

ORGANOSILICON-BASED MICROCAPSULES

Technical Field

5 The present invention relates to organosilicon-based microcapsules. A process for the preparation of said microcapsules is also an object of the invention. Perfuming compositions and consumer products comprising said microcapsules, in particular perfumed consumer products in the form of home care or personal care products, are also part of the invention.

Background of the Invention

10 One of the problems faced by the perfumery industry lies in the relatively rapid loss of olfactive benefit provided by odoriferous compounds due to their volatility, particularly that of “top-notes”. In order to tailor the release rates of volatiles, delivery systems such as microcapsules containing a perfume are needed to protect and later release the core payload when triggered. A key requirement from the industry regarding these systems is to survive
15 suspension in challenging bases without physically dissociating or degrading. This is referred to as *stability* for the delivery system. For instance, fragranced personal and household cleansers containing high levels of aggressive surfactant detergents are very challenging for the stability of microcapsules.

Polyurea and polyurethane-based microcapsule slurry are widely used for example in
20 perfumery industry for instance as they provide a long lasting pleasant olfactory effect after their applications on different substrates. Those microcapsules have been widely disclosed in the prior art.

In addition to the performance in terms of stability and olfactive performance, the consumer demand for eco-friendly delivery systems is more and more important and is driving
25 the development of new delivery systems.

There is therefore still a need to provide new microcapsules using more eco-friendly materials, while not compromising on the performance of the microcapsules, in particular in terms of stability in a challenging medium such as a consumer product base, as well as in delivering a good performance in terms of active ingredient delivery, e.g. olfactive performance
30 in the case of perfuming ingredients.

The present invention is proposing a solution to the above-mentioned problem by providing new organosilicon-based microcapsules and a process for preparing said microcapsules.

Summary of the invention

It has now been found that performing core-shell microcapsules encapsulating hydrophobic material could be obtained by reacting at least one polyfunctional monomer and at least one organosilicon compound, preferably a silsesquioxane. The microcapsules of the invention therefore provide a solution to the above-mentioned problems as it allows preparing eco-friendly microcapsules with the desired stability in challenging bases.

In a first aspect, the present invention relates to a core-shell microcapsule comprising:

- (i) a core comprising a hydrophobic material, preferably a perfume oil, and
- (ii) a shell comprising the reaction product between at least one polyfunctional monomer and at least one organosilicon compound.

Another object of the invention is a core-shell microcapsule slurry comprising at least one microcapsule, the microcapsule comprising:

- (i) a core comprising a hydrophobic material, preferably a perfume oil, and
- (ii) a shell comprising the reaction product between at least one polyfunctional monomer and at least one organosilicon compound.

Another object of the invention is a process for preparing a core-shell microcapsule slurry comprising the steps of:

- a) Dispersing an oil phase comprising a hydrophobic material into a dispersing phase to form a two-phases dispersion;
- b) Performing a curing step to form microcapsules in the form of a slurry; wherein at least one polyfunctional monomer is added in the dispersing phase and/or in the oil phase, and wherein at least one organosilicon compound is added in the dispersing phase and/or in the oil phase and/or in the two-phases dispersion.

The present invention also relates to perfumed consumer products and flavoured edible products comprising the microcapsules or microcapsule slurry as defined above.

Figures

Figure 1 represents scanning electron micrographs of microcapsules according to the invention (Microcapsules I).

Figure 2 represents scanning electron micrographs of mineralized microcapsules according to the invention (Microcapsules E).

Figure 3 represents scanning electron micrographs of microcapsules according to the invention (Microcapsules K).

Figure 4 represents energy dispersive spectroscopy (EDS) of the microcapsules (microcapsules H) according to the invention.

Figure 5 represents olfactive impact of microcapsules slurries from blotters before and after rubbing.

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Detailed description of the invention

Unless stated otherwise, percentages (%) are meant to designate a percentage by weight of a composition.

By “**active ingredient**”, it is meant a single compound or a combination of ingredients.

10 By “**perfume or flavour oil**”, it is meant a single perfuming or flavouring compound or a mixture of several perfuming or flavouring compounds.

By “**consumer product**” or “**end-product**” it is meant a manufactured product ready to be distributed, sold and used by a consumer.

15 For the sake of clarity, by the expression “**dispersion**” in the present invention it is meant a system in which particles are dispersed in a continuous phase of a different composition and it specifically includes a suspension or an emulsion.

A “**microcapsule**”, or the similar, in the present invention it is meant that core-shell microcapsules have a particle size distribution in the micron range (e.g. a mean diameter ($d(v, 0.5)$) comprised preferably between about 1 and 3000 microns, more preferably between
20 1 and 500 microns) and comprise an external solid polymeric shell and an internal continuous oil phase enclosed by the external shell.

By “**organosilicon-based microcapsule**”, it should be understood that the shell comprises an organosilicon compound.

25 According to an embodiment, the shell is an inorganic/organic hybrid-based shell, particularly an inorganic/organic hybrid polyamide-based shell. According to a particular embodiment, the polymeric shell is a polyamide-based shell.

By “**microcapsule slurry**”, it is meant microcapsule(s) that is (are) dispersed in a liquid. According to an embodiment, the slurry is an aqueous slurry, i.e the microcapsule(s) is (are) dispersed in an aqueous phase.

30 By “**amino-compound**” it should be understood a compound having at least one reactive amine groups.

By “**polyamide-based microcapsules**”, “**polyamide-based core-shell microcapsules**” or “**polyamide-based shell**”, it means that the microcapsule’s shell comprises a polyamide material. The wording “polyamide-based microcapsules” can also encompass a

shell made of a composite comprising a polyamide material and another material (for example a protein).

“**Polyamide-based microcapsules**” and “**polyamide microcapsules**” can be used indifferently in the present invention. “**Polyamide-based shell**” and “**polyamide shell**” can be used indifferently in the present invention.

“**Dispersing phase**” and “**continuous phase**” can be used indifferently in the present invention.

“**Amine group**” and “**amino group**” can be used indifferently in the present invention.

By “**polyfunctional monomer**”, it is meant a molecule that, as unit, reacts or binds chemically to form a polymer or a supramolecular polymer. The polyfunctional monomer of the invention has at least two functional groups that are capable to react with or bind to functional groups of another component and/or are capable to polymerize to form a polymeric shell.

CORE-SHELL MICROCAPSULE

A first object of the invention is a core-shell microcapsule comprising:

- (i) a core comprising a hydrophobic material, preferably a perfume oil, and
- (ii) a shell comprising the reaction product between at least one polyfunctional monomer and at least one organosilicon compound.

Hydrophobic material

According to an embodiment, the core is an oil-based core.

The hydrophobic material according to the invention can be “inert” material like solvents or active ingredients.

By “hydrophobic material”, it is meant any hydrophobic material which forms a two-phase dispersion when mixed with water. The hydrophobic material is typically liquid at about 20°C.

According to an embodiment, the hydrophobic material is a hydrophobic active ingredient.

When the hydrophobic materials is an active ingredient, it is preferably chosen from the group consisting of flavors, flavor ingredients, perfumes, perfume ingredients, nutraceuticals, cosmetics, pest control agents, biocide actives and mixtures thereof.

According to a particular embodiment, the hydrophobic material comprises a phase change material (PCM).

According to a particular embodiment, the hydrophobic material comprises a mixture of a perfume with another ingredient selected from the group consisting of nutraceuticals, cosmetics, pest control agents and biocide actives.

5 According to a particular embodiment, the hydrophobic material comprises a mixture of biocide actives with another ingredient selected from the group consisting of perfumes, nutraceuticals, cosmetics, pest control agents.

According to a particular embodiment, the hydrophobic material comprises a mixture of pest control agents with another ingredient selected from the group consisting of perfumes, nutraceuticals, cosmetics, biocide actives.

10 According to a particular embodiment, the hydrophobic material comprises a perfume.

According to a particular embodiment, the hydrophobic material consists of a perfume.

According to a particular embodiment, the hydrophobic material consists of biocide actives.

15 According to a particular embodiment, the hydrophobic material consists of pest control agents.

By “perfume” (or also “perfume oil”) what is meant here is an ingredient or a composition that is a liquid at about 20°C. According to any one of the above embodiments said perfume oil can be a perfuming ingredient alone or a mixture of ingredients in the form of a perfuming composition. As a “perfuming ingredient” it is meant here a compound, which is
20 used for the primary purpose of conferring or modulating an odor. In other words such an ingredient, to be considered as being a perfuming one, must be recognized by a person skilled in the art as being able to at least impart or modify in a positive or pleasant way the odor of a composition, and not just as having an odor. For the purpose of the present invention, perfume oil also includes a combination of perfuming ingredients with substances which together
25 improve, enhance or modify the delivery of the perfuming ingredients, such as perfume precursors, modulators, emulsions or dispersions, as well as combinations which impart an additional benefit beyond that of modifying or imparting an odor, such as long-lastingness, blooming, malodor counteraction, antimicrobial effect, microbial stability, pest control.

The nature and type of the perfuming ingredients present in the oil phase do not warrant
30 a more detailed description here, which in any case would not be exhaustive, the skilled person being able to select them on the basis of its general knowledge and according to intended use or application and the desired organoleptic effect. In general terms, these perfuming ingredients belong to chemical classes as varied as alcohols, aldehydes, ketones, esters, ethers, acetates, nitriles, terpenoids, nitrogenous or sulfurous heterocyclic compounds and essential oils (for

example Thyme oil), and said perfuming co-ingredients can be of natural or synthetic origin. Many of these co-ingredients are in any case listed in reference texts such as the book by S. Arctander, Perfume and Flavor Chemicals, 1969, Montclair, New Jersey, USA, or its more recent versions, or in other works of a similar nature, as well as in the abundant patent literature
 5 in the field of perfumery.

In particular one may cite perfuming ingredients which are commonly used in perfume formulations, such as:

- Aldehydic ingredients: decanal, dodecanal, 2-methyl-undecanal, 10-undecenal, octanal, nonanal and/or nonenal;
- 10 – Aromatic-herbal ingredients: eucalyptus oil, camphor, eucalyptol, 5-methyltricyclo[6.2.1.0^{2,7}]undecan-4-one, 1-methoxy-3-hexanethiol, 2-ethyl-4,4-dimethyl-1,3-oxathiane, 2,2,7/8,9/10-tetramethylspiro[5.5]undec-8-en-1-one, menthol and/or alpha-pinene;
- Balsamic ingredients: coumarin, ethylvanillin and/or vanillin;
- 15 – Citrus ingredients: dihydromyrcenol, citral, orange oil, linalyl acetate, citronellyl nitrile, orange terpenes, limonene, 1-p-menthen-8-yl acetate and/or 1,4(8)-p-menthadiene;
- Floral ingredients: methyl dihydrojasmonate, linalool, citronellol, phenylethanol, 3-(4-tert-butylphenyl)-2-methylpropanal, hexylcinnamic aldehyde, benzyl acetate, benzyl salicylate, tetrahydro-2-isobutyl-4-methyl-4(2H)-pyranol, beta ionone, methyl 2-
- 20 (methylamino)benzoate, (E)-3-methyl-4-(2,6,6-trimethyl-2-cyclohexen-1-yl)-3-buten-2-one, (1E)-1-(2,6,6-trimethyl-2-cyclohexen-1-yl)-1-penten-3-one, 1-(2,6,6-trimethyl-1,3-cyclohexadien-1-yl)-2-buten-1-one, (2E)-1-(2,6,6-trimethyl-2-cyclohexen-1-yl)-2-buten-1-one, (2E)-1-[2,6,6-trimethyl-3-cyclohexen-1-yl]-2-buten-1-one, (2E)-1-(2,6,6-trimethyl-1-cyclohexen-1-yl)-2-buten-1-one, 3-(3,3/1,1-dimethyl-5-indanyl)propanal,
- 25 2,5-dimethyl-2-indanmethanol, 2,6,6-trimethyl-3-cyclohexene-1-carboxylate, 3-(4,4-dimethyl-1-cyclohexen-1-yl)propanal, hexyl salicylate, 3,7-dimethyl-1,6-nonadien-3-ol, 3-(4-isopropylphenyl)-2-methylpropanal, verdyl acetate, geraniol, p-menth-1-en-8-ol, 4-(1,1-dimethylethyl)-1-cyclohexyle acetate, 1,1-dimethyl-2-phenylethyl acetate, 4-cyclohexyl-2-methyl-2-butanol, amyl salicylate, high cis methyl dihydrojasmonate, 3-
- 30 methyl-5-phenyl-1-pentanol, verdyl propionate, geranyl acetate, tetrahydro linalool, cis-7-p-menthanol, propyl (S)-2-(1,1-dimethylpropoxy)propanoate, 2-methoxynaphthalene, 2,2,2-trichloro-1-phenylethyl acetate, 4/3-(4-hydroxy-4-methylpentyl)-3-cyclohexene-1-carbaldehyde, amylcinnamic aldehyde, 8-decen-5-

- olide, 4-phenyl-2-butanone, isononyl acetate, 4-(1,1-dimethylethyl)-1-cyclohexyl acetate, verdyl isobutyrate and/or mixture of methylionones isomers;
- 5 – Fruity ingredients: gamma-undecalactone, 2,2,5-trimethyl-5-pentylcyclopentanone, 2-methyl-4-propyl-1,3-oxathiane, 4-decanolide, ethyl 2-methyl-pentanoate, hexyl acetate, ethyl 2-methylbutanoate, gamma-nonolactone, allyl heptanoate, 2-phenoxyethyl isobutyrate, ethyl 2-methyl-1,3-dioxolane-2-acetate, diethyl 1,4-cyclohexanedicarboxylate, 3-methyl-2-hexen-1-yl acetate, 1-[3,3-dimethylcyclohexyl]ethyl [3-ethyl-2-oxiranyl]acetate and/or diethyl 1,4-cyclohexane dicarboxylate;
- 10 – Green ingredients: 2-methyl-3-hexanone (E)-oxime, 2,4-dimethyl-3-cyclohexene-1-carbaldehyde, 2-tert-butyl-1-cyclohexyl acetate, styrallyl acetate, allyl (2-methylbutoxy)acetate, 4-methyl-3-decen-5-ol, diphenyl ether, (Z)-3-hexen-1-ol and/or 1-(5,5-dimethyl-1-cyclohexen-1-yl)-4-penten-1-one;
- 15 – Musk ingredients: 1,4-dioxo-5,17-cycloheptadecanedione, (Z)-4-cyclopentadecen-1-one, 3-methylcyclopentadecanone, 1-oxa-12-cyclohexadecen-2-one, 1-oxa-13-cyclohexadecen-2-one, (9Z)-9-cycloheptadecen-1-one, 2-[(1S)-1-[(1R)-3,3-dimethylcyclohexyl]ethoxy]-2-oxoethyl propionate, 3-methyl-5-cyclopentadecen-1-one, 4,6,6,7,8,8-hexamethyl-1,3,4,6,7,8-hexahydrocyclopenta[g]isochromene, (1S,1'R)-2-[1-(3',3'-dimethyl-1'-cyclohexyl)ethoxy]-2-methylpropyl propanoate,
- 20 oxacyclohexadecan-2-one and/or (1S,1'R)-[1-(3',3'-dimethyl-1'-cyclohexyl)ethoxycarbonyl]methyl propanoate;
- 25 – Woody ingredients: 1-[(1R,6SR)-2,2,6-trimethylcyclohexyl]-3-hexanol, 3,3-dimethyl-5-[(1R)-2,2,3-trimethyl-3-cyclopenten-1-yl]-4-penten-2-ol, 3,4'-dimethylspiro[oxirane-2,9'-tricyclo[6.2.1.0^{2,7}]undec[4]ene, (1-ethoxyethoxy)cyclododecane, 2,2,9,11-tetramethylspiro[5.5]undec-8-en-1-yl acetate, 1-(octahydro-2,3,8,8-tetramethyl-2-naphthalenyl)-1-ethanone, patchouli oil, terpenes fractions of patchouli oil, Clearwood[®], (1'R,E)-2-ethyl-4-(2',2',3'-trimethyl-3'-cyclopenten-1'-yl)-2-buten-1-ol, 2-ethyl-4-(2,2,3-trimethyl-3-cyclopenten-1-yl)-2-buten-1-ol, methyl cedryl ketone, 5-(2,2,3-trimethyl-3-cyclopentenyl)-3-methylpentan-
- 30 2-ol, 1-(2,3,8,8-tetramethyl-1,2,3,4,6,7,8,8a-octahydronaphthalen-2-yl)ethan-1-one and/or isobornyl acetate;
- Other ingredients (e.g. amber, powdery spicy or watery): dodecahydro-3a,6,6,9a-tetramethyl-naphtho[2,1-b]furan and any of its stereoisomers, heliotropin, anisic

aldehyde, eugenol, cinnamic aldehyde, clove oil, 3-(1,3-benzodioxol-5-yl)-2-methylpropanal, 7-methyl-2H-1,5-benzodioxepin-3(4H)-one, 2,5,5-trimethyl-1,2,3,4,4a,5,6,7-octahydro-2-naphthalenol, 1-phenylvinyl acetate, 6-methyl-7-oxa-1-thia-4-azaspiro[4.4]nonane and/or 3-(3-isopropyl-1-phenyl)butanal.

5 It is also understood that said ingredients may also be compounds known to release in a controlled manner various types of perfuming compounds also known as properfume or profragrance. Non-limiting examples of suitable properfumes may include 4-(dodecylthio)-4-(2,6,6-trimethyl-2-cyclohexen-1-yl)-2-butanone, 4-(dodecylthio)-4-(2,6,6-trimethyl-1-cyclohexen-1-yl)-2-butanone, 3-(dodecylthio)-1-(2,6,6-trimethyl-3-cyclohexen-1-yl)-1-butanone, 2-(dodecylthio)octan-4-one, 2-phenylethyl oxo(phenyl)acetate, 3,7-dimethylocta-2,6-dien-1-yl oxo(phenyl)acetate, (Z)-hex-3-en-1-yl oxo(phenyl)acetate, 3,7-dimethyl-2,6-octadien-1-yl hexadecanoate, bis(3,7-dimethylocta-2,6-dien-1-yl) succinate, (2-((2-methylundec-1-en-1-yl)oxy)ethyl)benzene, 1-methoxy-4-(3-methyl-4-phenethoxybut-3-en-1-yl)benzene, (3-methyl-4-phenethoxybut-3-en-1-yl)benzene, 1-(((Z)-hex-3-en-1-yl)oxy)-2-methylundec-1-ene, (2-((2-methylundec-1-en-1-yl)oxy)ethoxy)benzene, 2-methyl-1-(octan-3-yloxy)undec-1-ene, 1-methoxy-4-(1-phenethoxyprop-1-en-2-yl)benzene, 1-methyl-4-(1-phenethoxyprop-1-en-2-yl)benzene, 2-(1-phenethoxyprop-1-en-2-yl)naphthalene, (2-phenethoxyvinyl)benzene, 2-(1-((3,7-dimethyloct-6-en-1-yl)oxy)prop-1-en-2-yl)naphthalene, (2-((2-pentylcyclopentylidene)methoxy)ethyl)benzene, 4-allyl-2-methoxy-1-((2-methoxy-2-phenylvinyl)oxy)benzene, (2-((2-heptylcyclopentylidene)methoxy)ethyl)benzene, 1-isopropyl-4-methyl-2-((2-pentylcyclopentylidene)methoxy)benzene, 2-methoxy-1-((2-pentylcyclopentylidene)methoxy)-4-propylbenzene, 3-methoxy-4-((2-methoxy-2-phenylvinyl)oxy)benzaldehyde, 4-((2-(hexyloxy)-2-phenylvinyl)oxy)-3-methoxybenzaldehyde or a mixture thereof.

25 The perfuming ingredients may be dissolved in a solvent of current use in the perfume industry. The solvent is preferably not an alcohol. Examples of such solvents are diethyl phthalate, isopropyl myristate, Abalyn[®] (rosin resins, available from Eastman), benzyl benzoate, ethyl citrate, triethyl citrate, limonene or other terpenes, or isoparaffins. Preferably, the solvent is very hydrophobic and highly sterically hindered, like for example Abalyn[®] or 30 benzyl benzoate. Preferably the perfume comprises less than 30% of solvent. More preferably the perfume comprises less than 20% and even more preferably less than 10% of solvent, all these percentages being defined by weight relative to the total weight of the perfume. Most preferably, the perfume is essentially free of solvent.

