further described and exemplified above.

The content of fragrant components preferably ranges from 50 to 100%, more preferably from 60 to 100% and most preferably from 75 to 100% by weight based on the total weight of the fragrance formulation; with one or more excipients (as described above) making up the balance of the fragrance formulation as necessary.

The fragrance formulation will typically comprise from about 10 to about 60% and preferably from about 20 to about 40% by weight based on the total weight of the core-shell particle. The amount of fragrance formulation may be measured by taking a slurry of the core-shell particles, extracting into ethanol and measuring by liquid chromatography.

The benefit agent delivery particles of the invention are suitable for incorporation into laundry treatment compositions of all physical forms.

In a typical laundry treatment composition according to the invention the level of benefit agent delivery particles will generally range from 0.01 to 10%, preferably from 0.1 to 5%, more preferably from 0.3 to 3% (by weight based on the total weight of the composition).

Product Form

A laundry treatment composition according to the invention is preferably in liquid form.

The term "liquid" in the context of this invention denotes that a continuous phase or predominant part of the composition is liquid and that the composition is flowable at 15°C and above. Accordingly, the term "liquid" may encompass emulsions, suspensions, and compositions having flowable yet stiffer consistency, known as gels or pastes. The viscosity of the composition may suitably range from about 200 to about 10,000 mPa.s at 25°C at a shear rate of 21 sec⁻¹. This shear rate is the shear rate that is usually exerted on the liquid when poured from a bottle. Pourable liquid compositions generally have a viscosity of from 200 to 2,500 mPa.s, preferably from 200 to 1,500 mPa.s. Liquid compositions which are pourable gels generally have a viscosity of from 1,500 mPa.s to 6,000 mPa.s, preferably from 1,500 mPa.s to 2,000 mPa.s.

Product Types

Preferably the laundry treatment composition according to the invention is a laundry detergent.

Laundry detergents

The term "laundry detergent" in the context of this invention denotes formulated compositions intended for and
To provide cleaning effect, a laundry detergent according to the invention generally comprises at least 3%, such as from 5 to 60% (by weight based on the total weight of the composition) of one or more detersive surfactants. The choice of detersive surfactant, and the amount present, will depend on the intended use of the laundry detergent. For example, different surfactant systems may be chosen for hand-washing products and for products intended for use in different types of automatic washing machines. The total amount of surfactant present will also depend on the intended end use and may, in fully formulated products, be as high as 60% (by weight based on the total weight of the composition) in a composition for washing fabrics by hand. In compositions for machine washing of fabrics, an amount of from 5 to 40%, such as 15 to 35% (by weight based on the total weight of the composition) is generally appropriate.

The term "detersive surfactant" in the context of this invention denotes a surfactant which provides a detersive (i.e. cleaning) effect to laundry treated as part of a domestic laundering process.

Preferred detersive surfactants may be selected from non-soap anionic surfactants, nonionic surfactants and mixtures thereof.

Non-soap anionic surfactants are principally used to facilitate particulate soil removal. Non-soap anionic surfactants for use in the invention are typically salts of organic sulfates and sulfonates having alkyl radicals containing from about 8 to about 22 carbon atoms, the term "alkyl" being used to include the alkyl portion of higher acyl radicals. Examples of such materials include alkyl sulfates, alkyl ether sulfates, alkaryl sulfonates, alphaolefin sulfonates and mixtures thereof. The alkyl radicals preferably contain from 10 to 18 carbon atoms and may be unsaturated. The alkyl ether sulfates may contain from one to ten ethylene oxide or propylene oxide units per molecule, and preferably contain one to three ethylene oxide units per molecule. The counterion for anionic surfactants is generally an alkali metal such as sodium or potassium; or an ammoniacal counterion such as monoethanolamine, (MEA) diethanolamine (DEA) or triethanolamine (TEA). Mixtures of such counterions may also be employed.

A preferred class of non-soap anionic surfactant for use in the invention includes alkylbenzene sulfonates, particularly linear alkylbenzene sulfonates (LAS) with an alkyl chain length of from 10 to 18 carbon atoms. Commercial LAS is a mixture of closely related isomers and homologues alkyl chain homologues, each containing an aromatic ring sulfonated at the "para" position and attached to a linear alkyl chain at any position except the terminal carbons. The linear alkyl chain typically has a chain length of from 11 to 15 carbon atoms, with the predominant materials having a chain length of about C12. Each alkyl chain homologue consists of a mixture of all the possible sulfophenyl isomers except for the 1-phenyl isomer. LAS is normally formulated into compositions in acid (i.e. HLAS) form and then at least partially neutralized in-situ.

