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(54) **COMPOSITION RICH IN MONO-RHAMNOLIPIDS**

(57) The invention relates to the use of a composition rich in mono-rhamnolipids for the preparation of non-cosmetic cleaning formulations.

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Description

Field of the invention

5 **[0001]** The invention relates to the use of a composition rich in mono-rhamnolipids for the preparation of non-cosmetic cleaning formulations.

Prior art

10 **[0002]** EP3418388 discloses cells and nucleic acids and also use thereof for producing rhamnolipids, and also methods for producing rhamnolipids.

[0003] EP3261611 discloses a composition comprising at least one rhamnolipid and at least one siloxane, wherein the weight ratio of rhamnolipid to siloxane is from 5,000,000:1 to 100:1.

15 **[0004]** WO2015091294 discloses a bacteriostatic composition comprising a rhamnolipid, the rhamnolipid comprising at least 50 wt-% mono-rhamnolipid.

[0005] WO2021190993 discloses compositions containing 2 to 6 parts by weight of at least one rhamnolipid, 1 to 4 parts by weight of at least one alkyl polyglycoside, and 1 to 3 parts by weight of at least one acyl lactylate.

[0006] EP2787065 discloses detergent formulations for textiles, comprising rhamnolipids, where the content of di-rhamnolipids predominates, and to the use of certain rhamnolipid mixture compositions and of the aforementioned detergent formulations for increasing the rate of foam formation and/or for foam stabilization, and to the use of rhamnolipids for preventing the greying of a textile.

[0007] It is an object of the invention to provide outstanding non-cosmetic cleaning formulations.

Description of the invention

25 **[0008]** It was found that, surprisingly, that a composition rich in mono-rhamnolipids can solve the objective of the instant invention.

[0009] The present invention therefore provides the use of a composition rich in mono-rhamnolipids for the preparation of non-cosmetic cleaning formulations

30 **[0010]** The invention further provides the use of a composition rich in mono-rhamnolipids as anti-deposition aid, preferably on textiles, and/or for preventing the greying of a textile.

[0011] The invention further provides the use of a composition rich in mono-rhamnolipids for fatty stain removal preferably from hard surfaces.

35 **[0012]** It is an advantage of the present invention that the compositions according to the invention with an increased content of mono-rhamnolipids can have an outstanding cleaning performance, preferably coupled with the retention of the structure of suede.

[0013] One advantage of the present invention is that the compositions of the instant invention have a very good cleaning performance, especially in fatty stain removal from fabrics and also from hard surfaces.

40 **[0014]** A further advantage is that the compositions according to the instant invention have improved cleaning properties of surfaces.

[0015] A further advantage is that the compositions of the instant invention support enzyme stability in terms of storage.

[0016] Another advantage of the present invention is that the compositions according to the invention with an increased content of mono-rhamnolipids can eliminate undesired odours from surfaces, like textiles but also hard surfaces, like for example tiles.

45 **[0017]** Another advantage of the present invention is that the compositions according to the invention with an increased content of mono-rhamnolipids can leave behind a good, smooth and soft skin feel when used during manual hard surface cleaning, eg like dish washing or car cleaning, or manual textile care processes.

[0018] Another advantage of the present invention is that the compositions according to the invention with an increased content of mono-rhamnolipids can give rise to a large amount of foam in surface-active formulations.

50 **[0019]** A further advantage of the present invention is that the compositions according to the invention with an increased content of mono-rhamnolipids are able to give rise to a readily spreadable foam, in particular on hard surfaces and textiles, in surface-active formulations.

[0020] A further advantage of the present invention is that the compositions according to the invention with an increased content of mono-rhamnolipids can bring about increased shine on hard surfaces such as, for example, plastic and glass, preferably with a simultaneously exceptional cleaning performance.

55 **[0021]** A further advantage of the present invention is that the compositions according to the invention with an increased content of mono-rhamnolipids can have an outstanding cleaning performance coupled with a good rewettability of textiles.

[0022] Another advantage of the present invention is that the compositions of the instant invention with an increased

content of mono-rhamnolipids can be rinsed off from a surface, preferably from fibres, that had been cleaned, very easily.

[0023] A further advantage is that the compositions of the instant invention with an increased content of mono-rhamnolipids support enzyme stability in terms of storage.

[0024] One advantage of the present invention is that a pure biological composition can be provided with all ingredients being of biological origin by the composition of the instant invention with an increased content of mono-rhamnolipids.