Preferred perfuming ingredients are those having a high steric hindrance and in particular those from one of the following groups:

- Group 1: perfuming ingredients comprising a cyclohexane, cyclohexene, cyclohexanone or cyclohexenone ring substituted with at least one linear or branched C₁ to C₄ alkyl or alkenyl substituent;
- Group 2: perfuming ingredients comprising a cyclopentane, cyclopentene, cyclopentanone or cyclopentenone ring substituted with at least one linear or branched C₄ to C₈ alkyl or alkenyl substituent;
- Group 3: perfuming ingredients comprising a phenyl ring or perfuming ingredients comprising a cyclohexane, cyclohexene, cyclohexanone or cyclohexenone ring substituted with at least one linear or branched C₅ to C₈ alkyl or alkenyl substituent or with at least one phenyl substituent and optionally one or more linear or branched C₁ to C₃ alkyl or alkenyl substituents;
- Group 4: perfuming ingredients comprising at least two fused or linked C₅ and/or C₆ rings;
- Group 5: perfuming ingredients comprising a camphor-like ring structure;
- Group 6: perfuming ingredients comprising at least one C₇ to C₂₀ ring structure;
- Group 7: perfuming ingredients having a logP value above 3.5 and comprising at least one tert-butyl or at least one trichloromethyl substituent;

Examples of ingredients from each of these groups are:

- Group 1: 2,4-dimethyl-3-cyclohexene-1-carbaldehyde (origin: Firmenich SA, Geneva, Switzerland), isocyclocitral, menthone, isomenthone, methyl 2,2-dimethyl-6-methylene-1-cyclohexanecarboxylate (origin: Firmenich SA, Geneva, Switzerland), nerone, terpineol, dihydroterpineol, terpenyl acetate, dihydroterpenyl acetate, dipentene, eucalyptol, hexylate, rose oxide, (S)-1,8-p-menthadiene-7-ol (origin: Firmenich SA, Geneva, Switzerland), 1-p-menthene-4-ol, (1R,3R,4R)-3-p-mentanyl acetate, (1R,2S,4R)-4,6,6-trimethyl-bicyclo[3,1,1]heptan-2-ol, tetrahydro-4-methyl-2-phenyl-2H-pyran (origin: Firmenich SA, Geneva, Switzerland), cyclohexyl acetate, cyclanol acetate, 1,4-cyclohexane diethyldicarboxylate (origin: Firmenich SA, Geneva, Switzerland), (3R,3aR,6R,7aR)-perhydro-3,6-dimethyl-benzo[B]furan-2-one (origin: Firmenich SA, Geneva, Switzerland), ((6R)-perhydro-3,6-dimethyl-benzo[B]furan-2-one (origin: Firmenich SA, Geneva, Switzerland), 2,4,6-trimethyl-4-phenyl-1,3-dioxane, 2,4,6-trimethyl-3-cyclohexene-1-carbaldehyde;
- Group 2: (E)-3-methyl-5-(2,2,3-trimethyl-3-cyclopenten-1-yl)-4-penten-2-ol (origin: Givaudan SA, Vernier, Switzerland), (1R,E)-2-ethyl-4-(2',2',3'-trimethyl-3'-cyclopenten-

- 1'-yl)-2-buten-1-ol (origin: Firmenich SA, Geneva, Switzerland), (1'R,E)-3,3-dimethyl-5-(2',2',3'-trimethyl-3'-cyclopenten-1'-yl)-4-penten-2-ol (origin: Firmenich SA, Geneva, Switzerland), 2-heptylcyclopentanone, methyl-cis-3-oxo-2-pentyl-1-cyclopentane acetate (origin: Firmenich SA, Geneva, Switzerland), 2,2,5-trimethyl-5-pentyl-1-cyclopentanone (origin: Firmenich SA, Geneva, Switzerland), 3,3-dimethyl-5-(2,2,3-trimethyl-3-cyclopenten-1-yl)-4-penten-2-ol (origin: Firmenich SA, Geneva, Switzerland), 3-methyl-5-(2,2,3-trimethyl-3-cyclopenten-1-yl)-2-pentanol (origin: Givaudan SA, Vernier, Switzerland);
- Group 3: damascones, 1-(5,5-dimethyl-1-cyclohexen-1-yl)-4-penten-1-one (origin: Firmenich SA, Geneva, Switzerland), (1'R)-2-[2-(4'-methyl-3'-cyclohexen-1'-yl)propyl]cyclopentanone, alpha-ionone, beta-ionone, damascenone, mixture of 1-(5,5-dimethyl-1-cyclohexen-1-yl)-4-penten-1-one and 1-(3,3-dimethyl-1-cyclohexen-1-yl)-4-penten-1-one (origin: Firmenich SA, Geneva, Switzerland), 1-(2,6,6-trimethyl-1-cyclohexen-1-yl)-2-buten-1-one (origin: Firmenich SA, Geneva, Switzerland), (1S,1'R)-[1-(3',3'-Dimethyl-1'-cyclohexyl)ethoxycarbonyl]methyl propanoate (origin: Firmenich SA, Geneva, Switzerland), 2-tert-butyl-1-cyclohexyl acetate (origin: International Flavors and Fragrances, USA), 1-(2,2,3,6-tetramethyl-cyclohexyl)-3-hexanol (origin: Firmenich SA, Geneva, Switzerland), trans-1-(2,2,6-trimethyl-1-cyclohexyl)-3-hexanol (origin: Firmenich SA, Geneva, Switzerland), (E)-3-methyl-4-(2,6,6-trimethyl-2-cyclohexen-1-yl)-3-buten-2-one, terpenyl isobutyrate, 4-(1,1-dimethylethyl)-1-cyclohexyl acetate (origin: Firmenich SA, Geneva, Switzerland), 8-methoxy-1-p-menthene, (1S,1'R)-2-[1-(3',3'-dimethyl-1'-cyclohexyl) ethoxy]-2-methylpropyl propanoate (origin: Firmenich SA, Geneva, Switzerland), para tert-butylcyclohexanone, menthenethiol, 1-methyl-4-(4-methyl-3-pentenyl)-3-cyclohexene-1-carbaldehyde, allyl cyclohexylpropionate, cyclohexyl salicylate, 2-methoxy-4-methylphenyl methyl carbonate, ethyl 2-methoxy-4-methylphenyl carbonate, 4-ethyl-2-methoxyphenyl methyl carbonate;
- Group 4: Methyl cedryl ketone (origin: International Flavors and Fragrances, USA), a mixture of (1RS,2SR,6RS,7RS,8SR)-tricyclo[5.2.1.0^{2,6}]dec-3-en-8-yl 2-methylpropanoate and (1RS,2SR,6RS,7RS,8SR)-tricyclo[5.2.1.0^{2,6}]dec-4-en-8-yl 2-methylpropanoate, vetyverol, vetyverone, 1-(octahydro-2,3,8,8-tetramethyl-2-naphthalenyl)-1-ethanone (origin: International Flavors and Fragrances, USA), (5RS,9RS,10SR)-2,6,9,10-tetramethyl-1-oxaspiro[4.5]deca-3,6-diene and the (5RS,9SR,10RS) isomer, 6-ethyl-2,10,10-trimethyl-1-oxaspiro[4.5]deca-3,6-diene, 1,2,3,5,6,7-hexahydro-1,1,2,3,3-pentamethyl-4-indenone (origin: International Flavors

- and Fragrances, USA), a mixture of 3-(3,3-dimethyl-5-indanyl)propanal and 3-(1,1-dimethyl-5-indanyl)propanal (origin: Firmenich SA, Geneva, Switzerland), 3',4'-dimethyl-tricyclo[6.2.1.0(2,7)]undec-4-ene-9-spiro-2'-oxirane (origin: Firmenich SA, Geneva, Switzerland), 9/10-ethyldiene-3-oxatricyclo[6.2.1.0(2,7)]undecane, (perhydro-5,5,8A-trimethyl-2-naphthalenyl acetate (origin: Firmenich SA, Geneva, Switzerland), octalynol, (dodecahydro-3a,6,6,9a-tetramethyl-naphtho[2,1-b]furan, origin: Firmenich SA, Geneva, Switzerland), tricyclo[5.2.1.0(2,6)]dec-3-en-8-yl acetate and tricyclo[5.2.1.0(2,6)]dec-4-en-8-yl acetate as well as tricyclo[5.2.1.0(2,6)]dec-3-en-8-yl propanoate and tricyclo[5.2.1.0(2,6)]dec-4-en-8-yl propanoate, (+)-(1S,2S,3S)-2,6,6-trimethyl-bicyclo[3.1.1]heptane-3-spiro-2'-cyclohexen-4'-one;
- Group 5: camphor, borneol, isobornyl acetate, 8-isopropyl-6-methyl-bicyclo[2.2.2]oct-5-ene-2-carbaldehyde, pinene, camphene, 8-methoxycedrane, (8-methoxy-2,6,6,8-tetramethyl-tricyclo[5.3.1.0(1,5)]undecane (origin: Firmenich SA, Geneva, Switzerland), cedrene, cedrenol, cedrol, mixture of 9-ethylidene-3-oxatricyclo[6.2.1.0(2,7)]undecan-4-one and 10-ethylidene-3-oxatricyclo[6.2.1.0^{2,7}]undecan-4-one (origin: Firmenich SA, Geneva, Switzerland), 3-methoxy-7,7-dimethyl-10-methylene-bicyclo[4.3.1]decane (origin: Firmenich SA, Geneva, Switzerland);
- Group 6: (trimethyl-13-oxabicyclo-[10.1.0]-trideca-4,8-diene (origin: Firmenich SA, Geneva, Switzerland), 9-hexadecen-16-olide (origin: Firmenich SA, Geneva, Switzerland), pentadecenolide (origin: Firmenich SA, Geneva, Switzerland), 3-methyl-(4/5)-cyclopentadecenone, (origin: Firmenich SA, Geneva, Switzerland), 3-methylcyclopentadecanone (origin: Firmenich SA, Geneva, Switzerland), pentadecanolide (origin: Firmenich SA, Geneva, Switzerland), cyclopentadecanone (origin: Firmenich SA, Geneva, Switzerland), 1-ethoxyethoxycyclododecane (origin: Firmenich SA, Geneva, Switzerland), 1,4-dioxacycloheptadecane-5,17-dione, 4,8-cyclododecadien-1-one;
- Group 7: (+)-2-methyl-3-[4-(2-methyl-2-propanyl)phenyl]propanal (origin: Givaudan SA, Vernier, Switzerland), 2,2,2-trichloro-1-phenylethyl acetate.

Preferably, the perfume comprises at least 30%, preferably at least 50%, more preferably at least 60% of ingredients selected from Groups 1 to 7, as defined above. More preferably said perfume comprises at least 30%, preferably at least 50% of ingredients from Groups 3 to 7, as defined above. Most preferably said perfume comprises at least 30%, preferably at least 50% of ingredients from Groups 3, 4, 6 or 7, as defined above.

According to another preferred embodiment, the perfume comprises at least 30%, preferably at least 50%, more preferably at least 60% of ingredients having a logP above 3, preferably above 3.5 and even more preferably above 3.75.

According to a particular embodiment, the perfume used in the invention contains less
5 than 10% of its own weight of primary alcohols, less than 15% of its own weight of secondary alcohols and less than 20% of its own weight of tertiary alcohols. Advantageously, the perfume used in the invention does not contain any primary alcohols and contains less than 15% of secondary and tertiary alcohols.

According to an embodiment, the oil phase (or the oil-based core) comprises:

- 10
- 25-100wt% of a perfume oil comprising at least 15wt% of high impact perfume raw materials having a Log T<-4, and
 - 0-75wt% of a density balancing material having a density greater than 1.07 g/cm³.

“*High impact perfume raw materials*” should be understood as perfume raw materials having a LogT<-4. The odor threshold concentration of a chemical compound is determined in part by
15 its shape, polarity, partial charges and molecular mass. For convenience, the odor threshold concentration is presented as the common logarithm of the threshold concentration, i.e., Log [Threshold] (“LogT”).

A “*density balancing material*” should be understood as a material having a density greater than 1.07 g/cm³ and having preferably low or no odor.

20 The odor threshold concentration of a perfuming compound is determined by using a gas chromatograph (“GC”). Specifically, the gas chromatograph is calibrated to determine the exact volume of the perfume oil ingredient injected by the syringe, the precise split ratio, and the hydrocarbon response using a hydrocarbon standard of known concentration and chain-length distribution. The air flow rate is accurately measured and, assuming the duration of a
25 human inhalation to last 12 seconds, the sampled volume is calculated. Since the precise concentration at the detector at any point in time is known, the mass per volume inhaled is known and hence the concentration of the perfuming compound. To determine the threshold concentration, solutions are delivered to the sniff port at the back-calculated concentration. A panelist sniffs the GC effluent and identifies the retention time when odor is noticed. The
30 average across all panelists determines the odor threshold concentration of the perfuming compound. The determination of odor threshold is described in more detail in C. Vuilleumier et al., Multidimensional Visualization of Physical and Perceptual Data Leading to a Creative

Approach in Fragrance Development, Perfume & Flavorist, Vol. 33, September,, 2008, pages 54-61.

The nature of high impact perfume raw materials having a Log T<-4 and density balancing material having a density greater than 1.07 g/cm³ are described in WO2018115250, the content of which are included by reference.

According to an embodiment, the high impact perfume raw materials having a Log T<-4 are selected from the group consisting of (+-)-1-methoxy-3-hexanethiol, 4-(4-hydroxy-1-phenyl)-2-butanone, 2-methoxy-4-(1-propenyl)-1-phenyl acetate, pyrazobutyle, 3-propylphenol, 1-(3-methyl-1-benzofuran-2-yl)ethanone, 2-(3-phenylpropyl)pyridine, 1-(3,3/5,5-dimethyl-1-cyclohexen-1-yl)-4-penten-1-one, 1-(5,5-dimethyl-1-cyclohexen-1-yl)-4-penten-1-one, a mixture comprising (3RS,3aRS,6SR,7ASR)-perhydro-3,6-dimethylbenzo[b]furan-2-one and (3SR,3aRS,6SR,7ASR)-perhydro-3,6-dimethylbenzo[b]furan-2-one, (+-)-1-(5-ethyl-5-methyl-1-cyclohexen-1-yl)-4-penten-1-one, (1'S,3'R)-1-methyl-2-[(1',2',2'-trimethylbicyclo[3.1.0]hex-3'-yl)methyl]cyclopropyl}methanol, (+-)-3-mercaptohexyl acetate, (2E)-1-(2,6,6-trimethyl-1,3-cyclohexadien-1-yl)-2-buten-1-one, H-methyl-2h-1,5-benzodioxepin-3(4H)-one, (2E,6Z)-2,6-nonadien-1-ol, (4Z)-4-dodecenal, (+-)-4-hydroxy-2,5-dimethyl-3(2H)-furanone, methyl 2,4-dihydroxy-3,6-dimethylbenzoate, 3-methylindole, (+-)-perhydro-4alpha,8abeta-dimethyl-4a-naphthalenol, patchoulol, 2-methoxy-4-(1-propenyl)phenol, mixture comprising (+-)-5,6-dihydro-4-methyl-2-phenyl-2H-pyran and tetrahydro-4-methylene-2-phenyl-2H-pyran, mixture comprising 4-methylene-2-phenyltetrahydro-2H-pyran and (+-)-4-methyl-2-phenyl-3,6-dihydro-2H-pyran, 4-hydroxy-3-methoxybenzaldehyde, nonylenic aldehyde, 2-methoxy-4-propylphenol, 3-methyl-5-phenyl-2-pentenitrile, 1-(spiro[4.5]dec-6/7-en-7-yl)-4-penten-1-one, 2-methoxynaphthalene, (-)-(3aR,5AS,9AS,9BR)-3a,6,6,9a-tetramethyldodecahydronaphtho[2,1-b]furan, 5-nonanolide, (3aR,5AS,9AS,9BR)-3a,6,6,9a-tetramethyldodecahydronaphtho[2,1-b]furan, 7-isopropyl-2H,4H-1,5-benzodioxepin-3-one, coumarin, 4-methylphenyl isobutyrate, (2E)-1-(2,6,6-trimethyl-1,3-cyclohexadien-1-yl)-2-buten-1-one, beta,2,2,3-tetramethyl-delta-methylene-3-cyclopentene-1-butanol, delta damascone ((2E)-1-[(1RS,2SR)-2,6,6-trimethyl-3-cyclohexen-1-yl]-2-buten-1-one), (+-)-3,6-dihydro-4,6-dimethyl-2-phenyl-2h-pyran, anisaldehyde, paracresol, 3-ethoxy-4-hydroxybenzaldehyde, methyl 2-aminobenzoate, ethyl methylphenylglycidate, octalactone gamma, ethyl 3-phenyl-2-propenoate, (-)-(2E)-2-ethyl-4-[(1R)-2,2,3-trimethyl-3-cyclopenten-1-yl]-2-buten-1-ol, paracresyl acetate, dodecalactone, tricyclone, (+)-(3R,5Z)-3-methyl-5-cyclopentadecen-1-one, undecalactone, (1R,4R)-8-mercapto-3-p-menthanone, (3S,3AS,6R,7AR)-3,6-dimethylhexahydro-1-benzofuran-2(3H)-

one, beta ionone, (+)-6-pentyltetrahydro-2H-pyran-2-one, (3E,5Z)-1,3,5-undecatriene, 10-undecenal, (9E)-9-undecenal (9Z)-9-undecenal, (Z)-4-decenal, (+)-ethyl 2-methylpentanoate, 1,2-diallyldisulfane, 2-tridecenenitrile, 3-tridecenenitrile, , (+)-2-ethyl-4,4-dimethyl-1,3-oxathiane, (+)-(3R,5Z)-3-methyl-5-cyclopentadecen-1-one, 3-(4-tert-butylphenyl)propanal, allyl (cyclohexyloxy)acetate, methylnaphthylketone, (+)-(4E)-3-methyl-4-cyclopentadecen-1-one, (+)-5E3-methyl-5-cyclopentadecen-1-one, cyclopropylmethyl 3-hexenoate, (4E)-4-methyl-5-(4-methylphenyl)-4-pentenal, (+)-1-(5-propyl-1,3-benzodioxol-2-yl)ethanone, 4-methyl-2-pentylpyridine, (+)-(E)-3-methyl-4-(2,6,6-trimethyl-2-cyclohexen-1-yl)-3-buten-2-one, (3aRS,5aSR,9aSR,9bRS)-3a,6,6,9a-tetramethyldodecahydronaphtho[2,1-b]furan, (2S,5R)-5-methyl-2-(2-propanyl)cyclohexanone oxime, 6-hexyltetrahydro-2H-pyran-2-one, (+)-3-(3-isopropyl-1-phenyl)butanal, methyl 2-(3-oxo-2-pentylcyclopentyl)acetate, 1-(2,6,6-trimethyl-1-cyclohex-2-enyl)pent-1-en-3-one, indol, 7-propyl-2H,4H-1,5-benzodioxepin-3-one, ethyl praline, (4-methylphenoxy)acetaldehyde, ethyl tricyclo[5.2.1.0.^{2,6}]decane-2-carboxylate, (+)-(1'S,2S,E)-3,3-dimethyl-5-(2',2',3'-trimethyl-3'-cyclopenten-1'-yl)-4-penten-2-ol, (4E)-3,3-dimethyl-5-[(1R)-2,2,3-trimethyl-3-cyclopenten-1-yl]-4-penten-2-ol, 8-isopropyl-6-methyl-bicyclo[2.2.2]oct-5-ene-2-carbaldehyde, methylnonylacetaldehyde, 4-formyl-2-methoxyphenyl 2-methylpropanoate, (E)-4-decenal, (+)-2-ethyl-4-(2,2,3-trimethyl-3-cyclopenten-1-yl)-2-buten-1-ol, (1R,5R)-4,7,7-trimethyl-6-thiabicyclo[3.2.1]oct-3-ene, (1R,4R,5R)-4,7,7-trimethyl-6-thiabicyclo[3.2.1]octane, (-)-(3R)-3,7-dimethyl-1,6-octadien-3-ol, (E)-3-phenyl-2-propenenitrile, 4-methoxybenzyl acetate, (E)-3-methyl-5-(2,2,3-trimethyl-3-cyclopenten-1-yl)-4-penten-2-ol, allyl (2/3-methylbutoxy)acetate, (+)-(2E)-1-(2,6,6-trimethyl-2-cyclohexen-1-yl)-2-buten-1-one, (1E)-1-(2,6,6-trimethyl-1-cyclohexen-1-yl)-1-penten-3-one, and mixtures thereof.

According to an embodiment, perfume raw materials having a Log T<-4 are chosen in the group consisting of aldehydes, ketones, alcohols, phenols, esters lactones, ethers, epoxydes, nitriles and mixtures thereof.

According to an embodiment, perfume raw materials having a Log T<-4 comprise at least one compound chosen in the group consisting of alcohols, phenols, esters lactones, ethers, epoxydes, nitriles and mixtures thereof, preferably in amount comprised between 20 and 70% by weight based on the total weight of the perfume raw materials having a Log T<-4.

According to an embodiment, perfume raw materials having a Log T<-4 comprise between 20 and 70% by weight of aldehydes, ketones, and mixtures thereof based on the total weight of the perfume raw materials having a Log T<-4.

The remaining perfume raw materials contained in the oil-based core may have therefore a Log T>-4.

According to an embodiment, the perfume raw materials having a Log T>-4 are chosen in the group consisting of ethyl 2-methylbutyrate, (E)-3-phenyl-2-propenyl acetate, (+)-6/8-sec-butylquinoline, (+)-3-(1,3-benzodioxol-5-yl)-2-methylpropanal, verdyl propionate, 1-(octahydro-2,3,8,8-tetramethyl-2-naphtalenyl)-1-ethanone, methyl 2-((1R,2R)-3-oxo-2-pentylcyclopentyl)acetate, (+)-(E)-4-methyl-3-decen-5-ol, 2,4-dimethyl-3-cyclohexene-1-carbaldehyde, 1,3,3-trimethyl-2-oxabicyclo[2.2.2]octane, tetrahydro-4-methyl-2-(2-methyl-1-propenyl)-2H-pyran, dodecanal, 1-oxa-12/13-cyclohexadecen-2-one, (+)-3-(4-isopropylphenyl)-2-methylpropanal, aldehyde C11, (+)-2,6-dimethyl-7-octen-2-ol, allyl 3-cyclohexylpropanoate, (Z)-3-hexenyl acetate, 5-methyl-2-(2-propenyl)cyclohexanone, allyl heptanoate, 2-(2-methyl-2-propenyl)cyclohexyl acetate, 1,1-dimethyl-2-phenylethyl butyrate, geranyl acetate, neryl acetate, (+)-1-phenylethyl acetate, 1,1-dimethyl-2-phenylethyl acetate, 3-methyl-2-butenyl acetate, ethyl 3-oxobutanoate, (2Z)-ethyl 3-hydroxy-2-butenate, 8-p-menthanol, 8-p-menthanyl acetate, 1-p-menthanyl acetate, (+)-2-(4-methyl-3-cyclohexen-1-yl)-2-propenyl acetate, (+)-2-methylbutyl butanoate, 2-((1S)-1-[(1R)-3,3-dimethylcyclohexyl]ethoxy)-2-oxoethyl propionate, 3,5,6-trimethyl-3-cyclohexene-1-carbaldehyde, 2,4,6-trimethyl-3-cyclohexene-1-carbaldehyde, 2-cyclohexylethyl acetate, octanal, ethyl butanoate, (+)-(3E)-4-(2,6,6-trimethyl-1/2-cyclohexen-1-yl)-3-buten-2-one, 1-[(1R,6SR)-2,2,6-trimethylcyclohexyl]-3-hexanol, 1,3,3-trimethyl-2-oxabicyclo[2.2.2]octane, 1,3,3-trimethyl-2-oxabicyclo[2.2.2]octane, ethyl hexanoate, undecanal, decanal, 2-phenylethyl acetate, (1S,2S,4S)-1,7,7-trimethylbicyclo[2.2.1]heptan-2-ol, (1S,2R,4S)-1,7,7-trimethylbicyclo[2.2.1]heptan-2-ol), (+)-3,7-dimethyl-3-octanol, 1-methyl-4-(2-propenylidene)cyclohexene, (+)-(R)-4-(2-methoxypropan-2-yl)-1-methylcyclohex-1-ene, verdyl acetate, (3R)-1-[(1R,6S)-2,2,6-trimethylcyclohexyl]-3-hexanol, (3S)-1-[(1R,6S)-2,2,6-trimethylcyclohexyl]-3-hexanol, (3R)-1-[(1S,6S)-2,2,6-trimethylcyclohexyl]-3-hexanol, (+)-(1S,1'R)-2-[1-(3',3'-dimethyl-1'-cyclohexyl)ethoxy]-2-methylpropyl propanoate, and mixtures thereof.