Also suitable are alkyl ether sulfates having a straight or branched chain alkyl group having 10 to 18, more preferably 12 to 14 carbon atoms and containing an average of 1 to 3EO units per molecule. A preferred example is sodium lauryl ether sulfate (SLES) in which the predominantly C12 lauryl alkyl group has been ethoxylated with an average of 3EO units per molecule.

Some alkyl sulfate surfactant (PAS) may be used, such as non-ethoxylated primary and secondary alkyl sulfates with an alkyl chain length of from 10 to 18.

Mixtures of any of the above described materials may also be used. A preferred mixture of non-soap anionic surfactants for use in the invention comprises linear alkylbenzene sulfonate (preferably C11 to C15 linear alkyl benzene sulfonate) and sodium lauryl ether sulfate (preferably C10 to C18 alkyl sulfate ethoxylated with an average of 1 to 3 EO).

In a laundry detergent according to the invention, the total level of non-soap anionic surfactant may suitably range from 5 to 30% (by weight based on the total weight of the composition).

Nonionic surfactants may provide enhanced performance for removing very hydrophobic oily soil and for cleaning hydrophobic polyester and polyester/cotton blend fabrics. Nonionic surfactants for use in the invention are typically polyoxyalkylene compounds, i.e. the reaction product of alkylene oxides (such as ethylene oxide or propylene oxide or mixtures thereof) with starter molecules having a hydrophobic group and a reactive hydrogen atom which is reactive with the alkylene oxide. Such starter molecules include alcohols, acids, amides or alkyl phenols. Where the starter molecule is an alcohol, the reaction product is known as an alcohol alkoxylate. The polyoxyalkylene compounds can have a variety of block and heteric (random) structures. For example, they can comprise a single block of alkylene oxide, or they can be diblock alkoxylates or triblock alkoxylates. Within the block structures, the blocks can be all ethylene oxide or all propylene oxide, or the blocks can contain a heteric mixture of alkylene oxides. Examples of such materials include C8 to C22 alkyl phenol ethoxylates with an average of from 5 to 25 moles of ethylene oxide per mole of alkyl.
phenol; and aliphatic alcohol ethoxylates such as C₈ to C₁₈ primary or secondary linear or branched alcohol ethoxylates with an average of from 2 to 40 moles of ethylene oxide per mole of alcohol.

[0069] A preferred class of nonionic surfactant for use in the invention includes aliphatic C₈ to C₁₈, more preferably C₁₂ to C₁₅ primary linear alcohol ethoxylates with an average of from 3 to 20, more preferably from 5 to 10 moles of ethylene oxide per mole of alcohol.

[0070] Mixtures of any of the above described materials may also be used.

[0071] In a laundry detergent according to the invention, the total level of nonionic surfactant may suitably range from 0 to 25% (by weight based on the total weight of the composition).

[0072] A laundry detergent according to the invention is preferably in liquid form.

[0073] Mixtures of any of the above described materials may also be used.

[0074] A preferred class of nonionic surfactant for use in the invention includes aliphatic C₁₂ to C₁₅ primary linear alcohol ethoxylates with an average of from 3 to 20, more preferably from 5 to 10 moles of ethylene oxide per mole of alcohol.

[0075] Mixtures of any of the above described materials may also be used.

Builders

[0076] A laundry detergent according to the invention may contain one or more builders. Builders enhance or maintain the cleaning efficiency of the surfactant, primarily by reducing water hardness. This is done either by sequestration or chelation (holding hardness minerals in solution), by precipitation (forming an insoluble substance), or by ion exchange (trading electrically charged particles).

[0077] Builders for use in the invention can be of the organic or inorganic type, or a mixture thereof. Non-phosphate builders are preferred.

[0078] Inorganic, non-phosphate builders for use in the invention include hydroxides, carbonates, silicates, zeolites, and mixtures thereof.

[0079] Suitable hydroxide builders for use in the invention include sodium and potassium hydroxide.

[0080] Suitable carbonate builders for use in the invention include mixed or separate, anhydrous or partially hydrated alkali metal carbonates, bicarbonates or sesquicarbonates. Preferably the alkali metal is sodium and/or potassium, with sodium carbonate being particularly preferred.

[0081] Suitable silicate builders include amorphous forms and/or crystalline forms of alkali metal (such as sodium) silicates. Preferred are crystalline layered sodium silicates (phyllosilicates) of the general formula (I):

\[
NaMSi_{x}O_{2x+1}yH_{2}O
\]

in which M is sodium or hydrogen, x is a number from 1.9 to 4, preferably 2 or 3 and y is a number from 0 to 20. Sodium disilicates of the above formula in which M is sodium and x is 2 are particularly preferred. Such materials can be prepared with different crystal structures, referred to as α, β, γ and δ phases, with δ-sodium disilicate being most preferred.