[0025] A further advantage is by the composition of the instant invention with an increased content of mono-rhamnolipids that a high-performance detergent can be provided, which uses less ingredients. Thereby, the formulation complexity is reduced greatly, resulting in a simpler production process.

[0026] Another advantage of the present invention is that the composition of the instant invention with an increased content of mono-rhamnolipids shows especially good emulsification and dispersing properties.

[0027] Another advantage of the present invention is that detergents using mild surfactants with low aqua toxicity are provided by the composition of the instant invention.

[0028] Another advantage is that the composition of the instant invention with an increased content of mono-rhamnolipids can be diluted very easily with water without the necessity of excessive stirring. One advantage of the present invention is that the compositions according to the instant invention have a positive odour profile.

[0029] Another advantage of the present invention is that the compositions of the instant invention with an increased content of mono-rhamnolipids have an improved colour stability.

[0030] A further advantage is that the compositions of the instant invention with an increased content of mono-rhamnolipids cause reduced irritation for human skin.

[0031] Another advantage is that the compositions according to the instant invention with an increased content of mono-rhamnolipids are very mild and have a good physiological compatibility, in particular characterized by a high value in the red blood cell (RBC) test.

[0032] Another advantage is that the compositions according to the instant invention with an increased content of mono-rhamnolipids have an outstanding microbial stability.

[0033] Another advantage is that the compositions according to the instant invention with an increased content of mono-rhamnolipids have an improved ability to dissolve oils and fats.

[0034] One advantage of the present invention is that persistent, dried-on stains are removed very efficiently at low ambient temperatures by the compositions according to the instant invention with an increased content of mono-rhamnolipids.

[0035] Another advantage of the present invention is that detergents with less total surfactant load while maintaining cleaning capabilities are provided by the compositions according to the instant invention with an increased content of mono-rhamnolipids.

[0036] Another advantage of the present invention is that a detergent with increases performance, especially on fatty stains is provided by the compositions according to the instant invention with an increased content of mono-rhamnolipids.

[0037] A further advantage is, that by the compositions according to the instant invention with an increased content of mono-rhamnolipids a high-performance detergent is provided, which uses less ingredients. Thereby, the formulation complexity is reduced greatly, resulting in a simpler production process.

[0038] Another advantage of the present invention is that the compositions according to the instant invention with an increased content of mono-rhamnolipids show especially good emulsification and dispersing properties.

[0039] Another advantage of the present invention is that detergents using mild surfactants with low aqua toxicity are provided by the compositions according to the instant invention with an increased content of mono-rhamnolipids.

[0040] Another advantage of the present invention is that the compositions according to the instant invention with an increased content of mono-rhamnolipids can be formulated as 100 % biodegradable.

[0041] Another advantage is that the compositions according to the instant invention with an increased content of mono-rhamnolipids show excellent compatibility with all materials contained in washing machines and other cleaning devices with respect to corrosion.

[0042] Another advantage is that the compositions according to the instant invention with an increased content of mono-rhamnolipids do not lead to stress cracking of various plastic materials such as: polyetehrylenterephatalate, Plexiglas, polycarbonate, acrylnitril-butadien-styrol, polyamide, polypropylene, polyamide, polypropylene, polybutylterephthalate, polyoxymethylene: Moreover, the compositions according to the instant invention with an increased content of mono-rhamnolipids can be used to hinder the stress cracking effect by other surfactant system e.g. fatty alcohol alkoxyolate.

[0043] Another advantage is that the compositions according to the instant invention with an increased content of mono-rhamnolipids can be diluted very easily with water without the necessity of excessive stirring.

[0044] A further advantage is that the compositions according to the instant invention with an increased content of mono-rhamnolipids cause a good skin feel during and after cleaning step Another advantage is that the compositions according to the instant invention have an improved ability to dissolve oils and fats.

[0045] Another advantage is that that the compositions according to the instant invention with an increased content of mono-rhamnolipids lead to a higher viscosity in formulations.

[0046] Another advantage is that the compositions according to the instant invention with an increased content of mono-rhamnolipids lead to colour protection for fabrics when used in a laundry detergent.

[0047] Another advantage of the present invention is that the compositions according to the instant invention with an increased content of mono-rhamnolipids are capable of removing starchy soiling without needing to use enzymes.