According to an embodiment, the core comprises a perfume formulation comprising:

- 0 to 60 wt.% of a hydrophobic solvent (based on the total weight of the perfume formulation),

- 40 to 100 wt.% of a perfume oil (based on the total weight of the perfume formulation), wherein the perfume oil has at least two, preferably all of the following characteristics:
 - o at least 35%, preferably at least 40%, preferably at least 50%, more preferably at least 60% of perfuming ingredients having a log P above 3, preferably above 3.5,
 - o at least 20%, preferably at least 25%, preferably at least 30%, more preferably at least 40% of Bulky materials of groups 1 to 6, preferably 3 to 6 as herein defined and
 - o at least 15%, preferably at least 20%, more preferably at least 25%, even more preferably at least 30% of high impact perfume materials having a Log T < -4,

optionally, further hydrophobic active ingredients.

According to a particular embodiment, the perfume comprises 0 to 60 wt.% of a hydrophobic solvent.

According to a particular embodiment, the hydrophobic solvent is a density balancing material preferably chosen in the group consisting of benzyl salicylate, benzyl benzoate, cyclohexyl salicylate, benzyl phenylacetate, phenylethyl phenylacetate, triacetin, ethyl citrate, methyl and ethyl salicylate, benzyl cinnamate, and mixtures thereof.

In a particular embodiment, the hydrophobic solvent has Hansen Solubility Parameters compatible with entrapped perfume oil.

The term "Hansen solubility parameter" is understood refers to a solubility parameter approach proposed by Charles Hansen used to predict polymer solubility and was developed around the basis that the total energy of vaporization of a liquid consists of several individual parts. To calculate the "weighted Hansen solubility parameter" one must combine the effects of (atomic) dispersion forces, (molecular) permanent dipole-permanent dipole forces, and (molecular) hydrogen bonding (electron exchange). The weighted Hansen solubility parameter" is calculated as $(\delta D^2 + \delta P^2 + \delta H^2)^{0.5}$, wherein δD is the Hansen dispersion value (also referred to in the following as the atomic dispersion fore), δP is the Hansen polarizability value (also referred to in the following as the dipole moment), and δH is the Hansen Hydrogen-bonding ("h-bonding") value (also referred to in the following as hydrogen bonding). For a more detailed description of the parameters and values, see Charles Hansen, The Three

Dimensional Solubility Parameter and Solvent Diffusion Coefficient, Danish Technical Press (Copenhagen, 1967).

Euclidean difference in solubility parameter between a fragrance and a solvent is calculated as $(4 * (\delta D_{\text{solvent}} - \delta D_{\text{fragrance}})^2 + (\delta P_{\text{solvent}} - \delta P_{\text{fragrance}})^2 + (\delta H_{\text{solvent}} - \delta H_{\text{fragrance}})^2)^{0.5}$, in which $\delta D_{\text{solvent}}$, $\delta P_{\text{solvent}}$, and $\delta H_{\text{solvent}}$, are the Hansen dispersion value, Hansen polarizability value, and Hansen h-bonding values of the solvent, respectively; and $\delta D_{\text{fragrance}}$, $\delta P_{\text{fragrance}}$, and $\delta H_{\text{fragrance}}$ are the Hansen dispersion value, Hansen polarizability value, and Hansen h-bonding values of the fragrance, respectively.

In a particular embodiment, the perfume oil and the hydrophobic solvent have at least two Hansen solubility parameters selected from a first group consisting of: an atomic dispersion force (δD) from 12 to 20, a dipole moment (δP) from 1 to 8, and a hydrogen bonding (δH) from 2.5 to 11.

In a particular embodiment, the perfume oil and the hydrophobic solvent have at least two Hansen solubility parameters selected from a second group consisting of: an atomic dispersion force (δD) from 12 to 20, preferably from 14 to 20, a dipole moment (δP) from 1 to 8, preferably from 1 to 7, and a hydrogen bonding (δH) from 2.5 to 11, preferably from 4 to 11.

In a particular embodiment, at least 90% of the perfume oil, preferably at least 95% of the perfume oil, most preferably at least of 98% of the perfume oil has at least two Hansen solubility parameters selected from a first group consisting of: an atomic dispersion force (δD) from 12 to 20, a dipole moment (δP) from 1 to 8, and a hydrogen bonding (δH) from 2.5 to 11.

In a particular embodiment, the perfume oil and the hydrophobic solvent have at least two Hansen solubility parameters selected from a second group consisting of: an atomic dispersion force (δD) from 12 to 20, preferably from 14 to 20, a dipole moment (δP) from 1 to 8, preferably from 1 to 7, and a hydrogen bonding (δH) from 2.5 to 11, preferably from 4 to 11.

According to an embodiment, the perfuming formulation comprises a fragrance modulator (that can be used in addition to the hydrophobic solvent when present or as substitution of the hydrophobic solvent when there is no hydrophobic solvent).

Preferably, the fragrance modulator is defined as a fragrance material with

- i. a vapor pressure of less than 0.0008 Torr at 22°C;
- ii. a clogP of 3.5 and higher, preferable 4.0 and higher and more preferable 4.5

- iii. at least two Hansen solubility parameters selected from a first group consisting of: an atomic dispersion force from 12 to 20, a dipole moment from 1 to 7, and a hydrogen bonding from 2.5 to 11,
- iv. at least two Hansen solubility parameters selected from a second group consisting of: an atomic dispersion force from 14 to 20, a dipole moment from 1 to 8, and a hydrogen bonding from 4 to 11, when in solution with a compound having a vapor pressure range of 0.0008 to 0.08 Torr at 22°C.

Preferably, as examples the following ingredients can be listed as modulators but the list is not limited to the following materials: alcohol C12, oxacyclohexadec-12/13-en-2-one, 3-[(2',2',3'-trimethyl-3'-cyclopenten-1'-yl)methoxy]-2-butanol, cyclohexadecanone, (Z)-4-cyclopentadecen-1-one, cyclopentadecanone, (8Z)-oxacycloheptadec-8-en-2-one, 2-[5-(tetrahydro-5-methyl-5-vinyl-2-furyl)-tetrahydro-5-methyl-2-furyl]-2-propanol, muguet aldehyde, 1,5,8-trimethyl-13-oxabicyclo[10.1.0]trideca-4,8-diene, (+)-4,6,6,7,8,8-hexamethyl-1,3,4,6,7,8-hexahydrocyclopenta[g]isochromene, (+)-(1S,2S,3S,5R)-2,6,6-trimethylspiro[bicyclo[3.1.1]heptane-3,1'-cyclohexane]-2'-en-4'-one, oxacyclohexadecan-2-one, 2-[(1S)-1-[(1R)-3,3-dimethylcyclohexyl]ethoxy]-2-oxoethyl propionate, (+)-(4R,4aS,6R)-4,4a-dimethyl-6-(1-propen-2-yl)-4,4a,5,6,7,8-hexahydro-2(3H)-naphthalenone, amylcinnamic aldehyde, hexylcinnamic aldehyde, hexyl salicylate, (1E)-1-(2,6,6-trimethyl-1-cyclohexen-1-yl)-1,6-heptadien-3-one, (9Z)-9-cycloheptadecen-1-one.

According to a particular embodiment, the hydrophobic material is free of any active ingredient (such as perfume). According to this particular embodiment, it comprises, preferably consists of hydrophobic solvents, preferably chosen in the group consisting of isopropyl myristate, triglycerides (e.g. Neobee® MCT oil, vegetable oils), D-limonene, silicone oil, mineral oil, and mixtures thereof with optionally hydrophilic solvents preferably chosen in the group consisting of 1,4-butanediol, benzyl alcohol, triethyl citrate, triacetin, benzyl acetate, ethyl acetate, propylene glycol (1,2-propanediol), 1,3-propanediol, dipropylene glycol, glycerol, glycol ethers and mixtures thereof.

The term "biocide" refers to a chemical substance capable of killing living organisms (e.g. microorganisms) or reducing or preventing their growth and/or accumulation. Biocides are commonly used in medicine, agriculture, forestry, and in industry where they prevent the fouling of, for example, water, agricultural products including seed, and oil pipelines. A biocide can be a pesticide, including a fungicide, herbicide, insecticide, algicide, molluscicide, miticide and rodenticide; and/or an antimicrobial such as a germicide, antibiotic, antibacterial, antiviral, antifungal, antiprotozoal and/or antiparasite.

As used herein, a "pest control agent" indicates a substance that serves to repel or attract pests, to decrease, inhibit or promote their growth, development or their activity. Pests refer to any living organism, whether animal, plant or fungus, which is invasive or troublesome to plants or animals, pests include insects notably arthropods, mites, spiders, fungi, weeds, bacteria and other microorganisms.

By "flavor oil", it is meant here a flavoring ingredient or a mixture of flavoring ingredients, solvents or adjuvants of current use for the preparation of a flavoring formulation, i.e. a particular mixture of ingredients which is intended to be added to an edible composition or chewable product to impart, improve or modify its organoleptic properties, in particular its flavor and/or taste. Flavoring ingredients are well known to a person skilled in the art and their nature does not warrant a detailed description here, which in any case would not be exhaustive, the skilled flavorist being able to select them on the basis of his general knowledge and according to the intended use or application and the organoleptic effect it is desired to achieve. Many of these flavoring ingredients are listed in reference texts such as in the book by S. Arctander, *Perfume and Flavor Chemicals*, 1969, Montclair, N.J., USA, or its more recent versions, or in other works of similar nature such as *Fenaroli's Handbook of Flavor Ingredients*, 1975, CRC Press or *Synthetic Food Adjuncts*, 1947, by M. B. Jacobs, van Nostrand Co., Inc. Solvents and adjuvants of current use for the preparation of a flavoring formulation are also well known in the art.

In a particular embodiment, the flavor is a mint flavor. In a more particular embodiment, the mint is selected from the group consisting of peppermint and spearmint.

In a further embodiment, the flavor is a cooling agent or mixtures thereof.

In another embodiment, the flavor is a menthol flavor.

Flavors that are derived from or based on fruits where citric acid is the predominant, naturally-occurring acid include but are not limited to, for example, citrus fruits (e.g. lemon, lime), limonene, strawberry, orange, and pineapple. In one embodiment, the flavors food is lemon, lime or orange juice extracted directly from the fruit. Further embodiments of the flavor comprise the juice or liquid extracted from oranges, lemons, grapefruits, key limes, citrons, clementines, mandarins, tangerines, and any other citrus fruit, or variation or hybrid thereof.

In a particular embodiment, the flavor comprises a liquid extracted or distilled from oranges, lemons, grapefruits, key limes, citrons, clementines, mandarins, tangerines, any other citrus fruit or variation or hybrid thereof, pomegranates, kiwifruits, watermelons, apples, bananas, blueberries, melons, ginger, bell peppers, cucumbers, passion fruits, mangos, pears, tomatoes, and strawberries.

In a particular embodiment, the flavor comprises a composition that comprises limonene, in a particular embodiment, the composition is a citrus that further comprises limonene.

In another particular embodiment, the flavor comprises a flavor selected from the group comprising strawberry, orange, lime, tropical, berry mix, and pineapple.

The phrase flavor includes not only flavors that impart or modify the smell of foods but include taste imparting or modifying ingredients. The latter do not necessarily have a taste or smell themselves but are capable of modifying the taste that other ingredients provides, for instance, salt enhancing ingredients, sweetness enhancing ingredients, umami enhancing ingredients, bitterness blocking ingredients and so on.

In a further embodiment, suitable sweetening components may be included in the particles described herein. In a particular embodiment, a sweetening component is selected from the group consisting of sugar (e.g., but not limited to sucrose), a stevia component (such as but not limited to stevioside or rebaudioside A), sodium cyclamate, aspartame, sucralose, sodium saccharine, and Acesulfam K or mixtures thereof.

Organosilicon compound

By “Organosilicon compound”, it should be understood a compound that comprises Si-O and Si-C bonds.

According to an embodiment, the organosilicon compound is an amino-organosilicon.

By “amino-organosilicon”, it should be understood a compound that comprises Si-O, Si-C bonds and one or more amino groups.

The organosilicon compound can be a polysiloxane, an oligosiloxane, a silsesquioxane, or mixtures thereof.

According to an embodiment, the organosilicon compound is not 3-aminopropyltriethoxysilane.

Polysiloxane

According to an embodiment, the organosilicon compound is a polysiloxane, namely organic/inorganic hybrid polymer(s) comprising siloxane bonds (or linkages) (Si-O) as backbone.

According to an embodiment the polysiloxane contains unit structures of $(R_3SiO_{0.5})$, (R_2SiO) , $(RSiO_{1.5})$, or mixture of them with optional (SiO_2) unit structure.

According to a particular embodiment, the polysiloxane is an amino- polysiloxane.

Typically, the polysiloxane contains the unit structure of $[R_aSiO_{(2-(a/2))}]_n$, where $a=1, 2$, or 3 , or mixture of them ($a=1, a=2$, and $a=3$) with an option that $a=0$, and n is greater than 30 .

The polysiloxane can comprise at least one functional group chosen in the group consisting of at least one amino group, methacrylates, alkenes, styrenes, alcohols, phenols, thiols, acids, esters, alkyl chains, phenols, amides, alkynes, azides, urea, urethane, silanol, carboxylic acid, quarternized ammonium, and mixtures thereof.

According to an embodiment, the polysiloxane comprises at least one functional group chosen in the group consisting of at least one amino group.

The amino group can be primary amine, secondary amine, tertiary amine, urea group, guanidine group, imidazole group, pyridine group, pyrimidine group, pyrrole group, isothiuronium group, aniline group and mixtures thereof.

As non-limiting examples, amino group can include aminopropyl group, aminoethyl group, aminobutyl group, N-(2-aminoethyl)-3-aminopropyl group, 3-[2-(2-aminoethylamino)ethylamino]propyl group, 3-ureidopropyl group, (aminoethylaminomethyl)phenylethyl group and mixtures thereof.

According to an embodiment, all of the functional groups are amino groups.

According to an embodiment, the polysiloxane is not a silane.

20 ***Oligosiloxane***

According to an embodiment, the organosilicon compound is an oligosiloxane. Oligosiloxane means organic/inorganic hybrid oligomers—made up of siloxane bonds (or linkages) (Si–O).

Typically, the oligosiloxane contains the unit structure of $[R_aSiO_{(2-(a/2))}]_n$, where $a=1, 2$, or 3 , or mixture of them ($a=1, a=2$, and $a=3$) with an option that $a=0$, and $n=2$ to 30 . Typically, the oligosiloxane contains less siloxane bonds than polysiloxanes.

According to an embodiment the oligosiloxane could contain unit structures of $(-R_3SiO_{0.5}-)$, $(-R_2SiO-)$, $(-RSiO_{1.5}-)$, or mixture of them with optional $(-SiO_2-)$ unit structure.

According to a particular embodiment, the organosilicon compound is an amino-oligosiloxane.

The oligosiloxane can comprise at least one functional group chosen in the group consisting of at least one amino group, methacrylates, alkenes, styrenes, alcohols, phenols, thiols, acids, esters, alkyl chains, phenols, amides, alkynes, azides, urea, urethane, silanol, carboxylic acid, quarternized ammonium, and mixtures thereof.

According to an embodiment, the oligosiloxane comprises at least one functional group chosen in the group consisting of at least one amino group.

The amino group can be primary amine, secondary amine, tertiary amine, urea group, guanidine group, imidazole group, pyridine group, pyrimidine group, pyrrole group,
5 isothiuronium group, aniline group and mixtures thereof.

As non-limiting examples, amino group can include aminopropyl group, aminoethyl group, aminobutyl group, N-(2-aminoethyl)-3-aminopropyl group, 3-[2-(2-aminoethylamino)ethylamino]propyl, 3-ureidopropyl group,
10 (aminoethylaminomethyl)phenylethyl group and mixtures thereof.

According to an embodiment, all of the functional groups are amino groups.

Silsesquioxane

According to an embodiment, the organosilicon compound is silsesquioxane, preferably
15 oligomeric silsesquioxane, more preferably polyhedral oligomeric silsesquioxane (POSS).

Silsesquioxanes can be defined as components having the formula $[\text{RSiO}_{3/2}]_n$, n being an integer.

According to an embodiment, silsesquioxanes are a class of inorganic-organic hybrid compounds characterized by the general formula $[\text{RSiO}_{3/2}]_n$ where n is an integer (n = 1, 2,
20 3...).

According to an embodiment, silsesquioxanes are a class of inorganic-organic hybrid compounds characterized by the general formula $(\text{RSiO}_{1.5})_a(\text{H}_2\text{O})_{0.5b}$ or, after rearrangement, $\text{R}_a\text{Si}_a\text{O}_{(1.5a-0.5b)}(\text{OH})_b$, where R is a hydrogen atom or an organic group and a and b are integer numbers (a = 1, 2, 3...; b = 0, 1, 2, 3...), with a + b = 2n, where n is an integer (n = 1, 2, 3...),
25 and $b \leq a + 2$.

According to an embodiment, the silsesquioxane is linear or random-structured or ladder structured silsesquioxanes.

According to an embodiment, the silsesquioxane has a polyhedral structure.

30 According to an embodiment, the silsesquioxane is linear and is chosen in the group consisting of aminopropylsilsesquioxane; aminopropyl/vinylsilsesquioxane ; aminopropyl/methylsilsesquioxane ; aminoethylaminopropyl/methylsilsesquioxane, and mixtures thereof.

In a particular embodiment, the silsesquioxane is aminopropylsilsesquioxane.

In a particular embodiment, the silsesquioxane is oligomeric aminopropylsilsesquioxane.

Preferably, the silsesquioxane is an oligomeric silsesquioxane.

5 The silsesquioxane can comprise at least one functional group chosen in the group consisting of at least one amino group, methacrylates, alkenes, styrenes, alcohols, phenols, thiols, acids, esters, alkyl chains, phenols, amides, alkynes, azides, urea, urethane, silanol, carboxylic acid, quarternized ammonium, and mixtures thereof.

10 According to a particular embodiment, the silsesquioxane comprises at least one functional group chosen in the group consisting of at least one amino group.

The amino group can be primary amine, secondary amine, tertiary amine, urea group, guanidine group, imidazole group, pyridine group, pyrimidine group, pyrrole group, isothiuronium group, aniline group and mixtures thereof.

15 As non-limiting examples, amino group can include aminopropyl group, aminoethyl group, aminobutyl group, N-(2-aminoethyl)-3-aminopropyl group, 3-[2-(2-aminoethylamino)ethylamino]propyl, 3-ureidopropyl group, (aminoethylaminomethyl)phenylethyl group and mixtures thereof.

According to an embodiment, all of the functional groups are amino groups.

20 According to an embodiment, the organosilicon compound is a polyhedral oligomeric silsesquioxane (POSS).

By polyhedral oligomeric silsesquioxanes, it should be understood a condensed three-dimensional oligomeric silsesquioxane compounds with cage frameworks. These completely condensed structures are characterized by cages with a defined geometry (e.g., cubic, prismatic) and, therefore, are usually referred to as polyhedral oligomeric silsesquioxanes (POSS).

According to an embodiment, the polyhedral oligomeric silsesquioxanes (POSS) is an amine functionalized POSS, also called POSS-NH₂ or NH₂-POSS.

30 By amine functionalized POSS, it should be understood that the POSS contains at least one amine group, preferably at least two amine groups. The remaining functional groups can be amine group(s) and/or other functional groups, typically chosen in the group consisting of methacrylates, alkenes, styrenes, alcohols, phenols, thiols, acids, esters, alkyl chains, phenols, amides, alkynes, azides, urea, urethane, silanol, carboxylic acid, quarternized ammonium. and mixture thereof.

The amino group can be primary amine, secondary amine, tertiary amine, urea group, guanidine group, imidazole group, pyridine group, pyrimidine group, pyrrole group, isothiuronium group, aniline group and mixtures thereof.

As non-limiting examples, amino group can include aminopropyl group, aminoethyl group, aminobutyl group, N-(2-aminoethyl)-3-aminopropyl group, 3-[2-(2-aminoethylamino)ethylamino]propyl group, 3-ureidopropyl group, (aminoethylaminomethyl)phenylethyl group and mixtures thereof.

According to an embodiment, all of the functional groups are amino groups.

According to an embodiment, the polyhedral oligomeric silsesquioxanes (POSS) is chosen in the group consisting of octa($T_8(R_8Si_8O_{12})$), deca($T_{10}(R_{10}Si_{10}O_{15})$), and dodeca($T_{12}(R_{12}Si_{12}O_{18})$) POSS cages, and mixtures thereof.

According to an embodiment, NH_2 -POSS has an amino functional group comprised between 1 and 12, preferably between 2 and 10. Thereby, it is understood that the NH_2 -POSS comprises between 1 and 12, preferably 2 and 10, functional amine groups.

According to an embodiment, the polyhedral oligomeric silsesquioxane (POSS) is chosen in the group consisting Hexa- aminopropyl POSS hydrochloride (T_6), Octa- aminopropyl POSS hydrochloride (T_8), Deca- aminopropyl POSS hydrochloride (T_{10}), Dodeca- aminopropyl POSS hydrochloride (T_{12}), and mixtures thereof.

According to an embodiment, the POSS- NH_2 can be used with a counter ion to increase the solubility in water.

As non-limiting examples one may cite POSS- NH_2 HCl (hydrochloride), POSS- NH_2 - HNO_3 (nitric acid), or POSS- NH_2 -triflic acid (trifluoromethanesulfonate).