[0082] Zeolites are naturally occurring or synthetic crystalline aluminosilicates composed of (SiO₄)⁴⁻ and (AlO₄)⁵⁻ tetrahedra, which share oxygen-bridging vertices and form cage-like structures in crystalline form. The ratio between oxygen, aluminium and silicon is O:(Al + Si) = 2:1. The frameworks acquire their negative charge by substitution of some Si by Al. The negative charge is neutralised by cations and the frameworks are sufficiently open to contain, under normal conditions, mobile water molecules. Suitable zeolite builders for use in the invention may be defined by the general formula (II):

\[
Na_{x}[(AlO_{2})_{y}](SiO_{2})_{z}zH_{2}O
\]

in which x and y are integers of at least 6, the molar ratio of x to y is in the range from about 1 to about 0.5, and z is an integer of at least 5, preferably from about 7.5 to about 276, more preferably from about 10 to about 264.

[0083] Preferred inorganic, non-phosphate builders for use in the invention may be selected from zeolites (of the general formula (II) defined above), sodium carbonate, δ-sodium disilicate and mixtures thereof.
SRPs for use in the invention may suitably be selected from copolyesters of dicarboxylic acids (for example ethylene terephthalate or propylene terephthalate with polyethylene oxide or polypropylene oxide) or the combination of DMT, EG and/or PG, Me-capped PEG and Na-dimethyl-5-sulfoisophthalate, and copolymeric blocks of block polyester oligomeric compounds such as those produced from DMT, Me-capped PEG and EG and/or PG, or a nonionic-capped polyester produced by transesterification/oligomerization of poly(ethyleneglycol) methyl ether, dimethyl terephthalate with anionic groups, such as for example sulfonated isophthaloyl units. Examples of such materials include oligomeric esters produced by transesterification/oligomerization of poly(ethyleneglycol) methyl ether, dimethyl terephthalate ("DMT"), propylene glycol ("PG") and poly(ethyleneglycol) ("PEG"); partly- and fully-anionic-end-capped oligomeric esters such as oligomers from ethylene glycol ("EG"), PG, DMT and Na-3,6-dioxa-8-hydroxyoctanesulfonate; nonionic-capped block polyester oligomeric compounds such as those produced from DMT, Me-capped PEG and EG and/or PG, or a combination of DMT, EG and/or PG, Me-capped PEG and Na-dimethyl-5-sulfoisophthalate, and copolymeric blocks of ethylene terephthalate or propylene terephthalate with polyethylene oxide or polypropylene oxide terephthalate.
Other types of SRP for use in the invention include cellulosic derivatives such as hydroxyether cellulosic polymers, C₁₋₄ alkylcelluloses and C₂ hydroxyalkyl celluloses; polymers with poly(vinyl ester) hydrophobic segments such as graft copolymers of poly(vinyl ester), for example C₁₋₆ vinyl esters (such as poly(vinyl acetate)) grafted onto polyalkylene oxide backbones; poly(vinyl caprolactam) and related co-polymers with monomers such as vinyl pyrrolidone and/or dimethylaminoethyl methacrylate; and polyester-polyamide polymers prepared by condensing adipic acid, caprolactam, and polyethylene glycol.

Preferred SRPs for use in the invention include copolyesters formed by condensation of terephthalic acid ester and diol, preferably 1,2 propanediol, and further comprising an end cap formed from repeat units of alkylene oxide capped with an alkyl group. Examples of such materials have a structure corresponding to general formula (I):

\[
\begin{align*}
R^1 & \quad - \quad O \quad C \quad [ \quad \text{ } \quad C = \quad O \quad - \quad C_3H_6 \quad O \quad - \quad C \quad ]_a \quad O \quad C \quad - \quad R^2
\end{align*}
\]

in which \( R^1 \) and \( R^2 \) independently of one another are \( X - (OC_2H_4)_n(OC_3H_6)_m \);

in which \( X \) is \( C_1-4 \) alkyl and preferably methyl;

\( n \) is a number from 12 to 120, preferably from 40 to 50;

\( m \) is a number from 1 to 10, preferably from 1 to 7; and

\( a \) is a number from 4 to 9.

Because they are averages, \( m \), \( n \) and \( a \) are not necessarily whole numbers for the polymer in bulk.