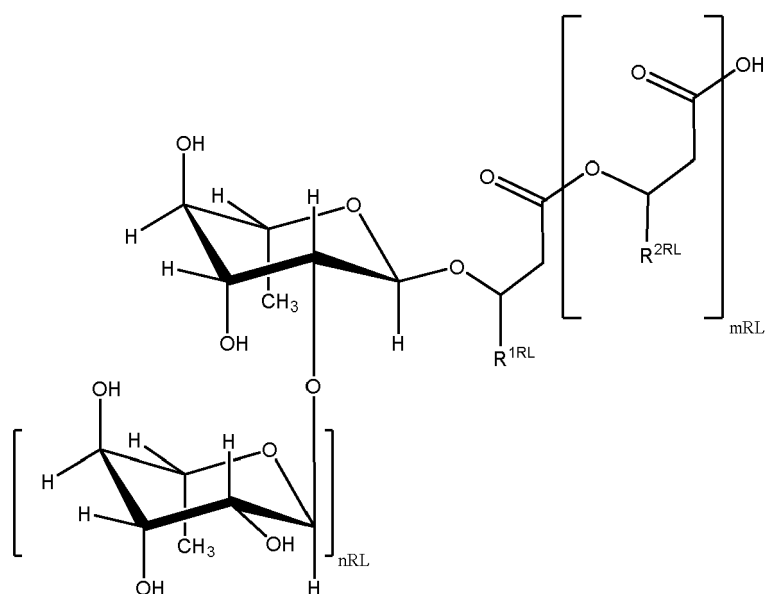
[0048] The present invention therefore provides the use of a composition comprising at least 92 wt.-%, preferably at least 95 wt.-%, more preferably at least 99 wt.-%, mono-rhamnolipids, wherein the weight percentages refer to all rhamnolipids comprised in the composition, for the preparation of a non-cosmetic cleaning formulation.

[0049] Where average values are stated hereinbelow, then, unless stated otherwise, these are number-averaged average values.

[0050] Unless stated otherwise, percentages are data in per cent by weight.

[0051] Wherever measurement values are stated hereinbelow, then, unless stated otherwise, these have been determined at a temperature of 25°C and a pressure of 1013 mbar.

[0052] The term "rhamnolipids" in the context of the present invention preferably is understood to mean particularly compounds of the general formula (I) and salts thereof,



Formula (I)

where

$mRL = 2, 1 \text{ or } 0$,

$nRL = 1 \text{ or } 0$,

R^{1RL} and R^{2RL} = mutually independently, identical or different, organic residues having 2 to 24, preferably 5 to 13 carbon atoms, in particular optionally branched, optionally substituted, particularly hydroxy-substituted, optionally unsaturated, in particular optionally mono-, bi- or tri-unsaturated alkyl residues, preferably those selected from the group consisting of pentenyl, heptenyl, nonenyl, undecenyl and tridecenyl and $(CH_2)_o-CH_3$ where $o = 1$ to 23, preferably 4 to 12. If $nRL = 1$, the glycosidic bond between the two rhamnose units is preferably in the α -configuration. The optically active carbon atoms of the fatty acids are preferably present as R-enantiomers (e.g. (R)-3-[(R)-3-[2-O-(α -L-rhamnopyranosyl)- α -L-rhamnopyranosyl]oxydecanoyl]oxydecanoate).

[0053] The term "di-rhamnolipid" in the context of the present invention is understood to mean compounds of the general formula (I) or salts thereof, where $nRL = 1$.

[0054] The term "mono-rhamnolipid" in the context of the present invention is understood to mean compounds of the general formula (I) or salts thereof, where $nRL = 0$.

[0055] Distinct rhamnolipids are abbreviated according to the following nomenclature:

"diRL-CXCY" are understood to mean di-rhamnolipids of the general formula (I) with $mRL=1$, in which one of the residues R^{1RL} and $R^{2RL} = (CH_2)_o-CH_3$ where $o = X-4$ and the remaining residue R^1 or $R^2 = (CH_2)_Y-CH_3$ where $Y=4$. "monoRL-CXCY" are understood to mean mono-rhamnolipids of the general formula (I) with $mRL=1$, in which one of the residues R^{1RL} and $R^{2RL} = (CH_2)_o-CH_3$ where $o = X-4$ and the remaining residue R^{1RL} or $R^{2RL} = (CH_2)_o-CH_3$

where o = Y-4.

[0056] The nomenclature used therefore does not distinguish between "CXCX" and "CYCX".