POSS synthesis have been published. As non-limiting examples, one may cite *Chem. Eur. J.* 2014, 20, 15966 – 15974 or *Angew. Chem. Int. Ed.*, 2019, 58, 10142-10147, *RSC Adv.*, 2015, 5, 72340.

According to an embodiment, the weight ratio between the organosilicon compound and the polyfunctional monomer is comprised between 50:1 and 0.05:1, preferably between 15:1 and 0.1:1, even more preferably between 7:1 and 0.4:1.

30 Polyfunctional monomer

According to an embodiment, the polyfunctional monomer is chosen in the group consisting of at least one acyl chloride, isocyanate, anhydride, epoxide, acrylate, alkoxysilane, aldehyde, and mixtures thereof.

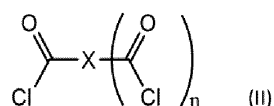
According to a particular embodiment the polyfunctional monomer does not comprise epoxides, such as sorbitol polyglycidylether, trimethylolpropane triglycidyl ether, castor oil glycidyl ether, isobrobide glycidyl ether and/or polyglycerol-3-glycidyl ether.

- According to a particular embodiment the polyfunctional monomer does not comprise isocyanates, such as pentane-1,5-diisocyanate, isocyanurate based trimer of pentane-1,5-dioscyanate and/or polyisocyanates.

According to a particular embodiment, the polyfunctional monomer is an acyl chloride.

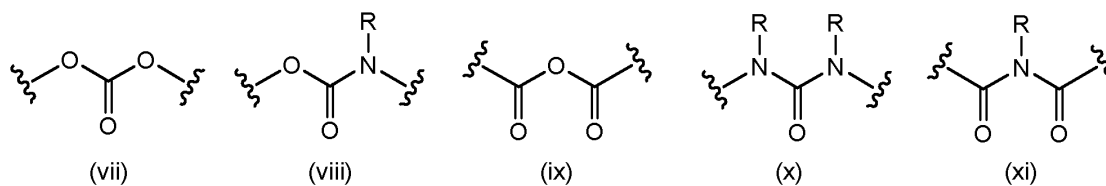
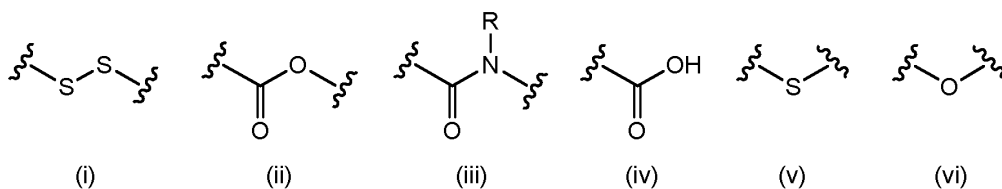
According to an embodiment, the acyl chloride has the following formula (II)

10



wherein n is an integer varying between 1 and 8, preferably between 1 and 6, more preferably between 1 and 4, and

- 15 wherein X is an (n+1)-valent C₂ to C₄₅ hydrocarbon group optionally comprising at least one group selected from (i) to (xi),



20

wherein R is a hydrogen atom or an alkyl group, preferably a hydrogen atom.

It is understood that by “... **hydrocarbon group** ...” it is meant that said group consists

of hydrogen and carbon atoms and can be in the form of an aliphatic hydrocarbon, i.e. linear or branched saturated hydrocarbon (e.g. alkyl group), a linear or branched unsaturated hydrocarbon (e.g. alkenyl or alkynyl group), a saturated cyclic hydrocarbon (e.g. cycloalkyl) or an unsaturated cyclic hydrocarbon (e.g. cycloalkenyl or cycloalkynyl), or can be in the form of an aromatic hydrocarbon, i.e. aryl group, or can also be in the form of a mixture of said type of groups, e.g. a specific group may comprise a linear alkyl, a branched alkenyl (e.g. having one or more carbon-carbon double bonds), a (poly)cycloalkyl and an aryl moiety, unless a specific limitation to only one type is mentioned. Similarly, in all the embodiments of the invention, when a group is mentioned as being in the form of more than one type of topology (e.g. linear, cyclic or branched) and/or being saturated or unsaturated (e.g. alkyl, aromatic or alkenyl), it is also meant a group which may comprise moieties having any one of said topologies or being saturated or unsaturated, as explained above. Similarly, in all the embodiments of the invention, when a group is mentioned as being in the form of one type of saturation or unsaturation, (e.g. alkyl), it is meant that said group can be in any type of topology (e.g. linear, cyclic or branched) or having several moieties with various topologies.

It is understood that with the term “... **a hydrocarbon group, optionally comprising ...**” it is meant that said hydrocarbon group optionally comprises heteroatoms to form ether, thioether, amine, nitrile or carboxylic acid groups and derivatives (including for example esters, acids, amide). These groups can either substitute a hydrogen atom of the hydrocarbon group and thus be laterally attached to said hydrocarbon, or substitute a carbon atom (if chemically possible) of the hydrocarbon group and thus be inserted into the hydrocarbon chain or ring.

According to a particular embodiment, the acyl chloride is chosen from the group consisting of benzene-1,3,5-tricarbonyl trichloride (trimesoyl chloride), benzene-1,2,4-tricarbonyl trichloride, benzene-1,2,4,5-tetracarbonyl tetrachloride, cyclohexane-1,3,5-tricarbonyl trichloride, isophthaloyl dichloride, diglycolyl dichloride, terephthaloyl chloride, fumaryl dichloride, adipoyl dichloride, succinic dichloride, propane-1,2,3-tricarbonyl trichloride, cyclohexane-1,2,4,5-tetracarbonyl tetrachloride, 2,2'-disulfanediyl disuccinyl dichloride, 2-(2-chloro-2-oxo-ethyl)sulfanylbutanedioyl dichloride, (4-chloro-4-oxobutanoyl)-L-glutamoyl dichloride, (S)-4-((1,5-dichloro-1,5-dioxopentan-2-yl)amino)-4-oxobutanoic acid, 2,2-bis[(4-chloro-4-oxo-butanoyl)oxymethyl]butyl 4-chloro-4-oxo-butanoate, [2-[2,2-bis[(4-chloro-4-oxo-butanoyl)oxymethyl]butoxymethyl]-2-[(4-chloro-4-oxo-butanoyl)oxymethyl]butyl] 4-chloro-4-oxo-butanoate, 2,2-bis[(2-chlorocarbonylbenzoyl)oxymethyl]butyl 2-chlorocarbonyl-benzoate, [2-[2,2-bis[(2-chlorocarbonylbenzoyl)oxymethyl]butoxymethyl]-2-[(2-

chlorocarbonylbenzoyl)oxymethyl]butyl] 2-chlorocarbonylbenzoate, 4-(2,4,5-trichlorocarbonylbenzoyl)oxybutyl 2,4,5-trichlorocarbonyl-benzoate, propane-1,2,3-triyl tris(4-chloro-4-oxobutanoate), propane-1,2-diyl bis(4-chloro-4-oxobutanoate) and mixtures thereof.

5 According to another particular embodiment, the acyl chloride is chosen from the group consisting of fumaryl dichloride, adipoyl dichloride, succinic dichloride, propane-1,2,3-triyl tris(4-chloro-4-oxobutanoate), propane-1,2-diyl bis(4-chloro-4-oxobutanoate), and mixtures thereof.

According to an embodiment, the acyl chloride is a mixture of acyl chlorides.

10 The weight ratio between acyl chloride and the hydrophobic material is preferably comprised between 0.005 and 0.5, more preferably between 0.01 and 0.07.

According to an embodiment, the acyl chloride is used in a concentration between 0.05 % to 50 %, preferably between 0.1 to 15%, by weight based on the oil phase (or hydrophobic material).

15 According to an embodiment, the shell comprises the reaction product between an acyl chloride and a NH_2 -POSS.

According to an embodiment, the mole ratio of amino group from NH_2 -POSS to acyl chloride group from the acyl chloride is 0.05:1 to 50:1, preferably 0.1:1 to 15:1.

20 According to a particular embodiment, the polyfunctional monomer is a polyisocyanate having at least two isocyanate functional groups.

Suitable polyisocyanates used according to the invention can include aromatic polyisocyanate, aliphatic polyisocyanate and mixtures thereof. Said polyisocyanate comprises at least 2, preferably at least 3 but may comprise up to 6, or even only 4, isocyanate functional groups. According to a particular embodiment, a triisocyanate (3 isocyanate functional group) is used.

According to one embodiment, said polyisocyanate is an aromatic polyisocyanate.

The term "aromatic polyisocyanate" is meant here as encompassing any polyisocyanate comprising an aromatic moiety. Preferably, it comprises a phenyl, a toluyl, a xylyl, a naphthyl or a diphenyl moiety, more preferably a toluyl or a xylyl moiety. Preferred aromatic polyisocyanates are biurets, polyisocyanurates and trimethylol propane adducts of diisocyanates, more preferably comprising one of the above-cited specific aromatic moieties. More preferably, the aromatic polyisocyanate is a polyisocyanurate of toluene diisocyanate (commercially available from Bayer under the tradename Desmodur[®] RC), a trimethylol propane-adduct of toluene diisocyanate (commercially available from Bayer under the

tradename Desmodur[®] L75), a trimethylol propane-adduct of xylylene diisocyanate (commercially available from Mitsui Chemicals under the tradename Takenate[®] D-110N). In a most preferred embodiment, the aromatic polyisocyanate is a trimethylol propane-adduct of xylylene diisocyanate.

5 According to another embodiment, said polyisocyanate is an aliphatic polyisocyanate. The term “aliphatic polyisocyanate” is defined as a polyisocyanate which does not comprise any aromatic moiety. Preferred aliphatic polyisocyanates are a trimer of hexamethylene diisocyanate, a trimer of isophorone diisocyanate, a trimethylol propane-adduct of hexamethylene diisocyanate (available from Mitsui Chemicals) or a biuret of hexamethylene diisocyanate (commercially available from Bayer under the tradename Desmodur[®] N 100),
10 among which a biuret of hexamethylene diisocyanate is even more preferred.

 According to another embodiment, the at least one polyisocyanate is in the form of a mixture of at least one aliphatic polyisocyanate and of at least one aromatic polyisocyanate, both comprising at least two or three isocyanate functional groups, such as a mixture of a biuret
15 of hexamethylene diisocyanate with a trimethylol propane-adduct of xylylene diisocyanate, a mixture of a biuret of hexamethylene diisocyanate with a polyisocyanurate of toluene diisocyanate and a mixture of a biuret of hexamethylene diisocyanate with a trimethylol propane-adduct of toluene diisocyanate. Most preferably, it is a mixture of a biuret of hexamethylene diisocyanate with a trimethylol propane-adduct of xylylene diisocyanate.
20 Preferably, when used as a mixture the molar ratio between the aliphatic polyisocyanate and the aromatic polyisocyanate is ranging from 80:20 to 10:90.

 In a particular embodiment, the shell material is a biodegradable material.

 In a particular embodiment, the shell has a biodegradability of at least 40%, preferably at least 45%, 50%, 60%, 65%, 70%, 75%, 80%, 85%, 90%, 95% or 98%, within 60 days
25 according to OECD301F.

 In a particular embodiment, the core-shell microcapsule has a biodegradability of at least 40 %, preferably at least 60 %, preferably at least 65%, 70%, 75%, 80%, 85%, 90%, 95% or 98% within 60 days according to OECD301F.

 Thereby it is understood that the core-shell microcapsule including all components,
30 such as the core, shell and optionally coating may have a biodegradability of at least 40 %, preferably at least 60 %, preferably at least 65%, 70%, 75%, 80%, 85%, 90%, 95% or 98% within 60 days according to OECD301F.

In a particular embodiment, the oil core, preferably perfume oil, has a biodegradability of at least 40 %, preferably at least 60 %, preferably at least 65%, 70%, 75%, 80%, 85%, 90%, 95% or 98% within 60 days according to OECD301F.

OECD301F is a standard test method on the biodegradability from the Organization of
5 Economic Co-operation and Development.

A typical method for extracting the shell for measuring the biodegradability is disclosed in *Gasparini and all in Molecules 2020, 25,718*.

Outer coating

10 According to a particular embodiment of the invention, the microcapsule comprises an outer coating, wherein the outer coating comprises a coating material selected from the group consisting of a non-ionic polysaccharide, a cationic polymer, a polysuccinimide derivative (as described for instance in WO2021185724) and mixtures thereof to form an outer coating to the microcapsule.

15 Non-ionic polysaccharide polymers are well known to a person skilled in the art and are described for instance in WO2012/007438 page 29, lines 1 to 25 and in WO2013/026657 page 2, lines 12 to 19 and page 4, lines 3 to 12. Preferred non-ionic polysaccharides are selected from the group consisting of locust bean gum, xyloglucan, guar gum, hydroxypropyl guar, hydroxypropyl cellulose and hydroxypropyl methyl cellulose.

20 Cationic polymers are well known to a person skilled in the art. Preferred cationic polymers have cationic charge densities of at least 0.5 meq/g, more preferably at least about 1.5 meq/g, but also preferably less than about 7 meq/g, more preferably less than about 6.2 meq/g. The cationic charge density of the cationic polymers may be determined by the Kjeldahl method as described in the US Pharmacopoeia under chemical tests for Nitrogen determination.

25 The preferred cationic polymers are chosen from those that contain units comprising primary, secondary, tertiary and/or quaternary amine groups that can either form part of the main polymer chain or can be borne by a side substituent directly connected thereto. The weight average (Mw) molecular weight of the cationic polymer is preferably between 10,000 and 3.5M Dalton, more preferably between 50,000 and 1.5M Dalton. According to a particular
30 embodiment, one will use cationic polymers based on acrylamide, methacrylamide, N-vinylpyrrolidone, quaternized N,N-dimethylaminomethacrylate, diallyldimethylammonium chloride, quaternized vinylimidazole (3-methyl-1-vinyl-1H-imidazol-3-ium chloride), vinylpyrrolidone, acrylamidopropyltrimonium chloride, cassia hydroxypropyltrimonium chloride, guar hydroxypropyltrimonium chloride or polygalactomannan 2-

hydroxypropyltrimethylammonium chloride ether, starch hydroxypropyltrimonium chloride and cellulose hydroxypropyltrimonium chloride. Preferably copolymers shall be selected from the group consisting of polyquaternium-5, polyquaternium-6, polyquaternium-7, polyquaternium-10, polyquaternium-11, polyquaternium-16, polyquaternium-22, polyquaternium-28, polyquaternium-43, polyquaternium-44, polyquaternium-46, cassia hydroxypropyltrimonium chloride, guar hydroxypropyltrimonium chloride or polygalactomannan 2-hydroxypropyltrimethylammonium chloride ether, starch hydroxypropyltrimonium chloride and cellulose hydroxypropyltrimonium chloride. As specific examples of commercially available products, one may cite Salcare® SC60 (cationic copolymer of acrylamidopropyltrimonium chloride and acrylamide, origin: BASF) or Luviquat®, such as the PQ 11N, FC 550 or Style (polyquaternium-11 to 68 or quaternized copolymers of vinylpyrrolidone origin: BASF), or also the Jaguar® (C13S or C17, origin Rhodia).

According to any one of the above embodiments of the invention, there is added an amount of polymer described above comprised between about 0% and 5% w/w, or even between about 0.1% and 2% w/w, percentage being expressed on a w/w basis relative to the total weight of the slurry. It is clearly understood by a person skilled in the art that only part of said added polymers will be incorporated into/deposited on the microcapsule shell.

According to a particular embodiment, the microcapsule of the present invention comprises a mineral layer. The mineral layer preferably comprises a material chosen in the group consisting of iron oxides, iron oxyhydroxide, titanium oxides, zinc oxides, calcium carbonates, calcium phosphates, barium salt, strontium salt, magnesium salt, and mixtures thereof and mixtures thereof.

Solid particles

Another object of the invention is a solid particle comprising:

- a carrier material, preferably a polymeric carrier material chosen in the group consisting of polyvinyl acetate, polyvinyl alcohol, dextrans, natural or modified starch, vegetable gums, pectins, xanthans, alginates, carragenans, cellulose derivatives and mixtures thereof, and
- microcapsules as defined above entrapped in said carrier material, and
- optionally free perfume entrapped in said carrier material.

Solid particle as defined above and microcapsule powder can be used indifferently in the present invention.

PROCESS FOR PREPARING MICROCAPSULES

Another object of the invention is a process for preparing a core-shell microcapsule slurry
5 comprising the steps of:

a) Dispersing an oil phase comprising a hydrophobic material into a dispersing phase to
form a two-phases dispersion;

b) Performing a curing step to form microcapsules in the form of a slurry;

wherein at least one polyfunctional monomer is added in the dispersing phase and/or in the oil
10 phase, and

wherein at least one organosilicon compound is added in the dispersing phase and/or in the oil
phase and/or in the two phases dispersion.

The embodiments disclosed for the core-shell microcapsules also apply for the process for
15 preparing core-shell microcapsules. It applies notably to the polyfunctional monomer, the
hydrophobic material, or the organosilicon compound.

According to an embodiment, the dispersing phase comprises, preferably consists of water.

According to an embodiment, the dispersing phase is a water phase.

According to an embodiment, the two-phases dispersion is an oil-in-water emulsion.

20 According to an embodiment, the dispersing phase comprises water and an alcohol such as
glycerol, 1,4-butanediol, ethylene glycol and mixtures thereof.

According to an embodiment, the dispersing phase consists of alcohol.

According to an embodiment silicate, preferably sodium silicate is added in the dispersing
phase, preferably water phase.

25 According to an embodiment, the polyfunctional monomer is added in the oil phase.

According to an embodiment, the organosilicon compound is added in the dispersing phase.

According to an embodiment, the organosilicon compound is added in the oil phase.

According to an embodiment, a stabilizer is added in the oil phase and/or in the dispersing
phase.

30 By “stabilizer”, it is meant a compound capable to stabilize oil/dispersing phase
interface (typically oil/water interface) as an emulsion.

The stabilizer is preferably used in an amount comprised between 0.05% to 20 %, preferably between 0.1 to 10%, even more preferably between 0.5 and 5% by weight based on the two-phases dispersion, preferably oil-in-water emulsion.

“Stabilizer” or “emulsifier” can be used indifferently in the present invention.

According to an embodiment, the stabilizer is a colloidal stabilizer.

The colloidal stabilizer can be a polymeric emulsifier (standard emulsion), a surfactant, or solid particles (Pickering emulsion).

5 By “polymeric emulsifier”, it meant an emulsifier having both a polar group with an affinity for water (hydrophilic) and a nonpolar group with an affinity for oil (hydrophobic). The hydrophilic part will dissolve in the water phase and the hydrophobic part will dissolve in the oil phase providing a film around droplets.

10 By “surfactant”, it meant a substance with a polar and a non-polar group that is added to the liquid to reduce the liquid surface tension.

According to an embodiment, the stabilizer is chosen in the group consisting of inorganic particles, polymeric emulsifier such as polysaccharides, proteins, glycoproteins, and mixtures thereof.

15 According to an embodiment, the stabilizer is present within the range of 0.01 to 5 wt.%, preferably 0.1 to 3 wt.%, based on the two-phases dispersion.

When the stabilizer is solid particles, it can be chosen in the group consisting of calcium phosphate, silica, silicates, titanium dioxide, aluminium oxide, zinc oxide, iron oxide, mica, kaolin, montmorillonite, laponite, bentonite, perlite, dolomite, diatomite, vermiculite, hectorite, gibbsite, illite, kaolinite, aluminosilicates, , gypsum, bauxite, magnesite, talc, 20 magnesium carbonate, calcium carbonate, diatomaceous earth and mixtures thereof.

According to a particular embodiment, the stabilizer is a biopolymer.

By “biopolymers” it is meant biomacromolecules produced by living organisms. Biopolymers are characterized by molecular weight distributions ranging from 1,000 (1 thousand) to 1,000,000,000 (1 billion) Daltons. These macromolecules may be carbohydrates (sugar based) 25 or proteins (amino-acid based) or a combination of both (gums) and can be linear or branched.

According to an embodiment, the polymeric emulsifier is chosen in the group consisting of gum Arabic, modified starch, polyvinyl alcohol, polyvinylpyrrolidone (PVP), carboxymethylcellulose (CMC), anionic polysaccharides, acrylamide copolymer, protein such as soy protein, rice protein, whey protein, white egg albumin, sodium caseinate, gelatin, bovine 30 serum albumin, hydrolyzed soy protein, hydrolyzed sericin, pseudocollagen, silk protein, sericin powder, potato protein, canola protein, chickpea protein, pea protein, algae protein, faba bean protein, barley protein, oat protein, wheat gluten protein, lupin protein, and mixtures thereof.

Potato proteins are typically extracted from potato tuber (*Solanum tuberosum*). According to an embodiment, the potato protein is a native potato protein and preferably patatin.

According to an embodiment, at least one salt is added in the dispersing phase and/or
5 in the oil phase and/or in the two-phases dispersion.

The salt is preferably used in an amount comprised between 0.01% and 10% by weight based on the two-phases dispersion.

The salt added in the aqueous phase can be chosen in the group consisting of calcium, zinc, sodium, potassium, lithium, magnesium, aluminum, iron, manganese, copper, titanium,
10 barium, sulphates, phosphates, nitrates, bromides, chlorides, iodides, acetates, and ammonium salts.

According to an embodiment, the salt is chosen in the group consisting of CaCl_2 , NaCl , KCl , ZnCl_2 , ZnSO_4 , $\text{Zn}(\text{NO}_3)_2$, LiCl , $\text{Ca}(\text{NO}_3)_2$, MgCl_2 , CaBr_2 , CaI_2 , NaBr , NaI , NaNO_3 , KBr , KI , KNO_3 , LiBr , LiI , MgBr_2 , CuCl_2 , FeCl_2 , FeCl_3 , TiCl_4 , MnCl_2 , and mixtures thereof.

15 The pH of the dispersing phase is preferably comprised between 3 and 12, preferably between 7 and 11.

The polyfunctional monomer, as defined previously, is preferably used in an amount comprised between 0.01% and 30%, preferably between 0.1% and 15%, preferably between 0.5 and 5% based on the total weight of the two phases dispersion, preferably oil-in-water
20 emulsion.