Mixtures of any of the above described materials may also be used.

The overall level of SRP, when included, may range from 0.1 to 10%, preferably from 0.3 to 7%, more preferably from 0.5 to 5% (by weight based on the total weight of the composition).

Transition metal ion chelating agents

A liquid or particulate laundry detergent according to the invention may contain one or more chelating agents for transition metal ions such as iron, copper and manganese. Such chelating agents may help to improve the stability of the composition and protect for example against transition metal catalysed decomposition of certain ingredients.

Suitable transition metal ion chelating agents include phosphonates, in acid and/or salt form. When utilized in salt form, alkali metal (e.g. sodium and potassium) or alkanolammonium salts are preferred. Specific examples of such materials include aminotris(methylene phosphonic acid) (ATMP), 1-hydroxyethyldene diphosphonic acid (HEDP) and diethylenetriamine penta(methylene phosphonic acid (DTPMP) and their respective sodium or potassium salts. HEDP is preferred. Mixtures of any of the above described materials may also be used.

Transition metal ion chelating agents, when included, may be present in an amount ranging from about 0.1 to about 10%, preferably from about 0.1 to about 3% (by weight based on the total weight of the composition).

Fatty Acid

A laundry detergent according to the invention may in some cases contain one or more fatty acids and/or salts thereof.

Suitable fatty acids in the context of this invention include aliphatic carboxylic acids of formula RCOOH, where R is a linear or branched alkyl or alkenyl chain containing from 6 to 24, more preferably 10 to 22, most preferably from 12 to 18 carbon atoms and 0 or 1 double bond. Preferred examples of such materials include saturated C₁₂-₁₈ fatty acids such as lauric acid, myristic acid, palmitic acid or stearic acid; and fatty acid mixtures in which 50 to 100% (by weight based on the total weight of the mixture) consists of saturated C₁₂-₁₈ fatty acids. Such mixtures may typically be derived from natural fats and/or optionally hydrogenated natural oils (such as coconut oil, palm kernel oil or tallow).

The fatty acids may be present in the form of their sodium, potassium or ammonium salts and/or in the form of soluble salts of organic bases, such as mono-, di- or triethanolamine.

Mixtures of any of the above described materials may also be used.

Fatty acids and/or their salts, when included, may be present in an amount ranging from about 0.25 to 5%, more preferably from 0.5 to 5%, most preferably from 0.75 to 4% (by weight based on the total weight of the composition).

For formula accounting purposes, in the formulation, fatty acids and/or their salts (as defined above) are not included in the level of surfactant or in the level of builder.
A liquid laundry detergent according to the invention may comprise one or more rheology modifiers. Examples of such materials include polymeric thickeners and/or structurants such as hydrophobically modified alkali swellable emulsion (HASE) copolymers. Exemplary HASE copolymers for use in the invention include linear or crosslinked copolymers that are prepared by the addition polymerization of a monomer mixture including at least one acidic vinyl monomer, such as (meth)acrylic acid (i.e. methacrylic acid and/or acrylic acid); and at least one associative monomer. The term "associative monomer" in the context of this invention denotes a monomer having an ethylenically unsaturated section (for addition polymerization with the other monomers in the mixture) and a hydrophobic section. A preferred type of associative monomer includes a polyoxyalkylene section between the ethylenically unsaturated section and the hydrophobic section. Preferred HASE copolymers for use in the invention include linear or crosslinked copolymers that are prepared by the addition polymerization of (meth)acrylic acid with (i) at least one associative monomer selected from linear or branched C₈-C₄₀ alkyl (preferably linear C₁₂-C₂₂ alkyl) polyethoxylated (meth)acrylates; and (ii) at least one further monomer selected from C₄-C₈ alkyl (meth) acrylates, polyacidic vinyl monomers (such as maleic acid, maleic anhydride and/or salts thereof) and mixtures thereof. The polyethoxylated portion of the associative monomer (i) generally comprises about 5 to about 100, preferably about 10 to about 80, and more preferably about 15 to about 60 oxyethylene repeating units.

Mixtures of any of the above described materials may also be used.

Polymeric thickeners, when included, may be present in an amount ranging from 0.1 to 5% (by weight based on the total weight of the composition).

A liquid laundry detergent according to the invention may also have its rheology modified by use of one or more external structurants which form a structuring network within the composition. Examples of such materials include hydrogenated castor oil, microfibrous cellulose and citrus pulp fibre. The presence of an external structurant may provide shear thinning rheology and may also enable materials such as encapsulates and visual cues to be suspended stably in the liquid.