[0057] For rhamnolipids where mRL=0, monoRL-CX or diRL-CX is used accordingly.

[0058] If one of the abovementioned indices X and/or Y is provided with "Z", this signifies that the respective residue R¹RL and/or R²RL is equal to an unbranched, unsubstituted hydrocarbon residue having X-3 or Y-3 carbon atoms having Z double bonds.

[0059] Methods for preparing the relevant rhamnolipids are disclosed, for example, in EP2786743 and EP2787065; if mixtures of di- and mono-rhamnolipids are obtained, they can be converted with rhamnosidase to the mono-rhamnolipids as described in the examples of the instant writ. Rhamnolipids applicable in the context of the instant invention can also be produced by fermentation of *Pseudomonas*, especially *Pseudomonas aeruginosa*, which are preferably non genetically modified cells, a technology already disclosed in the eighties, as documented e.g. in EP0282942 and DE4127908. Rhamnolipids produced in *Pseudomonas aeruginosa* cells which have been improved for higher rhamnolipid titres by genetical modification can also be used in the context of the instant invention; such cells have for example been disclosed by Lei et al. in Biotechnol Lett. 2020 Jun;42(6):997-1002.

[0060] Rhamnolipids produced by *Pseudomonas aeruginosa* are commercially available from Jeneil Biotech Inc., e.g. under the tradename Zonix, from Logos Technologies (technology acquired by Stepan), e.g. under the tradename Nat-SurFact, from Biotensidion GmbH, e.g. under the tradename Rhapynal, from AGAE technologies, e.g. under the name R90, R95, R95Md, R95Dd, from Locus Bio-Energy Solutions and from Shanghai Yusheng Industry Co. Ltd., e.g. under the tradename Bio-201 Glycolipids.

[0061] Most of the above are mixtures of di- and mono-rhamnolipids which need to be converted to the mono-rhamnolipids, for exaple with rhamnosidase as described in the examples of the instant writ

[0062] Preferably the use according to the instant invention is characterized in that the mono-rhamnolipids comprise

12 wt.-% to 32 wt.-% monoRL-C8C10,
51 wt.-% to 81 wt.-% monoRL-C10C10,
1 wt.-% to 9 wt.-% monoRLC-10C12,
1 wt.-% to 9 wt.-% monoRLC-10C12:1,

wherein the weight percentages refer to all mono-rhamnolipids comprised in the composition.

[0063] Preferably the use according to the instant invention is characterized in that the cleaning formulation is a laundry formulation, a dish washing formulation, a car cleaning formulation, a hard floor cleaning formulation, a glass cleaner, a bathroom cleaner, a kitchen cleaner, an over cleaner, an all purpose cleaner, a wet wipe, a metal cleaner, a membrane cleaner for food and beverage applications, a CIP (cleaning in place) cleaner, a big kitchen cleaner, a traffic film remover, a carpet cleaner, an alkaline cleaner, a prespotter, a mild cleaner or a neutral cleaner.

[0064] Preferably the use according to the instant invention is characterized in that the surface or fabrics of the article are cleaned from natural and synthetic fats and/or oils, traffic films, dust, food rests, enzyme relevant stains, bleach relevant stains, pigment containing soils, blood, milk, carbon black and/or starch soil.

[0065] The present invention further provides the use of a composition comprising at least 92 wt.-%, preferably at least 95 wt.-%, more preferably at least 99 wt.-%, mono-rhamnolipids, wherein the weight percentages refer to all rhamnolipids comprised in the composition, as anti-deposition aid, preferably on textiles, and/or for preventing the greying of a textile.

[0066] Preferably the use as anti-deposition aid according to the instant invention is characterized in that the mono-rhamnolipids comprise

12 wt.-% to 32 wt.-% monoRL-C8C10,
51 wt.-% to 81 wt.-% monoRL-C10C10,
1 wt.-% to 9 wt.-% monoRLC-10C12,
1 wt.-% to 9 wt.-% monoRLC-10C12:1,

wherein the weight percentages refer to all mono-rhamnolipids comprised in the composition.

[0067] The present invention further provides the use of a composition comprising at least 92 wt.-%, preferably at least 95 wt.-%, more preferably at least 99 wt.-%, mono-rhamnolipids, wherein the weight percentages refer to all rhamnolipids comprised in the composition, for fatty stain removal preferably from hard surfaces.