The organosilicon compound, as defined previously, is preferably used in an amount comprised between 0.05% and 30%, preferably between 0.1% and 20%, more preferably between 0.5 and 10% based on the total weight of the two phases dispersion, preferably oil-in-water emulsion.

25

Reactant

According to a particular embodiment, a reactant is added during the process, preferably in the dispersing phase. Examples of suitable reactant include alcohols, amines (or amino-compound), phenols, thiols.

30 The amino-compound can be chosen in the group consisting of a xylylene diamine, 1,2-diaminocyclohexane, 1,4-diaminocyclohexane, polyetheramines (Jeffamine®), ethylene diamine, diethylene triamine, spermine, spermidine, polyamidoamine (PAMAM), guanidine carbonate, chitosan, tris-(2-aminoethyl)amine, 3-aminopropyltriethoxysilane, L-arginine, 1,4-diaminobutane, 2,2 Dimethyl-1,3-propanediamine, 1,3-diaminopentane (Dytek EP diamine),

1,2-diaminopropane, an amine having a disulfide bond such as cystamine, cystamine hydrochloride, cystine, cystine hydrochloride, cystine dialkyl ester, cystine dialkyl ester hydrochloride; 1,3-diaminopropane; urea; ethylene urea; aminoguanidine bicarbonate; 1-(2-aminoethyl)imidazolidin-2-one; N-(3-aminopropyl)-N-dodecylpropane-1,3-diamine; N1-(2-aminoethyl)-N1-dodecyl-1,2-ethanediamine; aminoethylethanolamine; N1-(3-aminopropyl)propane-1,3-diamine, , amino-acid preferably chosen in the group consisting of L-Lysine, L-Arginine, L-leucine, L-Histidine, L-Tryptophane, L-Serin, L-Glutamine, L-Threonine and/or its derived oligomers and polymers, and mixtures thereof.

According to a particular embodiment, L-lysine is added in the dispersing phase.

According to an embodiment, the weight percent of amino-compound in the dispersing phase is comprised between 0 and 15, preferably between 0.1 and 10.

This is followed by a curing step b) which allows ending up with microcapsules in the form of a slurry. According to a preferred embodiment, to enhance the kinetics, said step is performed at a temperature comprised between 5 and 90°C, possibly under pressure, for 1 to 24 hours. More preferably it is performed at between 10 and 80°C for between 30 minutes and 5 hours.

MULTIPLE MICROCAPSULES SYSTEM

According to an embodiment, the microcapsules of the invention (first type of microcapsule) can be used in combination with a second type of microcapsules.

Another object of the invention is a microcapsule delivery system comprising:

- the microcapsules of the present invention as a first type of microcapsule, and
- a second type of microcapsules, wherein the first type of microcapsule and the second type of microcapsules differ in their hydrophobic material and/or their wall material and/or in their coating material.

According to a particular embodiment, the microcapsule delivery system is in the form of a slurry.

The wall of the second type of microcapsules can vary. As non-limiting examples, the polymer shell of the second type of microcapsules comprises a material selected from the group consisting of polyurea, polyurethane, polyamide, polyhydroxyalkanoates, polyacrylate, polyesters, polyaminoesters, polyepoxides, organosilicon, polycarbonate, polysulfonamide, urea formaldehyde, melamine formaldehyde resin, melamine formaldehyde resin cross-linked

with polyisocyanate or aromatic polyols, melamine urea resin, melamine glyoxal resin, gelatin/gum arabic shell wall, and mixtures thereof.

The second type of microcapsule can comprise an oil-based core comprising a hydrophobic active, preferably perfume, and a composite shell comprising a first material and a second material, wherein the first material and the second material are different, the first material is a coacervate, the second material is a polymeric material. In a particular embodiment, the weight ratio between the first material and the second material is comprised between 50:50 and 99.9:0.1. In a particular embodiment, the coacervate comprises a first polyelectrolyte, preferably selected among proteins (such as gelatin), polypeptides or polysaccharides (such as chitosan), most preferably Gelatin and a second polyelectrolyte, preferably alginate salts, cellulose derivatives guar gum, pectinate salts, carrageenan, polyacrylic and methacrylic acid or xanthan gum, or yet plant gums such as acacia gum (Gum Arabic), most preferably Gum Arabic. The coacervate first material can be hardened chemically using a suitable cross-linker such as glutaraldehyde, glyoxal, formaldehyde, tannic acid or genipin or can be hardened enzymatically using an enzyme such as transglutaminase. The second polymeric material can be selected from the group consisting of polyurea, polyurethane, polyamide, polyester, polyacrylate, organosilicon, polycarbonate, polysulfonamide, polymers of urea and formaldehyde, melamine and formaldehyde, melamine and urea, or melamine and glyoxal and mixtures thereof, preferably polyurea and/or polyurethane. The second material is preferably present in an amount less than 3 wt.%, preferably less than 1 wt.% based on the total weight of the second type of microcapsule slurry.

As non-limiting examples, the shell of the second type of microcapsules can be aminoplast-based, polyurea-based or polyurethane-based. The shell of the second type of microcapsules can also be hybrid, namely organic-inorganic such as a hybrid shell composed of at least two types of inorganic particles that are cross-linked, or yet a shell resulting from the hydrolysis and condensation reaction of a polyalkoxysilane macro-monomeric composition.

According to an aspect, the shell of the second type of microcapsules comprises an aminoplast copolymer, such as melamine-formaldehyde or urea-formaldehyde or cross-linked melamine formaldehyde or melamine glyoxal.

According to another aspect the shell of the second type of microcapsules is polyurea-based made from, for example but not limited to isocyanate-based monomers and amine-containing crosslinkers such as guanidine carbonate and/or guanazole. Certain polyurea microcapsules comprise a polyurea wall which is the reaction product of the polymerisation

between at least one polyisocyanate comprising at least two isocyanate functional groups and at least one reactant selected from the group consisting of an amine (for example a water-soluble guanidine salt and guanidine); a colloidal stabilizer or emulsifier; and an encapsulated perfume. However, the use of an amine can be omitted. According to a particular aspect, the
5 colloidal stabilizer includes an aqueous solution of between 0.1% and 0.4% of polyvinyl alcohol, between 0.6% and 1% of a cationic copolymer of vinylpyrrolidone and of a quaternized vinylimidazol (all percentages being defined by weight relative to the total weight of the colloidal stabilizer). According to another aspect, the emulsifier is an anionic or amphiphilic biopolymer, which may be, in one aspect, chosen from the group consisting of
10 gum Arabic, soy protein, gelatin, sodium caseinate and mixtures thereof.

According to another embodiment, the microcapsule wall material of the second type of microcapsules may comprise any suitable resin and especially including melamine, glyoxal, polyurea, polyurethane, polyamide, polyester, etc. Suitable resins include the reaction product of an aldehyde and an amine, suitable aldehydes include, formaldehyde and glyoxal. Suitable
15 amines include melamine, urea, benzoguanamine, glycoluril, and mixtures thereof. Suitable melamines include, methylol melamine, methylated methylol melamine, imino melamine and mixtures thereof. Suitable ureas include, dimethylol urea, methylated dimethylol urea, urea-resorcinol, and mixtures thereof. Suitable materials for making may be obtained from one or more of the following companies Solutia Inc. (St Louis, Missouri U.S.A.), Cytec Industries
20 (West Paterson, New Jersey U.S.A.), Sigma-Aldrich (St. Louis, Missouri U.S.A.).

According to another embodiment, the second type of microcapsules is a one-shell aminoplast core-shell microcapsule obtainable by a process comprising the steps of:

- 1) admixing a perfume oil with at least a polyisocyanate having at least two isocyanate functional groups to form an oil phase;
- 25 2) dispersing or dissolving into water an aminoplast resin and optionally a stabilizer to form a dispersing phase;
- 3) preparing an oil-in-water dispersion, wherein the mean droplet size is comprised between 1 and 100 microns, by admixing the oil phase and the dispersing phase;
- 4) performing a curing step to form the wall of said microcapsule; and
- 30 5) optionally drying the final dispersion to obtain the dried core-shell microcapsule.

According to an embodiment, the second type of microcapsules is a formaldehyde-free capsule. A typical process for the preparation of aminoplast formaldehyde-free microcapsules slurry comprises the steps of

- 1) preparing an oligomeric composition comprising the reaction product of, or obtainable by reacting together:
 - a. a polyamine component in the form of melamine or of a mixture of melamine and at least one C₁-C₄ compound comprising two NH₂ functional groups;
 - b. an aldehyde component in the form of a mixture of glyoxal, a C₄₋₆ 2,2-dialkoxy-ethanal and optionally a glyoxalate, said mixture having a molar ratio glyoxal/C₄₋₆ 2,2-dialkoxy-ethanal comprised between 1/1 and 10/1; and
 - c. a protic acid catalyst;
 - 2) preparing an oil-in-water dispersion, wherein the droplet size is comprised between 1 and 600 microns, and comprising:
 - a. an oil;
 - b. a water medium;
 - c. at least an oligomeric composition as obtained in step 1;
 - d. at least a cross-linker selected amongst:
 - i. C₄-C₁₂ aromatic or aliphatic di- or tri-isocyanates and their biurets, triurets, trimers, trimethylol propane-adduct and mixtures thereof; and/or
 - ii. a di- or tri-oxiran compounds of formula:
$$A-(\text{oxiran-2-ylmethyl})_n$$
wherein n stands for 2 or 3 and 1 represents a C₂-C₆ group optionally comprising from 2 to 6 nitrogen and/or oxygen atoms;
 - e. optionally a C₁-C₄ compounds comprising two NH₂ functional groups;
 - 3) Heating the dispersion; and
 - 4) Cooling the dispersion.
- In another particular embodiment, the second type of microcapsule comprises
- an oil-based core comprising a hydrophobic active, preferably perfume,
 - optionally an inner shell made of a polymerized polyfunctional monomer;
 - a biopolymer shell comprising a protein, wherein at least one protein is cross-linked.
- According to a particular embodiment, the protein is chosen in the group consisting of milk proteins, caseinate salts such as sodium caseinate or calcium caseinate, casein, whey protein, hydrolyzed proteins, gelatins, gluten, pea protein, soy protein, silk protein and mixtures thereof, preferably sodium caseinate, most preferably sodium caseinate

According to a particular embodiment, the protein comprises sodium caseinate and a globular protein, preferably chosen in the group consisting of whey protein, beta-lactoglobulin, ovalbumine, bovine serum albumin, vegetable proteins, and mixtures thereof.

The protein is preferably a mixture of sodium caseinate and whey protein.

5 According to a particular embodiment, the biopolymer shell comprises a crosslinked protein chosen in the group consisting of sodium caseinate and/or whey protein.

According to a particular embodiment, the second type of microcapsules slurry comprises at least one microcapsule made of:

- an oil-based core comprising the hydrophobic active, preferably perfume;
- 10 – an inner shell made of a polymerized polyfunctional monomer; preferably a polyisocyanate having at least two isocyanate functional groups
- a biopolymer shell comprising a protein, wherein at least one protein is cross-linked; wherein the protein contains preferably a mixture comprising sodium caseinate and a globular protein, preferably whey protein,
- 15 – optionally at least an outer mineral layer.

According to an embodiment, sodium caseinate and/or whey protein is (are) cross-linked protein(s).

The weight ratio between sodium caseinate and whey protein is preferably comprised between 0.01 and 100, preferably between 0.1 and 10, more preferably between 0.2 and 5.

20

In another particular embodiment, the second type of microcapsules is a polyamide core-shell polyamide microcapsule comprising:

- an oil-based core comprising comprising a hydrophobic active, preferably perfume, and
- 25 – a polyamide shell comprising or being obtainable from:
 - an acyl chloride,
 - a first amino compound,
 - a second amino compound,
 - optionally, a carbohydrate.

30

According to a particular embodiment, the second type of microcapsules comprises:

- an oil-based core comprising a hydrophobic active, preferably perfume, and
- a polyamide shell comprising or being obtainable from:

- an acyl chloride, preferably in an amount comprised between 5 and 98%, preferably between 20 and 98%, more preferably between 30 and 85% w/w
- 5 • a first amino compound, preferably in an amount comprised between 1% and 50% w/w, preferably between 7 and 40% w/w;
- a second amino compound, preferably in an amount comprised between 1% and 50% w/w, preferably between 2 and 25% w/w
- a stabilizer, preferably a biopolymer, preferably in an amount comprised between 0 and 90%, preferably between 0.1 and 75%, more preferably
10 between 1 and 70%,
- optionally, a carbohydrate.

According to a particular embodiment, the second type of microcapsules comprises:

- an oil-based core comprising a hydrophobic active, preferably perfume, and
- a polyamide shell comprising or being obtainable from:
15 • an acyl chloride,
- a first amino-compound being an amino-acid, preferably chosen in the group consisting of L-Lysine, L-Arginine, L-Histidine, L-Tryptophane and/or mixtures thereof.
- a second amino-compound, preferably chosen in the group consisting of
20 ethylene diamine, diethylene triamine, cystamine and/or mixtures thereof, and
- a biopolymer, preferably chosen in the group consisting of potato protein, canola protein, chickpea protein, pea protein, algae protein, faba bean protein, barley protein, oat protein, wheat gluten protein, lupin protein, soy
25 protein, rice protein, whey protein, white egg albumin, casein, sodium caseinate, gelatin (preferably fish gelatin), bovine serum albumin, hydrolyzed soy protein, hydrolyzed sericin, pseudocollagen, silk protein, sericin powder, gelatin and mixtures thereof,
- optionally a carbohydrate, preferably selected from the group consisting of
30 anionic salt of alginic acid, preferably alginic acid sodium salt, pectin, lignin, anionic modified starch, carboxymethylcellulose, carrageenan and mixtures thereof.

According to another aspect, the shell of the second type of microcapsules is polyurea- or polyurethane-based. Examples of processes for the preparation of polyurea and polyurethane-based microcapsule slurry are for instance described in International Patent Application Publication No. WO2007/004166, European Patent Application Publication
5 No. EP 2300146, and European Patent Application Publication No. EP25799. Typically a process for the preparation of polyurea or polyurethane-based microcapsule slurry include the following steps:

- a) Dissolving at least one polyisocyanate having at least two isocyanate groups in an oil to form an oil phase;
- 10 b) Preparing an aqueous solution of an emulsifier or colloidal stabilizer to form a dispersing phase;
- c) Adding the oil phase to the dispersing phase to form an oil-in-water dispersion, wherein the mean droplet size is comprised between 1 and 500 μm , preferably between 5 and 50 μm ; and
- 15 d) Applying conditions sufficient to induce interfacial polymerisation and form microcapsules in form of a slurry.

PERFUMING COMPOSITION AND CONSUMER PRODUCTS

- 20 The present invention also relates to a perfuming composition comprising
- a core-shell microcapsule or core-shell microcapsule slurry obtained by the process according to the present invention or as described herein-above,
 - at least one ingredient selected from the group consisting of a perfumery carrier and a perfumery base, and
 - 25 - optionally, at least one perfumery adjuvant.

In a particular embodiment, the composition comprises:

- a core-shell microcapsule or core-shell microcapsule slurry obtained by the process according to the present invention or as described herein-above;
- 30 - an active ingredient, preferably chosen in the group consisting of a cosmetic ingredient, skin caring ingredient, perfume ingredient, flavor ingredient, malodour counteracting ingredient, bactericide ingredient, fungicide ingredient, pharmaceutical or

agrochemical ingredient, a sanitizing ingredient, an insect repellent or attractant, and mixtures thereof.

In a particular embodiment, a core-shell microcapsule or core-shell microcapsule slurry obtained by the process according to the present invention or as described herein-above can also be added in different perfumed consumer products

In a particular embodiment, present invention relates to a perfuming composition comprising

- a core-shell microcapsule or core-shell microcapsule slurry obtained by the process according to the present invention or as described herein-above and
- optionally, a free perfume oil.

Preferably, the perfuming composition according to the invention comprises between 0.1 and 40 %, preferably between 0.1 and 30% by weight of a core-shell microcapsule or core-shell microcapsule slurry obtained by the process according to the present invention or as described herein-above.

By “free perfume” it is herein understood a perfume or perfume oil which is comprised in the perfuming composition and not entrapped in the core-shell microcapsule or core-shell microcapsule slurry obtained by the process according to the present invention or as described herein-above.

In a particular embodiment, the total amount of the core-shell microcapsule or core-shell microcapsule slurry obtained by the process according to the present invention or as described herein-above is 0.05 to 5 wt.% (based on the total weight of the perfuming composition) and the total amount of the free perfume oil is 0.05 to 5 wt.% (based on the total weight of the perfuming composition).

In a particular embodiment, the total perfume oil of the perfume formulation entrapped in the core-shell microcapsule or core-shell microcapsule slurry obtained by the process according to the present invention or as described herein-above and total free perfume oil are present in the perfuming composition in a weight ratio of 1:20 to 20:1, preferably 10:1 to 1:10.

The perfuming composition can further comprise at least one perfuming co-ingredient and, optionally a perfumery adjuvant,

By “perfuming co-ingredient” it is herein understood a compound, which is used in a perfuming preparation or a composition to impart a hedonic effect and which is not a microcapsule as 20 defined above. In other words such a co-ingredient, to be considered as being a perfuming one, must be recognized by a person skilled in the art as being able to impart

or modify in a positive or pleasant way the odor of a composition, and not just as having an odor. The nature and type of the perfuming co-ingredients present in the perfuming composition do not warrant a more detailed description here, which in any case would not be exhaustive, the skilled person being able to select them on the basis of his general knowledge and according to the intended use or application and the desired organoleptic effect. In general terms, these perfuming co-ingredients belong to chemical classes as varied as alcohols, lactones, aldehydes, ketones, esters, ethers, acetates, nitriles, terpenoids, nitrogenous or sulfur heterocyclic compounds and essential oils, and said perfuming co-ingredients can be of natural or synthetic origin. Many of these co-30 ingredients are in any case listed in reference texts such as the book by S. Arctander, *Perfume and Flavor Chemicals*, 1969, Montclair, New Jersey, USA, or its more recent versions, or in other works of a similar nature, as well as in the abundant patent literature in the field of perfumery. It is also understood that said co-ingredients may also be compounds known to release in a controlled manner various types of perfuming compounds. Co-ingredients may be chosen in the group consisting of 4-(dodecylthio)-4-(2,6,6-trimethyl-2-cyclohexen-1-yl)-2-butanone, 4-(dodecylthio)-4-(2,6,6-trimethyl-1-cyclohexen-1-yl)-2-butanone, trans-3-(dodecylthio)-1-(2,6,6-trimethyl-3-cyclohexen-1-yl)-1-butanone, 2-(dodecylthio)octan-4-one, 2-phenylethyl oxo(phenyl)acetate, 3,7-dimethylocta-2,6-dien-1-yl oxo(phenyl)acetate, (Z)-hex-3-en-1-yl oxo(phenyl)acetate, 3,7-dimethyl-2,6-octadien-1-yl hexadecanoate, bis(3,7-dimethylocta-2,6-dien-1-yl) succinate, (2-((2-methylundec-1-en-1-yl)oxy)ethyl)benzene, 1-methoxy-4-(3-methyl-4-phenethoxybut-3-en-1-yl)benzene, (3-methyl-4-phenethoxybut-3-en-1-yl)benzene, 1-(((Z)-hex-3-en-1-yl)oxy)-2-methylundec-1-ene, (2-((2-methylundec-1-en-1-yl)oxy)ethoxy)benzene, 2-methyl-1-(octan-3-yloxy)undec-1-ene, 1-methoxy-4-(1-phenethoxyprop-1-en-2-yl)benzene, 1-methyl-4-(1-phenethoxyprop-1-en-2-yl)benzene, 2-(1-phenethoxyprop-1-en-2-yl)naphthalene, (2-phenethoxyvinyl)benzene, 2-(1-((3,7-dimethyloct-6-en-1-yl)oxy)prop-1-en-2-yl)naphthalene, (2-((2-pentylcyclopentylidene)methoxy)ethyl)benzene, 4-allyl-2-methoxy-1-((2-methoxy-2-phenylvinyl)oxy)benzene, (2-((2-heptylcyclopentylidene)methoxy)ethyl)benzene, 1-isopropyl-4-methyl-2-((2-pentylcyclopentylidene)methoxy)benzene, 2-methoxy-1-((2-pentylcyclopentylidene)methoxy)-4-propylbenzene, 3-methoxy-4-((2-methoxy-2-phenylvinyl)oxy)benzaldehyde, 4-((2-(hexyloxy)-2-phenylvinyl)oxy)-3-methoxybenzaldehyde or a mixture thereof or a mixture thereof.

By “perfumery adjuvant” it is herein understood an ingredient capable of imparting additional 5 added benefit such as a color, a particular light resistance, chemical stability, etc. A detailed description of the nature and type of adjuvant commonly used in perfuming bases

cannot be exhaustive, but it has to be mentioned that said ingredients are well known to a person skilled in the art.

The core-shell microcapsule or core-shell microcapsule slurry obtained by the process according to the present invention or as described herein-above can advantageously be used in many application fields and used in consumer products.

The present invention also relates to a perfumed consumer product comprising

- a core-shell microcapsule or core-shell microcapsule slurry obtained by the process according to the present invention or as described herein-above, and
- a personal care, home care, or fabric care active base.

The consumer products of the invention, can in particular be of used in perfumed consumer products such as product belonging to fine fragrance or “functional” perfumery. Functional perfumery includes in particular personal-care products including hair-care, body cleansing, skin care, hygiene-care as well as home-care products including laundry care and air care.

In particular a liquid consumer product comprising:

- from 2 to 65% by weight, relative to the total weight of the consumer product, of at least one surfactant;
- water or a water-miscible hydrophilic organic solvent; and
- a perfuming composition or the core-shell microcapsule or core-shell microcapsule slurry obtained by the process according to the present invention or as described herein-above.

Also a powder consumer product comprising

- from 2 to 65% by weight, relative to the total weight of the consumer product, of at least one surfactant; and
- a perfuming composition or the core-shell microcapsule or core-shell microcapsule slurry obtained by the process according to the present invention or as described herein-above.