A laundry detergent according to the invention may comprise an effective amount of one or more enzymes selected from the group comprising, pectate lyase, protease, amylase, cellulase, lipase, mannanase and mixtures thereof. The enzymes are preferably present with corresponding enzyme stabilizers.

A liquid laundry detergent according to the invention preferably has a pH in the range of 5 to 9, more preferably 6 to 8, when measured on dilution of the composition to 1% (by weight based on the total weight of the composition) using demineralised water.

Further optional ingredients to enhance performance and/or consumer acceptability. Examples of such ingredients include foam boosting agents, preservatives (e.g. bactericides), antioxidants, sunscreens, anticorrosion agents, colorants, pearlisers and/or opacifiers, and shading dye. Each of these ingredients will be present in an amount effective to accomplish its purpose. Generally, these optional ingredients are included individually at an amount of up to 5% (by weight based on the total weight of the composition).

A laundry treatment composition of the invention may contain further optional ingredients to enhance performance and/or consumer acceptability. Examples of such ingredients include foam boosting agents, preservatives (e.g. bactericides), antioxidants, sunscreens, anticorrosion agents, colorants, pearlisers and/or opacifiers, and shading dye. Each of these ingredients will be present in an amount effective to accomplish its purpose. Generally, these optional ingredients are included individually at an amount of up to 5% (by weight based on the total weight of the composition).

Packaging and dosing

A laundry treatment composition of the invention may be packaged as unit doses in polymeric film soluble in the wash water. Alternatively, a composition of the invention may be supplied in multidose plastics packs with a top or bottom closure. A dosing measure may be supplied with the pack either as a part of the cap or as an integrated system.

A method of treating fabric using a laundry detergent according to the invention will usually involve diluting the dose of detergent to obtain a wash liquor, and washing fabrics with the wash liquor so formed. The method of laundering fabric may suitably be carried out in an automatic washing machine, or can be carried out by hand. In automatic washing machines, the dose of detergent is typically put into a dispenser and from there it is flushed into the machine by the water flowing into the machine, thereby forming the wash liquor. Alternatively, the dose of detergent may be added directly into the drum. Dosages for a typical front-loading washing machine (using 10 to 15 litres of water to form the wash liquor) may range from about 10 ml to about 60 ml, preferably about 15 to 40 ml. Dosages for a typical top-loading washing machine (using from 40 to 60 litres of water to form the wash liquor) may be higher, e.g. up to about 100 ml. Lower dosages of detergent (e.g. 50 ml or less) may be used for hand washing methods (using about 1 to 10 litres of water to form the wash liquor). A subsequent aqueous rinse step and drying the laundry is preferred.
Any input of water during any optional rinsing step(s) is not included when determining the volume of the wash liquor.

[0120] The laundry drying step can take place either in an automatic dryer or in the open air.

[0121] The invention will now be further described with reference to the following non-limiting Examples.

EXAMPLES

[0122] All weight percentages are by weight based on total weight unless otherwise specified. Examples according to the invention are indicated by a number; and Comparative Examples (not according to the invention) are indicated by a letter.

[0123] Melamine-formaldehyde core-shell particles were prepared having a shell of melamine-formaldehyde, a core containing a 15-component model fragrance, an average particle diameter of approximately 13 μm and a zeta potential of approximately -20mV (when measured as described above). The particles were obtained in an aqueous slurry having a solids content of about 30 wt.%.

[0124] The aqueous slurry was diluted with water to reduce the solids content to about 10 wt.%, and coatings added in a two-stage process using coating components as shown in Table 1. In this process, component 1 is added to the slurry of particles and mixed for 30 minutes. Component 2 is then added. The mixing of components 1 and 2 forms a salt which precipitates onto the surface of the core-shell particles to form a coating. A control in which no coating components were added to the slurry of particles was also included.

To test the leakage of fragrance from the core-shell particles, 1 ml of particle slurry was mixed with 9 ml of laundry liquid having ingredients shown in Table 2.