[0068] Preferably the use for fatty stain removal according to the instant invention is characterized in that the mono-rhamnolipids comprise

12 wt.-% to 32 wt.-% monoRL-C8C10,
51 wt.-% to 81 wt.-% monoRL-C10C10,

1 wt.-% to 9 wt.-% monoRLC-10C12,
1 wt.-% to 9 wt.-% monoRLC-10C12:1,

wherein the weight percentages refer to all mono-rhamnolipids comprised in the composition.

[0069] The examples adduced hereinafter describe the present invention by way of example, without any intention that the invention, the scope of application of which is apparent from the entirety of the description and the claims, be restricted to the embodiments specified in the examples.

Examples:

Example 1: Preparation of mono-rhamnolipids

[0070] A fermentation with a *Pseudomonas putida* strain *pBBR1MCS2-Plac-rhlABC-T-Ptac-rhIC-T* comprising the rhamnolipid biosynthesis genes *RhIA*, *RhIB* and *RhIC*, the preparation of which is described in US2014296168, was carried out. The preculture in a shake flask was carried out as described in WO2012013554A1. For the main culture, a mineral medium (M9) was likewise employed. The fermentation was conducted in a 2 litre fermenter in a carbon-limited manner via a glucose feed input. The glucose feed input takes place by reference to the dissolved oxygen signal. The dissolved oxygen was regulated at 20% saturation via the stirrer speed. The pH is regulated to 7 via a pH electrode and addition of 2M sulphuric acid or a 20% by weight ammonia solution. To prevent excessive foaming of the fermentation broth, the defoamer DOW Corning 1500 was added as required. The fermentation was conducted over 4 days to a dry biomass of 15 g/l. The rhamnolipid concentration was determined by HPLC and was 9.8 g/l. After separating off the cells by means of centrifugation at 10 000 g, the fermentation broth was adjusted to a pH of 3.1 by adding concentrated H₂SO₄. Renewed centrifugation at 500 g gave a pasty solid concentrate with a RL fraction of 45% by weight and with a viscosity of > 10 000 mPas. With continuous stirring, a 50% strength by weight aqueous KOH solution was added to the pasty suspension of the concentrated rhamnolipid precipitate and a pH of 6 was established. The paste-like mass liquefied at this point with an accompanying sharp drop in viscosity. The suspension became a clear solution. By adding water, the solution was adjusted to an active content of 35% by weight. The rhamnolipid purity was > 90% by weight, based on the dry mass.

[0071] Rhamnolipid species detected by means of HPLC were:

RL total [%] (HPLC)	91
diRL-C8C10	13.9
monoRL-C8C10	0.51
diRL-C10C10	61.4
monoRL -C10C10	1.4
diRL-C10C12:1	5.9
diRL-C10C12	5.5
other RL	2.2

[0072] In the examples below this composition was used as di-rhamnolipids.

[0073] The 35% by weight rhamnolipid solution prepared as described above was diluted to 1 % by adding water. Two litres of this solution were heated to 50°C. With gentle stirring, 200 units of a thermostable rhamnosidase (ThermoActive™ Rhamnosidase A, Prokazyme) were added and the reaction was carried out overnight. After 20 h, a sample of the solution was analysed by means of HPLC. The di-rhamnolipid had been completely converted to mono-rhamnolipid and rhamnose. Then, the enzyme was deactivated for one hour at 80°C. The entire mixture was then freeze-dried. The freeze-dried product was adjusted to a mono-rhamnolipid active content of 35% by weight by adding water.

[0074] In the examples below this composition was used as mono-rhamnolipids.

Example 2: Cleaning and greying inhibition/antiredeposition of Soil

[0075] The following formulations were prepared with the numbers given being weight percentages of active matter, Benchmark 1 as well as Benchmark 2 and Benchmark 3, (internal available detergents) being not according to the invention, Benchmark 1 was purchased from supermarket

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Preparation of Detergent 1 and Benchmarks

[0076] For the purpose of conducting tests, exemplary formulations (Detergent 1 and Benchmark 2 and 3) were prepared according to the following protocol. Initially, water and sodium hydroxide required for saponification of fatty acids were introduced into a glass beaker of suitable size. The mixture was heat up to 60°C under vigorous stirring using magnetic stirrer. Subsequently, fatty acids were preconditioned to temperature 50°C and slowly added into the sodium hydroxide solution. After the full portion of fatty acid was added into water, the solution was stirred for one hour at temperature between 65 and 80°C followed by cooling for 30 minutes to room temperature. Afterwards, further constituents (except enzyme cocktail) were added at room temperature and under vigorous stirring. The ingredients were added in no specific or uniform sequence as the order of addition to the solution was not critical. Finally, any remaining amount of water was introduced to ensure desired concentration of ingredients. All ingredients were mixed using a magnetic stirrer and pH of the solution was adjusted to 8.0 by addition of sodium hydroxide. Finally, enzyme cocktail was added in the solution under vigorous stirring. The mixture was then stirred for 5 minutes to ensure a homogenous solution. The exemplary compositions were easily pourable and stable at room temperature for extended period.