For the sake of clarity, it has to be mentioned that, by “perfumed consumer product” it is meant a consumer product which is expected to deliver among different benefits a perfuming effect to the surface to which it is applied (e.g. skin, hair, textile, paper, or home surface) or in the air (air-freshener, deodorizer etc). In other words, a perfumed consumer product according to the invention is a manufactured product which comprises a functional formulation also referred to as “base”, together with benefit agents, among which an effective amount of microcapsules according to the invention.

The nature and type of the other constituents of the perfumed consumer product do not warrant a more detailed description here, which in any case would not be exhaustive, the skilled

person being able to select them on the basis of his general knowledge and according to the nature and the desired effect of said product. Base formulations of consumer products in which the microcapsules of the invention can be incorporated can be found in the abundant literature relative to such products. These formulations do not warrant a detailed description here which
5 would in any case not be exhaustive. The person skilled in the art of formulating such consumer products is perfectly able to select the suitable components on the basis of his general knowledge and of the available literature.

Non-limiting examples of suitable perfumed consumer products can be a fine perfume, a splash or eau de perfume, a cologne, a shave or after-shave lotion, a liquid or solid detergent,
10 a mono or multi chamber unidose detergent, a fabric softener, a fabric refresher, liquid or solid scent-boosters (PEG / urea or salts), a dryer sheet, an ironing water, a paper, a bleach, a carpet cleaners, curtain-care products, a shampoo, a coloring preparation, a color care product, a hair shaping product, a dental care product, a disinfectant, an intimate care product, a hair spray, a hair conditioning product, a vanishing cream, a deodorant or antiperspirant, hair remover,
15 tanning or sun product, nail products, skin cleansing, a makeup, a perfumed soap, shower or bath mousse, oil or gel, or a foot/hand care products, a hygiene product, an air freshener, a “ready to use” powdered air freshener, a mold remover, furnisher care, wipe, a dish detergent or hard-surface detergent, a leather care product, a car care product.

In a particular embodiment, the perfumed consumer product is preferably selected from
20 the group consisting of personal care composition, home care composition or fabric care composition, most preferably in form of antiperspirants, hair care products, such as shampoo or hair-conditioner, body care products such as a shower gel, oral care products, laundry care products, preferably a detergent or a fabric softener.

Another object of the invention is a consumer product comprising:

- 25— a personal care active base, and
- microcapsules or a microcapsule slurry as defined above or the perfuming composition as defined above,
- wherein the consumer product is in the form of a personal care composition.

Personal care active bases in which the microcapsules of the invention can be
30 incorporated can be found in the abundant literature relative to such products. These formulations do not warrant a detailed description here which would in any case not be exhaustive. The person skilled in the art of formulating such consumer products is perfectly

able to select the suitable components on the basis of his general knowledge and of the available literature.

The personal care composition is preferably chosen in the group consisting of a hair-care product (e.g. a shampoo, hair conditioner, a coloring preparation or a hair spray), a cosmetic
5 preparation (e.g. a vanishing cream, body lotion or a deodorant or antiperspirant), or a skin-care product (e.g. a perfumed soap, shower or bath mousse, body wash, oil or gel, bath salts, or a hygiene product);

Another object of the invention is a consumer product comprising:

- a home care or a fabric care active base, and
- 10– microcapsules or a microcapsule slurry as defined above or the perfuming composition as defined above,

wherein the consumer product is in the form of a home care or a fabric care composition.

Home care or fabric care active bases in which the microcapsules of the invention can be incorporated can be found in the abundant literature relative to such products. These
15 formulations do not warrant a detailed description here which would in any case not be exhaustive. The person skilled in the art of formulating such consumer products is perfectly able to select the suitable components on the basis of his general knowledge and of the available literature.

Preferably, the consumer product comprises from 0.1 to 15 wt%, more preferably
20 between 0.2 and 5 wt% of the microcapsules of the present invention, these percentages being defined by weight relative to the total weight of the consumer product. Of course, the above concentrations may be adapted according to the benefit effect desired in each product.

For liquid consumer product mentioned below, by “active base”, it should be understood that the active base includes active materials (typically including surfactants).

25 For solid consumer product mention below, by “active base”, it should be understood that the active base includes active materials (typically including surfactants) and auxiliary agents (such as bleaching agents, buffering agent; builders; soil release or soil suspension polymers; granulated enzyme particles, corrosion inhibitors, antifoaming, sud suppressing agents; dyes, fillers, and mixtures thereof).

30 The home or fabric care composition is preferably chosen in the group consisting of fabric softener, liquid detergent, powder detergent, liquid scent booster and solid scent booster.

Fabric softener

An object of the invention is a consumer product in the form of a fabric softener composition comprising:

- 5 – a fabric softener active base; preferably comprising at least one active material chosen in the group consisting of dialkyl quaternary ammonium salts, dialkyl ester quaternary ammonium salts (esterquats), Hamburg esterquat (HEQ), TEAQ (triethanolamine quat), silicones and mixtures thereof, the active base being used preferably in an amount comprised between 85 and 99.95% by weight based on the total weight of the composition,
- 10 – microcapsules or a microcapsule slurry as defined above, preferably in an amount comprised between 0.05 to 15 wt%, more preferably between 0.1 and 5 wt% by weight based on the total weight of the composition,
- optionally free perfume oil.

15 Liquid detergent

An object of the invention is a consumer product in the form of a liquid detergent composition comprising:

- a liquid detergent active base; preferably comprising at least one active material chosen in the group consisting of anionic surfactant such as alkylbenzenesulfonate (ABS),
20 secondary alkyl sulfonate (SAS), primary alcohol sulfate (PAS), lauryl ether sulfate (LES), methyl ester sulfonate (MES) and nonionic surfactant such as alkyl amines, alkanolamide, fatty alcohol poly(ethylene glycol) ether, fatty alcohol ethoxylate (FAE), ethylene oxide (EO) and propylene oxide (PO) copolymers, amine oxydes, alkyl polyglucosides, alkyl polyglucosamides, the active base being used preferably in an
25 amount comprised between 85 and 99.95% by weight based on the total weight of the composition,
- microcapsules or a microcapsule slurry as defined above, preferably in an amount comprised between 0.05 to 15 wt%, more preferably between 0.1 and 5 wt% by weight based on the total weight of the composition,
- 30 – optionally free perfume oil.

Solid detergent

An object of the invention is a consumer product in the form of a solid detergent composition comprising:

- a solid detergent active base; preferably comprising at least one active material chosen in the group consisting of anionic surfactant such as alkylbenzenesulfonate (ABS), secondary alkyl sulfonate (SAS), primary alcohol sulfate (PAS), lauryl ether sulfate (LES), methyl ester sulfonate (MES) and nonionic surfactant such as alkyl amines, alkanolamide, fatty alcohol poly(ethylene glycol) ether, fatty alcohol ethoxylate (FAE), ethylene oxide (EO) and propylene oxide (PO) copolymers, amine oxydes, alkyl polyglucosides, alkyl polyglucosamides, the active base being used preferably in an amount comprised between 85 and 99.95% by weight based on the total weight of the composition,
- a microcapsule powder or microcapsule slurry as defined above, preferably in an amount comprised between 0.05 to 15 wt%, more preferably between 0.1 and 5 wt% by weight based on the total weight of the composition,
- optionally free perfume oil.

Shampoo/shower gel

An object of the invention is a consumer product in the form of a shampoo or a shower gel composition comprising:

- a shampoo or a shower gel active base; preferably comprising at least one active material chosen in the group consisting of sodium alkylether sulfate, ammonium alkylether sulfates, alkylamphoacetate, cocamidopropyl betaine, cocamide MEA, alkylglucosides and aminoacid based surfactants and mixtures thereof, the active base being used preferably in an amount comprised between 85 and 99.95% by weight based on the total weight of the composition,
- microcapsules or a microcapsule slurry as defined above, preferably in an amount comprised between 0.05 to 15 wt%, more preferably between 0.1 and 5 wt% by weight based on the total weight of the composition,
- optionally free perfume oil.

Rinse-Off Conditioner

An object of the invention is a consumer product in the form of a rinse-off conditioner composition comprising:

- 5 – a rinse-off conditioner active base; preferably comprising at least one active material chosen in the group consisting of cetyltrimonium chloride, stearyl trimonium chloride, benzalkonium chloride, behentrimonium chloride and mixture thereof, the active base being used preferably in an amount comprised between 85 and 99.95% by weight based on the total weight of the composition,
- 10 – microcapsules or a microcapsule slurry as defined above, preferably in an amount comprised between 0.05 to 15 wt%, more preferably between 0.1 and 5 wt% by weight based on the total weight of the composition,
- optionally free perfume oil.

Solid scent booster

- 15 An object of the invention is a consumer product in the form of a solid scent booster composition comprising:

- 20 – a solid carrier, preferably chosen in the group consisting of urea, sodium chloride, sodium sulphate, sodium acetate, zeolite, sodium carbonate, sodium bicarbonate, clay, talc, calcium carbonate, magnesium sulfate, gypsum, calcium sulfate, magnesium oxide, zinc oxide, titanium dioxide, calcium chloride, potassium chloride, magnesium chloride, zinc chloride, saccharides such as sucrose, mono-, di-, and polysaccharides and derivatives such as starch, cellulose, methyl cellulose, ethyl cellulose, propyl cellulose, polyols/sugar alcohols such as sorbitol, maltitol, xylitol, erythritol, and isomalt, PEG, PVP, citric acid or any water soluble solid acid, fatty alcohols or fatty acids and mixtures thereof,
- 25 – microcapsules or a microcapsule slurry as defined above, in a powdered form, preferably in an amount comprised between 0.05 to 15 wt%, more preferably between 0.1 and 5 wt% by weight based on the total weight of the composition,
- 30 – optionally free perfume oil.

Liquid scent booster

An object of the invention is a consumer product in the form of a liquid scent booster composition comprising:

- an aqueous phase,
- a surfactant system essentially consisting of one or more than one non-ionic surfactant, wherein the surfactant system has a mean HLB between 10 and 14, preferably chosen in the group consisting of ethoxylated aliphatic alcohols, POE/PPG (polyoxyethylene and polyoxypropylene) ethers, mono and polyglyceryl esters, sucrose ester compounds, polyoxyethylene hydroxylesters, alkyl polyglucosides, amine oxides and combinations thereof;
- a linker chosen in the group consisting of alcohols, salts and esters of carboxylic acids, salts and esters of hydroxyl carboxylic acids, fatty acids, fatty acid salts, glycerol fatty acids, surfactant having an HLB less than 10 and mixtures thereof, and
- microcapsules or a microcapsule slurry as defined above, in the form of a slurry, preferably in an amount comprised between 0.05 to 15 wt%, more preferably between 0.1 and 5 wt% by weight based on the total weight of the composition,
- optionally free perfume oil.

Hair coloration

An object of the invention is a consumer product in the form of an oxidative hair coloring composition comprising:

- an oxidizing phase comprising an oxidizing agent and an alkaline phase comprising an alkali agent, a dye precursor and a coupling compound; wherein said dye precursor and said coupling compound form an oxidative hair dye in the presence of the oxidizing agent, preferably in an amount comprised between 85 and 99.95% by weight based on the total weight of the composition,
- microcapsules or a microcapsule slurry as defined above, preferably in an amount comprised between 0.05 to 15 wt%, more preferably between 0.1 and 5 wt% by weight based on the total weight of the composition,
- optionally free perfume oil.

Perfuming composition

According to a particular embodiment, the consumer product is in the form of a perfuming composition comprising:

- 0.1 to 30%, preferably 0.1 to 20% of microcapsules or a microcapsule slurry as defined previously,
 - 0 to 40%, preferably 3-40% of perfume, and
 - 20-90%, preferably 40-90% of ethanol, by weight based on the total weight of the perfuming composition.
- 5

The invention will now be further described by way of examples. It will be appreciated that the invention as claimed is not intended to be limited in any way by these examples

10

Example 1aSynthesis of POSS-NH₂ triflate

Preparation of OA-POSS-CF₃SO₃ (octa(3-aminopropyl) polyhedral oligomeric silsesquioxane trifluoromethanesulfonate)

- 1) 0.5 M trifluoromethanesulfonic acid (triflic acid) solution, CF₃SO₃H was prepared using 98% concentrated triflic acid.
- 2) 100 ml of 0.5 M (0.05 mol) triflic acid solution was added to 7.379 g (3-aminopropyl)triethoxysilane (APTES) (0.033 mol) while stirring at room temperature.
- 3) The resulting solution was further stirred for 3 h and then heated to 50 °C in an open beaker until the solvent had evaporated (3h).
- 4) Optionally, the solution is stirred overnight at room temperature.
- 5) The solution was heated at 100 °C for approximately 1 to 2 h, until thick white precipitate slurry was achieved.
- 6) The product is cooled to RT, 30 ml of acetone is added to the final slurry, and the product is isolated by filtration and centrifuge, and further washed and rinsed with 30 ml acetone twice, and dried in a vacuum oven (50 °C, 48 h).

Example 1bSynthesis of POSS-NH₂ hydrochloride

Preparation of octa(3-aminopropyl) polyhedral oligomeric silsesquioxane hydrochloride

POSS-NH₂ hydrochloride is prepared by addition of 150 mL of aminopropyltriethoxysilane (APTES) to 1000 mL of pure methanol in a round bottom flask under magnetic stirring, followed by controlled addition of 200 mL of concentrated hydrochloric acid (37%). The mixture is capped and stirred at room temperature for seven days, at which point a white precipitate is formed. The mixture is filtered to separate out the precipitate, which is then rinsed with cold methanol three times before drying the residual precipitate in a vacuum oven at 50°C and 85 torr for 24 hours.

Example 2

Microcapsules preparation

Comparative microcapsules Z

- 5 The dispersing phase contains in 11.8 g of water, 0.16 g gum arabic, and 0.2 g L-lysine. 3.2 g of Perfume oil A (see Table 1) containing 0.16 g TPCl (terephthaloyl chloride) was mixed with the dispersing phase and homogenized at 10,000 rpm for 2 min using Ultraturrax T-25. The formed oil-in-water emulsion was then stirred at 60°C for 3h.

Microcapsules A

- 10 0.45 g POSS-NH₂ as prepared in example 1a was dissolved in 11.7 g of water containing 0.32 g of potato protein and 0.2g L-lysine as the dispersing phase whose pH was adjusted to 10 with 10% NaOH. 3.2 g of Perfume oil A (see Table 1) containing 0.16 g TPCl was mixed with the dispersing phase and homogenized at 10,000 rpm for 2 min using Ultraturrax T-25. The formed
15 oil-in-water emulsion was then stirred at 60°C for 3h.

Microcapsules B

- 0.45 g POSS-NH₂ as prepared in example 1b was dissolved in 11.1 g of water containing 0.32 g of potato protein and 0.2g L-lysine. A salt solution of 0.064g ZnCl₂ in 0.5g of water was
20 added to the above solution to form the dispersing phase whose pH was adjusted to 10 with 10% NaOH. 3.2 g of Perfume oil A (see Table 1) containing 0.14 g TMCl (Trimesoyl Chloride) was mixed with the dispersing phase and homogenized at 10,000 rpm for 2 min using Ultraturrax T-25. The formed oil-in-water emulsion was then stirred at 60°C for 3h.

Microcapsules C

- 25 0.45 g POSS-NH₂ HCl as prepared in example 1b was dissolved in 11.9 g of water containing 0.32 g of potato protein to form the dispersing phase. The pH of the dispersing phase was adjusted to 10 with 10% NaOH. 3.2 g of Perfume oil A (see Table 1) containing 0.16 g TPCl was mixed with the dispersing phase and homogenized at 10,000 rpm for 2 min using
30 Ultraturrax T-25. The formed oil-in-water emulsion was then stirred at 60°C for 3h.

Microcapsules D

2.8 g POSS-NH₂ HCl as prepared in example 1b was dissolved in 74.2 g of water containing 2.0 g of potato protein to form the dispersing phase. The pH of the dispersing phase was

adjusted to 10 with 10% NaOH. 20.0 g of Perfume oil A (see Table 1) containing 1.0 g TPCl was added slowly and consistently over 30 seconds into the dispersing phase while being homogenized at 18,000 rpm using Ultraturrax T-25. The emulsification process was completed after additional 30-second homogenization at 18,000 rpm. The formed oil-in-water emulsion
5 was then stirred at 60°C for 3h.

Microcapsules E

0.45 g POSS-NH₂ as prepared in example 1a was dissolved in 11.3 g of water containing 0.16 g gum arabic and 0.2 g L-lysine to make the POSS-NH₂ solution. A salt solution containing
10 0.064 g ZnCl₂ in 0.5g of water was then mixed with the POSS-NH₂ solution to form the dispersing phase. 3.2 g of Perfume oil A (see Table 1) containing 0.16 g TPCl was mixed with the dispersing phase and homogenized at 10,000 rpm for 2 min using Ultraturrax T-25. The formed oil-in-water emulsion was then stirred at 60°C for 3h.

The morphology and surface elemental analysis of the dried capsule slurry has been observed
15 under SEM (see figure 1).

Microcapsules F

0.45 g aminopropyl silsesquioxane oligomer (Origin: Gelest - 25% aq. solution) was mixed into 11.9 g of water containing 0.32 g of potato protein to form the dispersing phase. 3.2 g of
20 Perfume oil A (see Table 1) containing 0.16 g TPCl was mixed with the dispersing phase and homogenized at 10,000 rpm for 2 min using Ultraturrax T-25. The formed oil-in-water emulsion was then stirred at 60°C for 3h.

Microcapsules G

25 0.45 g POSS-NH₂ as prepared in example 1a was dissolved in 11.9 g of water containing 0.32 g of potato protein as the dispersing phase whose pH was adjusted to 10 with 10% NaOH. 3.2 g of Perfume oil A (see Table 1) containing 0.16 g TPCl was mixed with the dispersing phase and homogenized at 10,000 rpm for 2 min using Ultraturrax T-25. The formed oil-in-water emulsion was then stirred at 60°C for 3h.

30

Microcapsules H

0.45 g POSS-NH₂ HCl as prepared in example 1b was dissolved in 12 g of water containing 0.32 g of potato protein to form the dispersing phase. The pH of the emulsifier solution was adjusted to 10 with 10% NaOH. 3.2 g of Perfume oil A (see Table 1) containing 0.08 g TPCl

was mixed with the dispersing phase and homogenized at 10,000 rpm for 2 min using Ultraturrax T-25. The formed oil-in-water emulsion was then stirred at 60°C for 3h.

Microcapsules I

- 5 0.45 g POSS-NH₂ as prepared in example 1a was dissolved in 11.8 g of water containing 0.16 g gum arabic and 0.2 g lysine as the dispersing phase. 3.2 g of Perfume oil A (see Table 1) containing 0.16 g TPCl (terephthaloyl chloride) was mixed with the dispersing phase and homogenized at 10,000 rpm for 2 min using Ultraturrax T-25. The formed oil-in-water emulsion was then stirred at 60°C for 3h.
- 10 The morphology and surface elemental analysis of the dried capsule slurry has been observed under SEM (see figure 2).

Microcapsules J

- 0.45 g POSS-NH₂ as prepared in example 1a was dissolved in 6 g of water, and the solution
15 was mixed with the solution containing 0.16 g gum arabic in 6 g of water to form the dispersing phase. The pH of the emulsifier solution was adjusted to 10 with 10% NaOH. 3.2 g of Perfume oil A (see Table 1) containing 0.16 g TPCl was mixed with the dispersing phase and homogenized at 10,000 rpm for 2 min using Ultraturrax T-25. The formed oil-in-water emulsion was then stirred at 60°C for 3h.
- 20

Microcapsules K

- 0.45 g POSS-NH₂ as prepared in example 1a was dissolved in 6 g of water, and the solution
was mixed with the solution containing 0.32 g canola protein in 5.9 g of water to form the
dispersing phase. The pH of the emulsifier solution was adjusted to 10 with 10% NaOH. 3.2 g
25 of Perfume oil A (see Table 1) containing 0.16 g TPCl was mixed with the dispersing phase
and homogenized at 10,000 rpm for 2 min using Ultraturrax T-25. The formed oil-in-water
emulsion was then stirred at 60°C for 3h. The morphology of the dried capsule slurry has been
observed under SEM (see figure 3).

Microcapsule L

- 30 0.45 g aminopropyl silsesquioxane oligomer (Origin: Gelest - 25% aq. solution) was dissolved
in 5.56 g of water and the pH was adjusted to 10 with 10% HCl. 0.20 g of L-lysine and 0.32 g
of canola protein were dissolved in 5.57 g of water and the pH was adjusted to 10 with 50%
NaOH. The two solutions were mixed to form the dispersing phase. 0.064 g of ZnCl₂ were

dissolved in 0.50 g water and added to the dispersing phase. The resulting dispersing phase was homogenized at 10,000 rpm for 2 min using Ultraturrax T-25, while 3.2 g of Perfume oil A (see Table 1) containing 0.16 g TPCl were added to the dispersing phase during homogenization. The formed oil-in-water emulsion was then stirred at 60°C for 3h.

5

Microcapsule M

0.45 g POSS-NH₂ as prepared in example 1a was dissolved in 5.56 g of water. 0.20 g of *L*-lysine and 0.32 g of canola protein were dissolved in 5.57 g of water and the pH was adjusted to 10 with 50% NaOH. The two solutions were mixed to form the dispersing phase. 0.064 g of ZnCl₂ were dissolved in 0.50 g water and added to the dispersing phase. The resulting dispersing was homogenized at 10,000 rpm for 2 min using Ultraturrax T-25, while 3.2 g of Perfume oil A (see Table 1) containing 0.16 g TPCl were added to the dispersing phase during homogenization. The formed oil-in-water emulsion was then stirred at 60°C for 3h.

10

Microcapsules N

0.125 g sodium silicate were dissolved in 5.745 g of water. 0.45 g POSS-NH₂ as prepared in example 1a was added and the pH of the solution was adjusted to 10 with 10% NaOH. 0.32 g canola protein was dissolved in 6 g of water and mixed with the first solution to form the dispersing phase. The pH of the emulsifier solution was adjusted to 10 with 10% NaOH. 3.2 g of Perfume oil A (see Table 1) containing 0.16 g TPCl was mixed with the dispersing phase and homogenized at 10,000 rpm for 2 min using Ultraturrax T-25. The formed oil-in-water emulsion was then stirred at 60°C for 3h.