Table 1

<table>
<thead>
<tr>
<th>Example</th>
<th>Component 1</th>
<th>Component 2</th>
<th>Coating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>1</td>
<td>Calcium chloride</td>
<td>Sodium carbonate</td>
<td>Calcium carbonate</td>
</tr>
<tr>
<td>2</td>
<td>Magnesium chloride</td>
<td>Sodium carbonate</td>
<td>Magnesium carbonate</td>
</tr>
<tr>
<td>3</td>
<td>Magnesium chloride</td>
<td>Sodium hydroxide</td>
<td>Magnesium hydroxide</td>
</tr>
<tr>
<td>4</td>
<td>Calcium chloride</td>
<td>Citric acid</td>
<td>Calcium citrate</td>
</tr>
</tbody>
</table>

Table 2

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>wt.% (active ingredient)</th>
</tr>
</thead>
<tbody>
<tr>
<td>C_{12-14} linear alkylbenzene sulfonic acid (LAS)</td>
<td>11.2</td>
</tr>
<tr>
<td>C_{12-15} alcohol ethoxylate (7EO)</td>
<td>8.4</td>
</tr>
<tr>
<td>SLES (3EO)</td>
<td>8.4</td>
</tr>
<tr>
<td>Monopropylene glycol</td>
<td>8.0</td>
</tr>
<tr>
<td>Monoethanolamine</td>
<td>To pH 8.3</td>
</tr>
<tr>
<td>Water, minors</td>
<td>q.s.</td>
</tr>
</tbody>
</table>

[0125] To test the leakage of fragrance from the core-shell particles, 1 ml of particle slurry was mixed with 9 ml of laundry liquid having ingredients shown in Table 2.

[0126] Each test mixture was then placed on a roller for 24 hours, followed by centrifugation for 30 minutes at 11000 rpm. The supernatant liquid was then removed and filtered through a 3.1 μm filter. 1 ml of the filtrate was then placed in a 20 ml headspace vial. The headspace above the filtrate was measured after incubation for 10 minutes at 40°C on a CombiPAL autosampler. Sampling was achieved using a PDMS/Carboxen/DVB fibre with an exposure time of 60 seconds. The fibre was then desorbed for 5 minutes at 270°C in the inlet of an Agilent 6890 gas chromatograph. Separation was achieved using a 30m BPX-5 capillary column. Peak identification was achieved using an Agilent 5973N inert mass detector in conjunction with the appropriate software/NIST library. Integrations for the peaks from the fragrance were summed to give a total fragrance level. A calibration plot, constructed by adding known amounts of free fragrance to the model laundry liquid, allowed the result to be converted into a percentage leakage figure.

[0127] The results are shown in Table 3.
The coated particles of Examples 1 to 4 according to the invention all demonstrate a significantly lower fragrance leakage percentage than the uncoated control particles when incorporated into laundry liquid. When the laundry liquid is diluted in a washing operation (typically 35ml liquid into 21L water) the coatings are removed. In this way, the particles of the invention provide an improvement in the stability of the fragrance toward leakage in product, whilst providing an enhanced fragrance experience in the early stages post wash.

**Claims**

1. A process for preparing a benefit agent delivery particle having a core-shell structure in which a porous shell of polymeric material surrounds a core containing the benefit agent; the pores in the shell being at least partially occluded by a wash-removable coating provided at the exterior surface of the shell;

   whereby removal of the coating during a washing operation facilitates release of the benefit agent through the pores in the shell; and **characterized in that** the wash-removable coating is formed from deposited particles of alkaline earth metal salt;

   in which aqueous solutions of the constituent anions and cations respectively of the alkaline earth metal salt are separately prepared and then added to a slurry of pre-formed particles having a core-shell structure in which a porous shell of polymeric material surrounds a core containing the benefit agent, in which aqueous solutions of the constituent anions and cations respectively of the alkaline earth metal salt are separately prepared and then added to a slurry of pre-formed core-shell particles and the anions and cations combine to form particles of the alkaline earth metal salt which deposit by precipitation onto the exterior shell surface of the pre-formed core-shell particles;

   and in which the alkaline earth metal salt has a solubility in distilled water (at 25°C and at atmospheric pressure) of less than 10mg/L

2. A process according to claim 1, in which the benefit agent is a fragrance formulation comprising a blend of at least 10 fragrant components selected from hydrocarbons; aliphatic and araliphatic alcohols; aliphatic aldehydes and their acetals; aliphatic carboxylic acids and esters thereof; acyclic terpene alcohols; cyclic terpene aldehydes and ketones; cyclic and cycloaliphatic ethers; esters of cyclic alcohols; esters of araliphatic alcohols and aliphatic carboxylic acids; araliphatic ethers and their acetals; aromatic and araliphatic aldehydes and ketones; and aromatic and araliphatic carboxylic acids and esters thereof.

3. A process according to claim 1 or claim 2, in which the fragrance formulation comprises from 20 to 40% by weight based on the total weight of the benefit agent delivery particle.

4. A process according to claim 3, in which the alkaline earth metal salt is selected from calcium carbonate, magnesium carbonate, magnesium hydroxide and calcium citrate and mixtures thereof.