Ingredient	Detergent 1	Benchmark 2
Na soap from palm kernel oil	2	2
Sodium Citrate	6	6
mono-rhamnolipids	15	
di-rhamnolipids		15
Trilon® M	1	1
Phenoxyethanol	0.45	0.45
NaOH (water solution)	1,6	1,6
Medley® Brilliant 300 L	2	2
	Add water to 100 %	Add water to 100 %
pH	8.3	8.3
Viscosity (mPas)	100	100
Appearance	clear	clear

Ingredient	Benchmark 3
Na soap from palm kernel oil	2
Sodium Citrate	6
SLES	15
Dissolvine® GLDA	1
Phenoxyethanol	0.45
NaOH (water solution)	1.6
Medley® Brilliant 300 L	2
	Add water to 100 %
pH	8.0
Viscosity (mPas)	25
Appearance	clear

[0077] A commercial product was used as Benchmark 1 and has the composition listed below: Benchmark 1 (Commercial product)

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Ingredient	Benchmark 1
Texapon N70	4.2%
Dehydol LT7	12.3%
Glyceryl Cocoate Peg 30	8.4
Potassium Oleate	8.0%
Polyquarternium PQ 6	0.5%
Sodium citrate	8.0%
Lactic Acid	3.0%
Perfume	0.5%
Ethanol (denatured, 96%)	8.5%
Glycerin	6.0%
Liquanase,2.5 L	0.5%
Stainzyme Plus 12 L	0.2%
Celluclean 4500 L	0.2%
	Add water to 100 %
pH	7.95

Laundry Detergents Results

[0078] For the evaluation of the products, the stain removal test and whiteness grade test have been carried out: 2 cycles (replicates) for the stain removal for 14 standard stains plus 8 additional fat stains, following A.I.S.E test (reduced version); and 6 consecutive cycles for whiteness grade assay with four different textiles (Polyamide, Polyester, Polyester:Cotton and Cotton). This test has been done at 30°C. The protocol that has been followed for this comparison is the A.I.S.E. test published on its website and named "Minimum protocol for comparative detergent tests".

[0079] A programmable Miele electronic household washing machine has been used for the development of this test. Fuzzy logic type control has been disabled. The selected program for performance test has been Cotton, 30°C and 1200rpm for the centrifugation process.

[0080] The 3kg of standardized cotton load was previously washed at 60°C with ECE2 detergent without bleach.

[0081] The dosage of the samples was 50mL for each formulation and following the commercial instructions of benchmark products. The water used had a water hardness of 14 ° deutsche Haerte.

[0082] The conditions were:

	Cotton wash program (at 30°C)
Duration Main Wash	70 min
Total Program Duration	120 min
Water Quantity Main Wash	(15 ± 2) L
Total Water Quantity	(55 ± 5) L
Number of Rinse Cycles	3
Final Spin Speed	1200 rpm

[0083] Together with the 3kg of ballast load, the set of 14-standard stains and 8-additional fat stains and 2 new units of soil SBL2004 have been introduced in each wash cycle.

[0084] Subsequently, cleaning performance of Detergent 1 was evaluated against the Benchmark formulations 1 and 2. The procedure used for the evaluating the cleaning performance is described below:

The evaluation of stain removal and whiteness degree were carried out using the Y values of the colour coordinate measurements of Y, x, y, with a light source D65 and with a UV filter that cuts at 420nm in a spectrophotometer. Stains

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were measured unfolded, 2 measurements per stain (in the center of the circular area, or closest homogenous area). Measurements were taken on each stain before wash (to verify quality of stains) and after the wash and to evaluate standard deviations and are reported.

[0085] Stain removal results are expressed as the mean of value Y between two replicates and its standard deviation. The better the soil removal, the larger the Y value.