20

Table 1: Perfume oil A formulation

Ingredient	% in oil
Ethyl 2-methyl-pentanoate	3.20%
Eucalyptol	7.80%
2,4-Dimethyl-3-cyclohexene-1-carbaldehyde	0.75%
Aldehyde C ₁₀	0.75%
Citronellyl Nitrile	4.30%
Isobornyl acetate	3.00%
2-tert-butyl-1-cyclohexyl acetate	9.80%
Citronellyl Acetate	1.30%

2-Methylundecanal	3.00%
Diphenyloxide	0.80%
Aldehyde C ₁₂	1.30%
Dicyclopentadiene acetate	9.85%
Ionone beta	3.30%
Undecalactone gamma	18.75%
Hexyl Salicylate	15.9%
Benzyl Salicylate	16.2%

Microcapsule compositions are given in the Tables below.

Table 2 : Microcapsule compositions

Ingredients	Capsules A	Capsules B	Capsules C and Capsules D	Capsules F	Capsules G	Capsules H	Capsules K
POSS-NH ₂ ^a / aminopropyl silsesquioxane ^b	2.8 ^a	2.8 ^a	2.8 ^a	0.7 ^b	2.8 ^a	2.8 ^a	2.8 ^a
TPCI ¹⁾ (TMC1 for capsules B)	1	0.88	1	1	1	0.5	1
Potato Protein ^{2c)} /Canola Protein ^{2d}	2 ^c	2 ^c	2 ^c	2 ^c	2 ^c	2 ^c	2 ^d
Perfume oil A	20	20	20	20	20	20	20
Lysine ³⁾	1.25	1.25					
ZnCl ₂ ⁴⁾		0.4					
Sodium Silicate ⁵⁾							

5

Table 2 : Continued.

Ingredients	Capsules L	Capsules M	Capsules N
POSS-NH ₂ ^a / aminopropyl silsesquioxane ^b	2.8 ^b	2.8 ^a	2.8 ^a
TPCl ¹⁾ (TMC1 for capsules B)	1	1	1
Potato Protein ^{c)} /Canola Protein ^d	2 ^d	2 ^d	2 ^d
Perfume oil A	20	20	20
Lysine ³⁾	1.25	1.25	
ZnCl ₂ ⁴⁾	0.4	0.4	
Sodium Silicate ⁵⁾			0.78

^a Effective amount of ingredients (wt%)

- 1) ^a Commercial name or Trademark®; trademark and origin : Alfa Aesar;
- 2) ^b Aminopropyl silsesquioxane oligomer solution from Gelest (2.8 x25%)
- 3) ^cOrigin: Solanic® 200 - Royal Avebe,
- 4) ^d CanolaPRO, a dsm-firmenich product
- 5) L- Lysine - Origin: Acros Organics
- 6) Origin: Acros Organics
- 7) Supplier Info : Ricca Chemical Company, Arlington, TX

Table 3 : Microcapsules compositions

Ingredients	Example I a	Example J ^a	Example E a	Control Z ^a
POSS- NH2	2.8	2.8	2.8	

TPCI ¹⁾	1	1	1	1
Gum Arabic ²⁾	1	1	1	1
Perfume oil A	20	20	20	20
Lysine ³⁾	1.25		1.25	2.25
ZnCl ₂ ⁴⁾			0.4	

^a Effective amount of ingredients (wt%)

- 1) Commercial name or Trademark®; trademark and origin : Alfa Aesar
- 2) Origin: Nexira
- 5 3) Origin: Acros Organics
- 4) Origin: Acros Organics

Example 3

Microcapsules stability

The microcapsules were added in a Fabric Softener base (see Table 4) and stored for 3 days at 37°C with a perfume oil dosage in the base is 0.2%.

Table 4: Fabric Softener composition

Product	Wt %
Stepantex VL 90A	8.88
Calcium Chloride Sol. 10%	0.36
Proxel GXL	0.04
Perfume	1.00
Water	89.72
TOTAL	100.00

Weigh 2g of sample (base with capsules) in a 20mL vial. Add to the vial 10 mL of the extraction solvent isooctane containing the internal standard 1,4-dibromobenzene at a precisely known concentration around 90 ng/uL. Shake for 45 min at 40RPM to extract the free perfume. Remove the solvent phase.

- 5 To measure the leakage in the base the Agilent GCFID7890A is use, the injector is set at 250°C, helium is used as the carrier gas at a flow rate of 1 mL/min, the oven temperature is programmed from 120°C, held 5 minutes, increased to 170°C at 10°C/min, increased to 220°C at 25°C/min and then increased to 260 at 25°C/min. To finish a post run is apply at 260°C to finish the measure.
- 10 Calibration solutions are prepared at 100, 300 and 600 ng/uL of fragrance oil in the isooctane. It is important that the fragrance oil used to prepare the calibration curve comes from the same batch used to produce the microcapsules.

Table 5: Stability (Perfume Leakage at 37°C – 3 days/1 month)

15

Sample	3 days	1 month
Comparative Z	93.8%	NM
A	9.2%	21.4%
B	22.7%	28.2%
C	16.2%	23.7%
D	14.8%	37.2%
E	22.2%	NM
K	22.9%	NM
L	11.3%	NM
M	17.7%	NM
N	18.3%	NM

NM: Not measured

Example 4

EDS characterization

Energy dispersive spectroscopy performed on microcapsules H confirms the elemental
5 presence of silicon in the microcapsule shell (see figure 4).

Example 5

Sensory Evaluation

10 Microcapsules were loaded into deionized water at 0.2 wt% equivalent oil, and 250 μ L of the dilute slurry was applied to the area within a 1" diameter circle centered on a 2"x3" piece of perfumery blotter paper. The samples were then allowed to dry under ambient conditions on a bench top for 120 hours. One set of samples was subjected to 60 minutes in an oven at 60°C to simulate standard conditions for machine drying before sitting on the bench top at ambient
15 conditions for 119 more hours. Panelists (n=11) were then asked to hold an individual blotter 2 inches from their noses, smell, and rate the before-rubbing fragrance intensity of the blotter using a 1-7 scale (1 = no fragrance detected, 7 = extremely strong fragrance intensity). The panelists repeated the process for each sample. The panelists were then instructed to use a gloved finger to swipe once across the surface of the circular application area of the blotter,
20 hold the blotter 2 inches from their noses, smell, and rate the after-rubbing fragrance intensity using the same 1-7 scale, repeating the process for each sample.

Microcapsule C (60°C) was dried in the oven at 60°C for 1 hr to simulate the machine drying condition, and then dried along with other samples at ambient condition for 120 hrs.

25

The data illustrated in Figure 5 shows the average olfactive intensity of each sample evaluated from the blotters before and after rubbing. The results of this scratch-and-sniff test from blotters demonstrate that there is a significant burst effect and sensory performance of capsules.

30

Example 6

Spray-dried microcapsules preparation

Emulsions A-E having the following ingredients are prepared.

Table 6: Composition of Emulsions A-E and composition of granulated powder A-E after spray-drying

Ingredients	Emulsion A	Emulsion B	Emulsion C	Emulsion D	Emulsion E
Modified starch ¹⁾	2.6%	2.6%	2.6%	12.5%	2%
Maltodextrin ²⁾	26.8%	22.8%	19.3%	0%	19.1%
Maltose ³⁾	0%	0%	0%	7.9%	0%
Citric Acid	0%	0%	0%	1%	0%
Tripotassium Citrate	0%	0%	0%	1.9%	0%
Exemplified Microcapsules	12.0%	24%	37.0%	8.9%	56.2%
Silica ⁴⁾	1.1%	1.1%	1.1%	0%	0%
Free Perfume C ⁵⁾	0%	0%	0%	11%	0%
Water	57.6%	49.6%	40.1%	56.9%	22.7%
	Granule A	Granule B	Granule C	Granule D	Granule E
Modified starch ¹⁾	7.5%	7.4%	7.2%	31.6%	4.9%
Maltodextrin ²⁾	77.4%	65.5%	53.8%	0%	44.7%
Maltose	0%	0%	0%	20.9%	
Citric Acid	0%	0%	0%	2.6%	0%
Tripotassium citrate	0%	0%	0%	4.9%	0%
Encapsulated perfume C	0%	0%	0%	28.1%	0%
Exemplified microcapsules	12.%	24.1%	36.1%	9.8%	48.4%
Silica	3.0	3.0%	2.9%	2.0%	2%

Fragrance loading in powder after spray-drying	10.1%	20.1%	30%	35.8%	40.2%
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- 1) Capsul™, Ingredion
- 2) Maltodextrin 10DE origin: Roquette
- 3) Maltose, Lehmann & Voss
- 5 4) Silica, Evonik
- 5) see table 7

Table 7: Composition of Perfume C

Component	%
ACÉTATE DE 4-(1,1-DIMÉTHYLÉTHYL)-1-CYCLOHEXYLE ¹⁾	14.50
LINALOL BJ	10.50
LILIAL® ²⁾	10.00
ISO E SUPER ³⁾	10.00
CITRONELLYL NITRILE	9.00
DIPHENYLOXYDE	6.50
ISOBORNYL ACETATE	6.00
BETA IONONE	6.00
TRICYCLO[5.2.1.0~2,6~]DEC-3-EN-8-YL ACETATE (A) + TRICYCLO[5.2.1.0~2,6~]DEC-4-EN-8-YL ACETATE (B) ⁴⁾	5.50
ETHER MT	4.00
HEDIONE® ⁵⁾	4.00
GERANIOL 60	3.00
CITRAL	2.50
ALDEHYDE C 10	2.50
ALLYL HEPTANOATE	2.50
ETHYL METHYL-2-BUTYRATE	1.50
GERANYL ACETATE	1.00

2,4-DIMETHYL-3-CYCLOHEXENE-1-CARBALDEHYDE ⁶⁾	1.00
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- 1) Firmenich SA, Switzerland
- 2) 3-(4-tert-butylphenyl)-2-methylpropanal, Givaudan SA, Vernier, Switzerland
- 3)1-(octahydro-2,3,8,8-tetramethyl-2-naphtalenyl)-1-ethanone, International Flavors & Fragrances, USA
- 4) Firmenich SA, Switzerland
- 5) Methyl dihydrojasmonate, Firmenich SA, Switzerland
- 6) Firmenich SA, Switzerland
- 10 Components for the polymeric matrix (Maltodextrin and capsulTM, or capsulTM , citric acid and tripotassium citrate) are added in water at 45-50°C until complete dissolution.
For emulsion D, free perfume C is added to the aqueous phase.
Microcapsules slurry is added to the obtained mixture. Then, the resulting mixture is then mixed gently at 25°C (room temperature).
- 15 Granulated powder A-E are prepared by spray-drying Emulsion A-E using a Sodeva Spray Dryer (Origin France), with an air inlet temperature set to 215°C and a throughput set to 500 ml per hour. The air outlet temperature is of 105°C. The emulsion before atomization is at ambient temperature.

20

Example 7
Liquid scent booster composition

A sufficient amount of exemplified microcapsules is weighed and mixed in a liquid scent booster to add the equivalent of 0.2% perfume.

25

Table 8: Liquid scent booster composition

Ingredients	Amount (% wt)					
	1	2	3	4	5	6
Water	71.20%	89.5%	78.8%	79.4%	70%	70%
Propylene glycol	20.30%	-	-	-	20%	20%
Polyethylene glycol ethers of decyl alcohol ¹⁾	4.00%	6%				

Polyethylene glycol ether of Lauryl Alcohol ²⁾					4.00%	4.00%
alkyl polyglucoside C8-C10 ³⁾			8.30%	7.7%		
Deceth-3 ¹⁾	1.50%					
Lauryl lactate				1%		
Lauric acid		1.5%	1.60%			
Glyceryl Caprylate					3.00%	3.00%
Fragrance	3.00%	3.0%	3.00%	3.00%	3.00%	0%

1) Deceth-8; trademark and origin : KKK Oleo

2) Laureth-9; ; trademark and origin

3) Plantacare 2000UP; trademark and origin : BASF

5 Different ringing gel compositions are prepared (compositions 1-6) according to the following protocol.

In a first step, the aqueous phase (water), the solvent (propylene glycol) if present and surfactants are mixed together at room temperature under agitation with magnetic stirrer at 300 rpm for 5 min.

10 In a second step, the linker is dissolved in the hydrophobic active ingredient (fragrance) at room temperature under agitation with magnetic stirrer at 300 rpm. The resulting mixture is mixed for 5 min.

Then, the aqueous phase and the oil phase are mixed together at room temperature for 5 min leading to the formation of a transparent or opalescent ringing gel.

15

Example 8

Liquid detergent composition

A sufficient amount of exemplified microcapsules is weighed and mixed in a liquid detergent to add the equivalent of 0.2% perfume.

20

Table 9: Liquid detergent composition

Ingredients	Concentration [wt%]
Sodium C ₁₄₋₁₇ Alkyl Sec Sulfonate ¹⁾	7
Fatty acids, C ₁₂₋₁₈ and C ₁₈ -unsaturated ²⁾	7.5
C _{12/14} fatty alcohol polyglycol ether with 7 mol EO ³⁾	17
Triethanolamine	7.5
Propylene Glycol	11
Citric acid	6.5
Potassium Hydroxyde	9.5
Properase L ⁴⁾	0.2
Puradax EG L ⁴⁾	0.2
Purastar ST L ⁴⁾	0.2
Acrylates/Steareth-20 Methacrylate structuring Crosspolymer ⁵⁾	6
Deionized Water	27.4

- 1) Hostapur SAS 60; Origin: Clariant
- 2) Edenor K 12-18; Origin: Cognis
- 3) Genapol LA 070; Origin: Clariant
- 4) Origin: Genencor International
- 5) Aculyn 88; Origin: Dow Chemical

5

10

Example 9
Unit dose formulation

A sufficient amount of exemplified microcapsules is weighed and mixed in a unit dose
5 formulation to add the equivalent of 0.2% perfume.
The unit dose formulation can be contained in a PVOH (polyvinyl alcohol) film.

Table 10: Unit dose composition

Ingredients	Concentration [wt%]
C12 - C14 alkyl poly ethoxylate	15
C12 - C14 alkyl poly ethoxylate sulfate Mono Ethanol Amine salt	9.5
Linear Alkylbenzene sulfonic acid	17
Citric Acid	0.5
C12 - C18 Fatty Acid	17
Enzymes	1.2
Fluorescent brightener	0.3
1,2 propanediol	12
Glycerol	9
Sodium Hydroxide	1
Mono Ethanol Amine	6
PDMS	2.5
Potassium sulphite	0.2
Water	8.8
Total	100

10

Example 10
Powder detergent composition

A sufficient amount of exemplified microcapsules is weighed and mixed in a powder detergent
15 composition to add the equivalent of 0.2% perfume.

Table 11: Powder detergent composition

Ingredients	Part
Anionic (Linear Alkyl Benzene Sulphonates)	20%
Nonionics (Alcohol Ethoxylates (5-9 ethylene oxide)	6%
Builders (zeolites, sodium carbonate)	25%
Silicates	6%
Sodium Sulphate	35%
Others (Enzymes, Polymers, Bleach)	7.5%
Spray-dried granule powder A-E	0.5%

5

Example 11

Concentrated All Purpose Cleaner composition

A sufficient amount of exemplified microcapsules is weighed and mixed in a concentrated all-purpose cleaner composition to add the equivalent of 0.2% perfume.

10

Table 12: concentrated all-purpose cleaner composition

Ingredients	Amount (%) wt)	Function
Ethoxylated Alcohol (C9-C11, 8EO) ⁽¹⁾	20	Non-ionic surfactant
Sodium Dodecyl Benzene Sulfonate ⁽²⁾	16	Anionic surfactant
Sodium Cumene Sulfonate ⁽³⁾	8	Hydrotrope
Methyl chloro isothiazolinone Methyl isothiazolinone 3.3:1 ⁽⁴⁾	0.8%	preservative
Water	55.9	solvent

1) Neodol 91-8 ®; trademark and origin : Shell Chemical

2) Biosoft D-40®; trademark and origin : Stepan Company

15

- 3) Stepanate SCS®; trademark and origin : Stepan Company
- 4) Kathon CG®; trademark and origin : Dow Chemical Company

All ingredients are mixed together and then the mixture was diluted with water to 100%.

5

Example 12

Solid scent booster composition

The following compositions are prepared.

10 **Table 13:** Salt-based solid scent booster compositions

Ingredients	Part
Sodium chloride	95
Spray-dried granule powder A-E	5

Table 14: Urea-based solid scent booster compositions

Ingredients	Part
Urea (beads)	94
Spray-dried granule powder A-E	8
Bentonite	3
Perfume	3

15

Example 13

Shampoo composition

20

A sufficient amount of exemplified microcapsules is weighed and mixed in a shampoo composition to add the equivalent of 0.2% perfume.

Table 15: Shampoo composition

	Ingredients	Concentration [wt%]
A	Water deionized	44.4
	Polyquaternium-10 ¹⁾	0.3
	Glycerin 85% ²⁾	1
	DMDM Hydantoin ³⁾	0.2
B	Sodium Laureth Sulfate ⁴⁾	28
	Cocamidopropyl Betaine ⁵⁾	3.2
	Disodium Cocoamphodiacetate ⁶⁾	4
	Ethoxy (20) Stearyl Alcohol ⁶⁾	1
C	Sodium Laureth Sulfate ⁴⁾	3
	Glyceryl Laureate ⁷⁾	0.2
D	Water deionized	1
	Sodium Methylparaben ⁸⁾	0.1
E	Sodium Chloride 10% aqueous sol.	15
	Citric acid 10% aqueous sol. till pH 5.5-6	q.s.
	Perfume	0.5
	T O T A L:	100

1) Ucare Polymer JR-400, Noveon

2) Schweizerhall

3) Glydant, Lonza

4) Texapon NSO IS, Cognis

5) Tego Betain F 50, Evonik

6) Amphotensid GB 2009, Zschimmer & Schwarz

7) Monomuls 90 L-12, Gruenau

8) Nipagin Monosodium, NIPA

- 5 Polyquaternium-10 is dispersed in water. The remaining ingredients of phase A are mixed separately by addition of one after the other while mixing well after each adjunction. Then this pre-mix is added to the Polyquaternium-10 dispersion and was mixed for 5 min. Then Phase B

and the premixed Phase C (heat to melt Monomuls 90L-12 in Texapon NSO IS) are added. The mixture is mixed well. Then, Phase D and Phase E are added while agitating. The pH was adjusted with citric acid solution till pH: 5.5 – 6.0.

5

Example 14

Shampoo composition

- 10 A sufficient amount of exemplified microcapsules is weighed and mixed in a shampoo composition to add the equivalent of 0.2% perfume.

Table 16: Shampoo composition

	Ingredients	Concentration [wt%]
A	Water deionized	45.97
	Tetrasodium EDTA ¹⁾	0.05
	Guar Hydroxypropyltrimonium Chloride ²⁾	0.05
	Polyquaternium-10 ³⁾	0.075
B	NaOH 10% aqueous sol.	0.3
C	Ammonium Lauryl Sulfate ⁴⁾	34
	Ammonium Laureth Sulfate ⁵⁾	9.25
	Cocamidopropyl Betaine ⁶⁾	2
	Dimethicone (&) C12-13 Pareth-4 (&) C12-13 Pareth-23 (&) Salicylic Acid ⁷⁾	2.5
D	Cetyl Alcohol ⁸⁾	1.2
	Cocamide MEA ⁹⁾	1.5
	Glycol Distearate ¹⁰⁾	2
E	Methylchloroisothiazolinone & Methylisothiazolinone ¹¹⁾	0.1
	D-Panthenol 75% ¹²⁾	0.1
	Water deionized	0.3
F	Sodium Chloride 25% aqueous sol.	0.6

	T O T A L:	100
--	-------------------	------------

- 1) EDETA B Powder, BASF
- 2) Jaguar C14 S, Rhodia
- 3) Ucare Polymer JR-400, Noveon
- 4) Sulfetal LA B-E, Zschimmer & Schwarz
- 5) Zetesol LA, Zschimmer & Schwarz
- 6) Tego Betain F 50, Evonik
- 7) Xiameter MEM-1691, Dow Corning
- 8) Lanette 16, BASF
- 9) Comperlan 100, Cognis
- 10) Cutina AGS, Cognis
- 11) Kathon CG, Rohm & Haas
- 12) D-Panthenol, Roche

- A premix comprising Guar Hydroxypropyltrimonium Chloride and Polyquaternium-10 are added to water and Tetrasodium EDTA while mixing. When the mixture is homogeneous, NaOH is added. Then, Phase C ingredients are added and the mixture was heat to 75 °C. Phase
- 5 D ingredients are added and mixed till homogeneous. The heating is stopped and temperature of the mixture is decreased to RT. At 45 °C, ingredients of Phase E while mixing final viscosity is adjusted with 25% NaCl solution and pH of 5.5-6 is adjusted with 10% NaOH solution.

Example 15

10

Rinse-off hair composition

A sufficient amount of exemplified microcapsules is weighed and mixed in a rinse-off composition to add the equivalent of 0.2% perfume.

15 **Table 17:** rinse-off composition

	Ingredients	Concentration [wt%]
A	Water deionized	81.8
	Behentrimonium Chloride ¹⁾	2.5

	Hydroxyethylcellulose ²⁾	1.5
B	Cetearyl Alcohol ³⁾	4
	Glyceryl Stearate (and) PEG-100 Stearate ⁴⁾	2
	Behentrimonium Methosulfate (and) Cetyl alcohol (and) Butylene Glycol ⁵⁾	4
	Ethoxy (20) Stearyl Alcohol ⁶⁾	1
C	Amodimethicone (and) Trideceth-12 (and) Cetrimonium Chloride ⁷⁾	3
	Chlorhexidine Digluconate ⁸⁾ 20% aqueous solution	0.2
D	Citric acid 10% aqueous sol. till pH 3.5-4	q.s.
	T O T A L:	100

- 1) Genamin KDMP, Clariant
- 2) Tylose H10 Y G4, Shin Etsu
- 3) Lanette O, BASF
- 4) Arlacel 165, Croda
- 5) Incroquat Behenyl TMS-50-PA- (MH), Croda
- 6) Brij S20, Croda
- 7) Xiameter MEM-949, Dow Corning
- 8) Alfa Aesar

- 10 Ingredients of Phase A are mixed until an uniform mixture was obtained. Tylose is allowed to completely dissolve. Then the mixture is heated up to 70-75°C. Ingredients of Phase B are combined and melted at 70-75°C. Then ingredients of Phase B are added to Phase A with good agitation and the mixing is continued until cooled down to 60°C. Then, ingredients of Phase C are added while agitating and keeping mixing until the mixture cooled down to 40°C. The pH is adjusted with citric acid solution till pH: 3.5 – 4.0.
- 15

Example 16

Antiperspirant spray anhydrous composition

- 20 A sufficient amount of exemplified microcapsules is weighed and mixed in an antiperspirant spray anhydrous composition to add the equivalent of 0.2% perfume.