5. A process according to any one of claims 1 to 4, in which the aqueous solution of constituent anions is an aqueous solution of sodium carbonate or of sodium hydroxide or of citric acid or of a mixture thereof.

6. A process according to any one of claims 1 to 5, in which the aqueous solution of constituent cations is an aqueous
solution of calcium chloride or of magnesium chloride or of a mixture thereof.

7. A laundry treatment composition comprising a benefit agent delivery particle obtainable by the process as defined in any one of claims 1 to 6.

8. A laundry treatment composition according to claim 7, which is a laundry detergent comprising from 5 to 40% (by weight based on the total weight of the composition) of detersive surfactants selected from non-soap anionic surfactants, nonionic surfactants and mixtures thereof.

9. A laundry treatment composition according to claim 7 or claim 8, which is a liquid comprising from 5 to 95% water (by weight based on the total weight of the composition).

Patentansprüche

1. Verfahren zur Herstellung eines Pflegemittelabgabepartikels mit einer Kern/Schale-Struktur, in der eine poröse Schale polymeren Materials einen Kern umgibt, der das Pflegemittel enthält; wobei die Poren in der Schale zumindest teilweise durch eine durch Waschen entfernbar Beschichtung verschlossen sind, die auf der Außenfläche der Schale vorgesehen ist;

   wodurch das Entfernen der Beschichtung während eines Waschvorgangs die Freisetzung des Pflegemittels durch die Poren in der Schale erleichtert und dadurch gekennzeichnet, dass

   die durch Waschen entfernbare Beschichtung aus abgeschiedenen Partikeln von Erdalkalimetallsalz gebildet wird, wobei die wässrigen Lösungen der konstituierenden Anionen bzw. Kationen des Erdalkalimetallsalzes getrennt hergestellt und dann zu einer Aufschlämmung vorgeformter Partikel mit einer Kern/Schale-Struktur gegeben werden, in der eine poröse Schale polymeren Materials einen das Pflegemittel enthaltenden Kern umgibt, wobei die wässrigen Lösungen der konstituierenden Anionen bzw. Kationen des Erdalkalimetallsalzes getrennt hergestellt und dann zu einer Aufschlämmung vorgeformter Kern/Schale-Partikel gegeben werden und sich die Anionen und die Kationen kombinieren, um Partikel des Erdalkalimetallsalzes zu bilden, die sich durch Ausfällen auf der Außenfläche der Schale der vorgeformten Kern/Schale-Partikel ablagn,

   und wobei das Erdalkalimetallsalz in destilliertem Wasser (bei 25°C und bei Atmosphärendruck) eine Löslichkeit von weniger als 10 mg/l aufweist.

2. Verfahren nach Anspruch 1, in welchem das Pflegemittel eine Duftstoffformulierung ist, umfassend eine Mischung von mindestens 10 Duftstoffkomponenten, ausgewählt aus Kohlenwasserstoffen, aliphatischen und araliphatischen Alkoholen, aliphatischen Aldehyden und deren Acetalen; aliphatischen Carbonsäuren und Estern davon, acyclischen Terpenalkoholen, cyclischen Terpenaldehyden und -Ketonen; cyclischen und cycloaliphatischen Ethern; Estern von cyclischen Alkoholen; Estern von araliphatischen Alkoholen und aliphatischen Carbonsäuren; araliphatischen Ethern und deren Acetalen; aromatischen und araliphatischen Aldehyden und -Ketonen; und aromatischen und araliphatischen Carbonsäuren und Estern davon.

3. Verfahren nach Anspruch 1 oder Anspruch 2, in dem die Duftstoffformulierung 20 bis 40 Gewichts-%, bezogen auf das Gesamtgewicht des Pflegemittelabgabepartikels, beträgt.


5. Verfahren nach irgendeinem der Ansprüche 1 bis 4, bei dem die wässrige Lösung der konstituierenden Anionen eine wässrige Lösung von Natriumcarbonat oder Natriumhydroxid oder von Citronensäure oder einer Mischung davon ist.

6. Verfahren nach irgendeinem der Ansprüche 1 bis 5, bei dem die wässrige Lösung der konstituierenden Kationen eine wässrige Lösung von Calciumchlorid oder von Magnesiumchlorid oder einer Mischung davon ist.

7. Wäschebehandlungszusammensetzung, umfassend Pflegemittelabgabepartikel, erhältlich nach dem Verfahren, wie in irgendeinem der Ansprüche 1 bis 6 definiert.