[0086] Whiteness degree has been evaluated by Y-value in four standard textiles (Polyamide, Polyester, Polyester:Cotton and Cotton) through 6 consecutive washes. Also here: The better the soil removal, the higher the Y value.

[0087] A set of 14 current A.I.S.E. stains set for each replicate was used (purchased from CFT, MON-AISE A+B). The different stains are:

Stains	Stain classes (Consumer denomination / chemical nature)
Fruit juice	Drink/Bleachable
Tee	Drink/Bleachable
Grass	General soil/Bleachable - enzymatic
Unused motor oil	Grease, oil/Greasy particulate
Make up	Cosmetic/Greasy particulate
Red wine	Drink/Bleachable
Coffee	Drink/Bleachable
Tomato Puree	Food/Bleachable
Salad Dressing/Balsamico	Food/Bleachable-Enzymatic
Blood	General Soil/Enzymatic
French Squeezy Mustard	Food/Bleachable-Enzymatic
Chocolate	Food/Enzymatic
Grass/Mud	General Soil/Bleachable-enzymatic- particulate
Beef fat	Grease, oil/Greasy - Enzymatic

[0088] A set of 8 fatty stains set for each replicate was used. The different stains are:

Stains		
Lipstick diluted red (instead of another make up stain)	Grease, oil/Greasy - Enzymatic	C-S-216
Carbon black/ olive oil	Grease, oil/Greasy	E-106
IEC carbon black/mineral oil	Grease, oil/Greasy	C-01
Butterfat with colorant	Grease, oil/Greasy - Enzymatic	C-S-10
High discriminative sebum	Grease, oil/Greasy - Enzymatic	C-S-132
Olive oil with chlorophyll	Grease, oil/Greasy - Enzymatic	C-04
Beef fat, colored with sudan red	Grease, oil/Greasy - Enzymatic	C-S-61
50%lard, 50%Beef fat with colorant	Grease, oil/Greasy - Enzymatic	C-S-63s

[0089] For the evaluation of whiteness degree, four different textiles were used:

- Polyamide 100% (PA)
- Polyester 100% (PES)
- Polyester:Cotton 70:30 (PESCO)
- Cotton 100% (CO)

[0090] Performance results in stain removal properties:

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Cleaning performance results on 14 AISE stains for tested compositions and benchmarks

STAIN PART 1		Benchmark 1	Benchmark 2	Detergent 1
		Average	Average	Average
Fruit Juice	1	56,66	56,87	57,47
Tea	2	65,11	64,58	66,43
Grass	3	72,06	72,47	71,67
Motor oil	4	60,07	57,9	66,03
Make up	5	66,49	67,14	67,16
Red Wine	6	51,04	50,96	53,49
Coffee	7	53,63	55,8	55,37
Tomato Puree	8	66	73,5	70,54
Salad Dressing Balsamico	9	61,09	57,6	59,01
Blood	10	61,66	70,96	73,29
French squeezy mustard	11	76,95	74,66	74,62
Chocolate	12	54,36	54,52	55,11
Grass/mud	13	37,7	51,78	49,23
Beef fat	14	70,36	71,72	78,01
%stain removal (AISE stains)		59,95	62,89	64,1
Total		839,36	880,42	897,42

Cleaning performance results on 8 fatty stains for tested compositions and benchmarks

STAIN PART 2	Benchmark 1	Benchmark 2	Detergent 1
	Average	Average	Average
Lipstick diluted red	57,73	59,05	58,17
Carbon black/olive oil	32,83	31,58	33,68
IEC carbon black/mineral oil	40,7	46,8	48,78
Butterfat with colourant	65,68	69,2	72,95
High discriminative sebum	63,75	63,92	64,35
Olive oil with chlorophyll	47	49,57	47,28
50%lard. 50%Beef fat with colorant	35,68	32,66	51,22
Beef fat. coloured with sudan red	38,85	42	53,84
%stain removal (AISE stains)	47,78	49,35	53,78
Total	382,2	382,2	430,25

Results evaluation:

[0091] It was surprisingly found that the composition according to the instant invention delivers superior cleaning results to the commercial (Benchmark 1) and internal benchmark (Benchmark 2). Detergent 1 achieved an average of 53,78 % stain removal (for the 8 additional fatty stains) and 64.1 % stain removal (for the 14 AISE stains) compared to the two benchmarks: Benchmark 1: 47,78 % stain removal (for the 8 additional fatty stains) and 59,95 % stain removal (for the 14 AISE stains); Benchmark 2: 49,95 % stain removal (for the 8 additional fatty stains) and 62,89 % stain removal

(for the 14 AISE stains). Therefore it becomes evident that mono-rhamnolipids containing detergent provides surprisingly superior performance. Especially in the case of solid fatty stains the object of invention is showing better stain removal performance in laundry cleaning application than traditional surfactants and even better than the di-rhamnolipid based detergents (Benchmark 2).