Table 18: antiperspirant spray anhydrous composition

Ingredient	Amount (wt %)
Cyclomethicone ¹⁾	53.51
Isopropyl miristate	9.04
Silica ²⁾	1.03
Quaternium-18-Hectorite ³⁾	3.36
Aluminium Chlorohydrate ⁴⁾	33.06

1) Dow Corning[®] 345 Fluid; trademark and origin: Dow Corning

2) Aerosil[®] 200 ; trademark and origin : Evonik

3) Bentone[®] 38; trademark and origin : Elementis Specialities

4) Micro Dry Ultrafine; origin : Reheis

Using a high speed stirrer, Silica and Quaternium-18-Hectorite are added to the Isopropyl miristate and Cyclomethicone mixture. Once completely swollen, Aluminium Chlorohydrate is added portion wise under stirring until the mixture was homogeneous and without lumps. The aerosol cans are filled with 25 % Suspension of the suspension and 75 % of Propane/Butane (2,5 bar).

Example 17

Antiperspirant spray emulsion composition

A sufficient amount of exemplified microcapsules is weighed and mixed in antiperspirant spray emulsion composition to add the equivalent of 0.2% perfume.

Table 19: antiperspirant spray emulsion composition

Ingredient	Amount (wt %)
Polysorbate 65 ¹⁾ (Part A)	0.95

Polyglyceryl-2 dipolyhydroxystearate ²⁾ (Part A)	1.05
Cetyl PEG/PPG-10/1 Dimethicone ³⁾ (Part A)	2.75
Cyclomethicone ⁴⁾ (Part A)	16.4
Isopropylisostearate ⁵⁾ (Part A)	4.5
Phenoxyethanol ⁶⁾ (Part A)	0.5
Ethylhexylglycerin ⁷⁾ (Part A)	0.2
C12-15 Alkyl Benzoate ⁸⁾ (Part A)	5.65
Silica Silylate ⁹⁾ (Part A)	0.1
Sodium Methylparaben ¹⁰⁾ (Part B)	0.1
Aluminium Chlorohydrate ¹¹⁾ (Part B)	20
Water (Part B)	44.47
Fragrance (Part C)	3.33

- 1) Tween 65; trademark and origin : CRODA
- 2) Dehymuls PGPH; trademark and origin : BASF
- 3) Abil EM-90; trademark and origin : BASF
- 4) Dow Corning 345 fluid; trademark and origin : Dow Corning
- 5) Crodamol ipis; trademark and origin : CRODA
- 6) Phenoxyethanol; trademark and origin : LANXESS
- 7) Sensiva sc 50; trademark and origin : KRAFT
- 8) Tegosoft TN; trademark and origin : Evonik
- 9) Aerosil R 812; trademark and origin : Evonik
- 10) Nipagin mna; trademark and origin : CLARIANT
- 11) Locron L; trademark and origin : CLARIANT

The ingredients of Part A and Part B are weighted separately. Ingredients of Part A are heated up to 60°C and ingredients of Part B are heated to 55 °C. Ingredients of Part B are poured small parts while continuous stirring into A. Mixture were stirred well until the room temperature was reached. Then, ingredients of part C are added. The emulsion is mixed and is introduced into the aerosol cans. The propellant is crimped and added.

Aerosol filling: 30% Emulsion: 70% Propane / Butane 2,5 bar

Example 18

Deodorant spray composition

5 A sufficient amount of exemplified microcapsules is weighed and mixed in antiperspirant deodorant spray composition to add the equivalent of 0.2% perfume.

Table 20: deodorant spray composition

Ingredient	Amount (wt %)
Ethanol 95 %	90.65
Triclosan ¹⁾	0.26
Isopropyl miristate	9.09

10 1) Irgasan[®] DP 300; trademark and origin : BASF

All the ingredients according to the sequence of the Table 24 are mixed and dissolved. Then the aerosol cans are filled, crimp and the propellant is added (Aerosol filling: 40% active
15 solution 60% Propane / Butane 2.5 bar).

Example 19

Antiperspirant roll-on emulsion composition

20

A sufficient amount of exemplified microcapsules is weighed and mixed in antiperspirant roll-on emulsion composition to add the equivalent of 0.2% perfume.

Table 21: antiperspirant roll-on emulsion composition

25

Ingredient	Amount (wt %)
Steareth-2 ¹⁾ (Part A)	3.25
Steareth-21 ²⁾ (Part A)	0.75
PPG-15 Stearyl Ether ³⁾ (Part A)	4

WATER deionised (Part B)	51
Aluminum Chlorohydrate 50% aqueous solution ⁴⁾ (Part C)	40
Fragrance (Part D)	1

- 1) BRIJ 72; origin : ICI
- 2) BRIJ 721; origin : ICI
- 3) ARLAMOL E; origin : UNIQEMA-CRODA
- 4) LOCRON L; origin : CLARIAN

5
Part A and B are heated separately to 75°C; Part A is added to part B under stirring and the mixture is homogenized for 10 minutes. Then, the mixture is cooled down under stirring; and part C is slowly added when the mixture reached 45°C and part D when the mixture reached at 35 °C while stirring. Then the mixture is cooled down to RT.

10

Example 20
Antiperspirant roll-on composition

A sufficient amount of exemplified microcapsules is weighed and mixed in antiperspirant roll-on composition to add the equivalent of 0.2% perfume.

15

Table 22: antiperspirant roll-on composition

Ingredient	QUANTITY
Water (Part A)	45
Aluminum Chlorohydrate 50% aqueous solution ¹⁾ (Part B)	20
Alcohol Denat. (Ethanol 96%) (Part B)	30
Ceteareth-12 ²⁾ (Part C)	2
Ceteareth-30 ³⁾ (Part C)	2
Fragrance (Part D)	1

- 1) LOCRON L; origin: CLARIANT
- 2) EUMULGIN B-1; origin : BASF
- 3) EUMULGIN B-3; origin : BASF

20

The ingredients of part B are mixed in the vessel then ingredient of part A is added. Then dissolved part C in part A and B. With perfume, 1 part of Cremophor RH40 for 1 part of perfume is added while mixing well

5

Example 21

Antiperspirant roll-on composition

A sufficient amount of exemplified microcapsules is weighed and mixed in antiperspirant roll-on emulsion composition to add the equivalent of 0.2% perfume.

10

Table 23: antiperspirant roll-on emulsion composition

Ingredient	Amount (wt %)
Water (Part A)	50.51
Hydroxyethylcellulose ¹⁾ (Part A)	0.71
Ethanol 95 % (Part B)	40.40
1,2-Propylene Glycol (Part B)	5.05
Triclosan ²⁾ (Part B)	0.30
PEG-40 Hydrogenated castor oil ³⁾ (Part C)	3.03

- 1) Natrosol® 250 H; trademark and origin: Ashland
- 2) Irgasan® DP 300; trademark and origin : BASF
- 3) Cremophor® RH 40; trademark and origin : BASF

15

Part A is prepared by sprinkling little by little the Hydroxyethylcellulose in the water whilst rapidly stirring with the turbine. Stirring is continued until the Hydroxyethylcellulose is entirely swollen and giving a limpid gel. Then, Part B is poured little by little in Part A whilst continuing stirring until the whole is homogeneous. Part C is added.

20

Example 22

Deodorant pump without alcohol formulation

A sufficient amount of exemplified microcapsules is weighed and mixed in the following composition to add the equivalent of 0.2% perfume.

25

Table 24: deodorant composition

Ingredients	Amount (wt %)
C12-15 Alkyl Lactate ¹⁾	5
Dimethicone ²⁾	91.6
Cetyl Lactate ³⁾	1
Octyldodecanol ⁴⁾	0.8
Triclosan ⁵⁾	0.1
PERFUME	1.5

- 1) Ceraphyl 41; trademark and origin ASHLAND
- 5 2) DOW CORNING 200 FLUID 0.65cs; trademark and origin DOW CORNING CORPORATION
- 3) Ceraphyl 28; trademark and origin ASHLAND
- 4) Eutanol G; trademark and origin BASF
- 5) Irgasan[®] DP 300; trademark and origin : BASF

10

All the ingredients are mixed according to the sequence of the table and the mixture is heated slightly to dissolve the Cetyl Lactate.

Example 23

15

Deodorant pump with alcohol formulation

A sufficient amount of exemplified microcapsules is weighed and mixed in the following composition to add the equivalent of 0.2% perfume.

20 **Table 25:** deodorant composition

Ingredients	Amount (wt %)
Ethyl Alcohol (Part A)	60
PEG-6 Caprylic/Capric Glycerides ¹⁾ (Part A)	2
Water (Part A)	35.6

PEG-40 Hydrogenated Castor Oil ²⁾ (Part B)	0.4
PERFUME (Part B)	2

- 1) Softigen 767; trademark and origin CRODA
- 2) Cremophor[®] RH 40; trademark and origin : BASF

Ingredients from Part B are mixed together. Ingredients of Part A are dissolved according to the sequence of the Table and are poured into part B.

Example 24

Talc formulation

- A sufficient amount of granules A-E is weighed and mixed in introduced in a standard talc base: 100% talc, very slight characteristic odor, white powder, origin: LUZENAC to add the equivalent of 0.2% perfume.

Example 25

Shower-gel Reference

A sufficient amount of exemplified microcapsules is weighed and mixed in the following composition to add the equivalent of 0.2% perfume.

- Table 26:** shower gel composition

Ingredients	Amount (% wt)	Function
WATER deionized	49.350	Solvent
Tetrasodium EDTA ¹⁾	0.050	Chelating agent
Acrylates Copolymer ²⁾	6.000	Thickener
Sodium C12-C15 Pareth Sulfate ³⁾	35.000	Surfactant
Sodium Hydroxide 20% aqueous solution	1.000	pH adjuster
Cocamidopropyl Betaine ⁴⁾	8.000	Surfactant
Methylchloroisothiazolinone and Methylisothiazolinone ⁵⁾	0.100	Preservative
Citric Acid (40%)	0.500	pH adjuster

- 1) EDETA B POWDER; trademark and origin: BASF

- 2) CARBOPOL AQUA SF-1 POLYMER; trademark and origin: NOVEON
- 3) ZETESOL AO 328 U; trademark and origin: ZSCHIMMER & SCHWARZ
- 4) TEGO-BETAIN F 50; trademark and origin: GOLDSCHMIDT
- 5) KATHON CG; trademark and origin: ROHM & HASS

5

Ingredients are mixed, pH is adjusted to 6-6.3 (Viscosity: 4500cPo +/-1500cPo (Brookfield RV / Spindle#4 / 20RPM)).

Example 26

10

Shower-gel composition

A sufficient amount of exemplified microcapsules is weighed and mixed in the following composition to add the equivalent of 0.2% perfume.

15 Table 27: shower gel composition

Ingredients	Amount (% wt)	Function
WATER deionized	52.40	Solvent
Tetrasodium EDTA ¹⁾	0.10	Chelating agent
Sodium Benzoate	0.50	Preservative
Propylene Glycol	2.00	Solvent
Sodium C12-C15 Pareth Sulfate ²⁾	35.00	Surfactant
Cocamidopropyl Betaine ³⁾	8.00	Surfactant
Polyquaternium-7 ⁴⁾	0.20	Conditioning agent
Citric Acid (40%)	1.00	pH adjuster
Sodium Chloride	0.80	Viscosity adjuster

- 1) EDETA B POWDER; trademark and origin: BASF
- 2) ZETESOL AO 328 U; trademark and origin: ZSCHIMMER & SCHWARZ
- 3) TEGO-BETAIN F 50; trademark and origin: GOLDSCHMIDT
- 4) MERQUAT 550; trademark and origin: LUBRIZOL

20

Ingredients are mixed, pH is adjusted to 4.5 (Viscosity: 3000cPo +/-1500cPo (Brookfield RV / Spindle#4 / 20RPM)).

Example 27

Shower-gel composition

- 5 A sufficient amount of exemplified microcapsules is weighed and mixed in the following composition to add the equivalent of 0.2% perfume.

Table 28: shower gel composition

Ingredients	Amount (% wt)	Function
WATER deionized	50.950	Solvent
Tetrasodium EDTA ¹⁾	0.050	Chelating agent
Sodium Benzoate	0.500	Preservative
Glycerin 86%	3.500	Solvent
Sodium Laureth Sulfate ²⁾	27.000	Surfactant
Polyquaternium-7 ³⁾	1.000	Conditioning Agent
Coco-Betaine ⁴⁾	6.000	Surfactant
PEG-120 Methyl Glucose trioleate ⁵⁾	1.000	Thickener
Citric Acid (40%)	1.000	pH adjuster
Glycol Distearate & Laureth-4 & Cocamidopropyl Betaine ⁶⁾	3.000	Pearlizing agent
Sodium Chloride 20%	5.000	Viscosity adjuster
PEG-40 Hydrogenated Castor Oil ⁷⁾	1.000	Viscosity adjuster

- | | |
|----|--|
| | 1) EDETA B POWDER; trademark and origin: BASF |
| 10 | 2) Texapon NSO IS; trademark and origin: COGNIS |
| | 3) MERQUAT 550; trademark and origin: LUBRIZOL |
| | 4) DEHYTON AB-30; trademark and origin: COGNIS |
| | 5) GLUCAMATE LT; trademark and origin: LUBRIZOL |
| | 6) EUPERLAN PK 3000 AM; trademark and origin: COGNIS |
| 15 | 7) CREMOPHOR RH 40; trademark and origin: BASF |

Ingredients are mixed, pH is adjusted to 4.5 (Viscosity: 4000cPo +/-1500cPo (Brookfield RV / Spindle#4 / 20RPM))

Example 28

Hand Dishwash

A sufficient amount of exemplified microcapsules is weighed and mixed in the following composition to add the equivalent of 0.2% perfume.

5

Table 29: Hand dishwash composition

Ingredients	Amount (% wt)	Function
Linear alkylbenzene sulfonic acid ⁽¹⁾	20	Anionic surfactant
Diethanolamide ⁽²⁾	3.5	Foam booster
Sodium Hydroxide (50%) ⁽³⁾	3.4	pH Adjuster/neutralizer
Secondary alcohol ethoxolate ⁽⁴⁾	2.5	Non-ionic surfactant
Sodium xylene sulfonate	6.3	Hydrotrope
Water	64.3	Solvent

1) Biosoft S-118®; trademark and origin : Stepan Company

2) Ninol 40-CO®; trademark and origin : Stepan Company

10 3) Stepanate SXS®; trademark and origin : Stepan Company

4) Tergitol 15-S-9®; trademark and origin : Dow Chemical Company

Water with sodium hydroxide and diethanolamide are mixed. LAS is added. After the LAS is neutralized, the remaining ingredients are added. The pH was Checked (=7-8) and adjusted if necessary.

15

Example 29

Toothpaste formulation

A sufficient amount of a microcapsule slurry M (prepared according to the protocol disclosed in example 1 except that a menthol flavor is encapsulated) is weighed and mixed in the following composition to add the equivalent of 0.2% flavor.

20

Table 30: Toothpaste formulation

Ingredients	Amount (% wt)
Polyethylene glycol 400	2.0%
Xanthan Gum	0.6%
Sorbitol 70% Solution	50%
Sodium Fluoride	0.220%
Sodium Benzoate	0.2%
Water	15.230%
Hydrated Silica ¹⁾	22.0%
Hydrated Silica ²⁾	7.0%
Titanium Dioxide CI77891	0.5%
Sodium Lauryl Sulfate	1.250%
Flavor	1.2%
TOTAL	100%

1) Tixosil 73; trademark and origin :

2) Tixosil 43; trademark and origin :

5

Example 30

Dicalcium Phosphate based toothpaste formulation

10 A sufficient amount of a microcapsule slurry M (prepared according to the protocol disclosed in example 1 except that a menthol flavor is encapsulated) is weighed and mixed in the following composition to add the equivalent of 0.2% flavor.

Table 31: Toothpaste formulation

15

Ingredients	Amount (% wt)
Sodium carboxymethyl cellulose	1.2%
Flavor	1.2%
DI/Purified Water	Q.S to Final Wt.

Sodium Lauryl Sulfate	1.3%
Glycerine	20.0%
Sodium Saccharin	0.2%
Dicalcium phosphate dihydrate	36.0%
Methylparaben	0.2%
Silica ¹⁾	3.0%
TOTAL	100%

1) Aerosil®200; trademark and origin:

Example 31

Mouthwash alcohol free formulation

5

A sufficient amount of a microcapsule slurry M (prepared according to the protocol disclosed in example 1 except that a menthol flavor is encapsulated) is weighed and mixed in the following composition to add the equivalent of 0.2% flavor.

10 **Table 32:** Mouthwash formulation

Ingredients	Amount (% wt)
Propylene Glycol	10%
Flavor	0.240%
DI/Purified Water	Q.S to Final Wt.
Poloxamer 407 NF	0.240%
Sodium Lauryl Sulfate	0.040%
Sorbitol 70% Solution	10.0%
Sodium Saccharin	0.030%
Glycerine	3.0%
Sodium Benzoate	0.100%
Sucralose	0.020%
Benzoic Acid	0.050%
TOTAL	100%

Example 32
Mouthwash formulation

- 5 A sufficient amount of a microcapsule slurry M (prepared according to the protocol disclosed in example 1 except that a menthol flavor is encapsulated) is weighed and mixed in the following composition to add the equivalent of 0.2% flavor.

Table 33: Mouthwash formulation

Ingredients	Amount (% wt)
Ethyl Alcohol 190 Proof	15.0%
Flavor	0.240%
DI/Purified Water	Q.S to Final Wt.
Poloxamer 407 NF	0.240%
Sodium Lauryl Sulfate	0.040%
Sorbitol 70% Solution	10.0%
Sodium Saccharin	0.030%
Glycerine	3.0%
Sodium Benzoate	0.100%
Sucralose	0.020%
Benzoic Acid	0.050%
TOTAL	100%

10

CLAIMS

1. Core-shell microcapsule comprising :
 - (i) a core comprising a hydrophobic material, preferably a perfume oil, and
 - 5 (iii) a shell comprising the reaction product between at least one polyfunctional monomer and at least one organosilicon compound.
2. The microcapsule according to claim 1, wherein the organosilicon compound is selected from the group consisting of polysiloxane, oligosiloxane, silsesquioxane, and
10 mixtures thereof.
3. The microcapsule according to claim 1 or 2, wherein the organosilicon compound is a silsesquioxane, preferably an oligomeric silsesquioxane.
- 15 4. The microcapsule according to claim 3, wherein the silsesquioxane is a polyhedral oligomeric silsesquioxane (POSS), a linear oligomeric silsesquioxane or a mixture thereof.
- 20 5. The microcapsule according to claim 4, wherein the polyhedral oligomeric silsesquioxane is an amine functionalized polyhedral oligomeric silsesquioxane (NH₂-POSS).
- 25 6. The microcapsule according to claim 5, wherein the amine functionalized polyhedral oligomeric silsesquioxane has an amino functional group comprised between 1 and 12, preferably between 2 and 10.
- 30 7. The microcapsule according to anyone of the preceding claims, wherein the organosilicon compound is a polyhedral oligomeric silsesquioxane (POSS) chosen in the group consisting hexa- aminopropyl POSS hydrochloride (T6), octa-aminopropyl POSS hydrochloride (T8), deca- aminopropyl POSS hydrochloride (T10), dodeca-aminopropyl POSS hydrochloride (T12), and mixtures thereof.
8. The microcapsule according to any one of the preceding claims, wherein the polyfunctional monomer is chosen in the group consisting of at least one acyl chloride,

an isocyanate, anhydride, epoxide, acrylate, alkoxysilane, aldehyde, and mixtures thereof.

5 **9.** The microcapsule according to claim 8, wherein the polyfunctional monomer is an acyl chloride.

10. The microcapsule according to anyone of the preceding claims, wherein the hydrophobic material comprises a perfume.

10 **11.** The microcapsule according to anyone of the preceding claims, wherein the shell comprises the reaction product between an acyl chloride and an amine functionalized polyhedral oligomeric silsesquioxane (NH₂-POSS).

15 **12.** The microcapsule according to claim 11, wherein the mole ratio of amino group from an amine functionalized polyhedral oligomeric silsesquioxane to acyl chloride group from the acyl chloride is 0.05:1 to 50:1, preferably 0.1:1 to 15:1.

13. A process for preparing a core-shell microcapsule slurry comprising the steps of:
a) Dispersing an oil phase comprising a hydrophobic material into a dispersing phase
20 to form a two-phases dispersion;
b) Performing a curing step to form microcapsules in the form of a slurry;
wherein at least one polyfunctional monomer is added in the dispersing phase and/or in the oil phase, and
wherein at least one organosilicon compound is added in the dispersing phase and/or in the oil
25 phase and/or in the two-phases dispersion.

14. The process according to claim 13, wherein a stabilizer, preferably is chosen in the group consisting of inorganic particles, polymeric emulsifier such as polysaccharides, proteins, glycoproteins, and mixtures thereof is added in the dispersing phase and/or
30 the oil phase.

15. The process according to claim 13 or 14, wherein at least one salt is added in the dispersing phase and/or in the oil phase and/or in the two-phases dispersion.

16. Consumer product, preferably in the form of a home-care product or personal care product or fabric care product, comprising the microcapsules as defined in anyone of claims 1 to 12.