8. Wäschebehandlungszusammensetzung nach Anspruch 7, das ein Waschmittel ist, umfassend 5 bis 40 Gewichts-
% (bezogen auf das Gesamtgewicht der Zusammensetzung) waschaktive Tenside, ausgewählt aus anionischen
Tensiden, die keine Seifen sind, nichtionischen Tensiden und Mischungen davon.

9. Wäschebehandlungs zusammensetzung nach Anspruch 7 oder Anspruch 8, welche eine Flüssigkeit darstellt, um-
fassend 5 bis 95 Gewichts-% Wasser (bezogen auf das Gesamtgewicht der Zusammensetzung).

Revendications

1. Procédé pour la préparation d’une particule délivrant un agent bénéfique ayant une structure noyau-enveloppe dans
laquelle une enveloppe poreuse de matériau polymère entoure un noyau contenant l’agent bénéfique ; les pores
dans l’enveloppe étant au moins partiellement occlus par un revêtement éliminable au lavage fourni sur la surface
externe de l’enveloppe ; sur quoi l’élimination du revêtement pendant une opération de lavage facilite la libération
de l’agent bénéfique à travers les pores dans l’enveloppe ; et caractérisé en ce que le revêtement éliminable au
lavage est formé de particules déposées de sel de métal alcalino-terreux ; dans lequel des solutions aqueuses des
anions et cations constitutifs respectivement du sel de métal alcalino-terreux sont séparément préparées et puis
ajoutées à une suspension de particules pré-formées ayant une structure noyau-enveloppe dans laquelle une
enveloppe poreuse de matériau polymère entoure un noyau contenant l’agent bénéfique, dans lequel des solutions
aqueuses des anions et cations constitutifs respectivement du sel de métal alcalino-terreux sont préparées sépa-
rectement et puis ajoutées à une suspension de particules noyau-enveloppe pré-formées et les anions et cations se
combinent pour former des particules du sel de métal alcalino-terreux qui se déposent par précipitation sur la surface
d’enveloppe extérieure des particules noyau-enveloppe pré-formées ;
e dans lequel le sel de métal alcalino-terreux présente une solubilité dans l’eau distillée (à 25°C à pression atmos-
phérique) inférieure à 10 mg/L.

2. Procédé selon la revendication 1, dans lequel l’agent bénéfique est une formulation de parfum comprenant une
combinaison d’au moins 10 constituants de parfums choisis parmi des hydrocarbures ; alcools aliphatiques et
araliphatiques ; aldéhydes aliphatiques et leurs acétals ; acides carboxyliques aliphatiques et leurs esters ; alcools
de terpènes acycliques ; aldéhydes et cétones de terpènes cycliques ; éthers cycliques et cycloaliphatiques ; esters
d’alcools cycliques ; esters d’alcools araliphatiques et d’acides carboxyliques aliphatiques ; éthers araliphatiques
et leurs acétals ; aldéhydes et cétones aromatiques et araliphatiques ; et acides carboxyliques aromatiques et
araliphatiques et leurs esters.

3. Procédé selon la revendication 1 ou revendication 2, dans lequel la formulation de parfum comprend de 20 à 40 %
en masse sur la base de la masse totale de la particule délivrant un agent bénéfique.

4. Procédé selon la revendication 3, dans lequel le sel de métal alcalino-terreux est choisi parmi le carbonate de
calcium, carbonate de magnésium, hydroxyde de magnésium et citrate de calcium et leurs mélanges.

5. Procédé selon l’une quelconque des revendications 1 à 4, dans lequel la solution aqueuse d’anions constituants
est une solution aqueuse de carbonate de sodium ou d’hydroxyde de sodium ou d’acide citrique ou d’un mélange
de ceux-ci.

6. Procédé selon l’une quelconque des revendications 1 à 5, dans lequel la solution aqueuse de cations constituants
est une solution aqueuse de chlore de calcium ou de chlore de magnésium ou d’un mélange de ceux-ci.

7. Composition de traitement de lessive comprenant une particule délivrant un agent bénéfique pouvant être obtenue
par le procédé comme défini dans l’une quelconque des revendications 1 à 6.

8. Composition de traitement de lessive selon la revendication 7, qui est un détergent de lessive comprenant de 5 à
40 % (en masse sur la base de la masse totale de la composition) de tensioactifs détersifs choisis parmi des
tensioactifs anioniques, tensioactifs non ioniques autres que le savon et mélanges de ceux-ci.

9. Composition de traitement de lessive selon la revendication 7 ou revendication 8, qui est un liquide comprenant de
5 à 95 % d’eau (en masse sur la base de la masse totale de la composition).
REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

• US 20180009996 A [0006]