[0092] Performance results in Whiteness Degree:

	NO WASH	Benchmark 1	Benchmark 2	Detergent 1
	Y	Y	Y	Y
Cotton	89,71	90,01	91,21	91,58
Polyamide	89,72	86,49	87,22	87,96
Polyester	85,13	82,45	72,82	83,19
Polyester/Cotton	88,69	87,25	88,16	88,81

Results evaluation:

[0093] As seen in the results described above, the composition according to the instant invention surprisingly delivers better results than the two benchmarks (Benchmark 1 and Benchmark 2). Especially in the case of polyester fabrics the performance is even better than the Benchmark 2, containing the di-rhamnolipid.

Example 3: Rinse Properties

[0094] This example demonstrates perceived rinsability of surfactants and surfactant-based formulations from skin, simulating rinsing hands after either cleaning hands or washing fabric or dishes.

[0095] Perceived rinsability of Detergent 1 was tested and evaluated against Benchmark 1 and Benchmark 2 as well as Benchmark 3,

[0096] The procedure used for the evaluating perceived rinsability from skin is described in the following test protocol based on the internal test methodology:

12.5 g of tested formulation (either Test formulation Detergent 1 or Benchmark Formulations 1 - 3) were mixed with 2.5 L of tap water that was pre-heated to temperature of 30°C and placed inside a basin of minimum volume equal to 5 L. Subsequently, trained panellists were asked to evaluate perceived rinsability of the formulation. For this reason, the panellist immersed hands in the aqueous solution prepared according to the above-described method and simulated moves associated with washing hands for 30 seconds. Subsequently, the panellist was asked to rinse hands under tap water at temperature of 30°C. This step was performed under constant flow of water and above a basin used to collect all water used for the rinse. Once the panellist communicated that there is no perceived need to continue rinse, water flow was stopped, and the weight of water used for the rinse was measured. Test was performed separately with 10 different panellists for each of the tested formulations. It was required that one panellist was testing only one formulation per day and the order of tested formulations for each of the panellist was randomized. The results were evaluated, and average amount of water used in the rinse step is described below.

[0097] Average amount of water required for rinsing-off hands immersed in tested formulations as perceived by the panellists:

	Benchmark formulation 1	Benchmark formulation 2	Benchmark formulation 3	Detergent 1
Average amount of water required for rinse / mL	318	147	283	129

[0098] As is readily evident from the results the composition according to the instant invention surprisingly requires substantially less water to be rinsed-off, as perceived by trained panellists participating in the experiment. Test formulation Detergent 1 requires on average 129 mL of water for the rinse step, that is substantially less than 283 mL of water required to rinse off hands after immersing them in the solution of Benchmark formulation 3 that contains sodium laureth sulfate. The amount of water used for rinsing of solution of Test formulation Detergent 1 is also substantially lower than the average value of 318 mL needed in the test with a commercially available laundry detergent described as Benchmark formulation 1.

[0099] Finally, Test formulation 1 required on average less water for the rinse step than Di-rhamnolipid-based Benchmark formulation 2 (147 mL on average). Therefore, it becomes evident that mono-rhamnolipid-containing formulation unexpectedly provides better perceived rinsability from skin than formulation based on commonly used commercially available surfactants.

[0100] Consequently, this means that the use of the composition of the instant invention leads to a decrease of water use in the rinsing step of up to 60 %

Example 4: Hard Surface Cleaning (HSC) Performance

[0101] This example demonstrates the cleaning effect of mono-rhamnolipids when used in formulations of household cleaners on hard surfaces.

[0102] Exemplary formulations described in the table below were prepared according to the following protocol. Initially, a measured amount of water was introduced into a glass beaker of a suitable size. Subsequently, further constituents were added at room temperature and under vigorous stirring. The ingredients were added in no specific or uniform sequence as the order of addition to the solution was not critical. Finally, any remaining amount of water was introduced to ensure desired concentration of ingredients. All ingredients were mixed using a magnetic stirrer and pH of the solution was adjusted to 8.7 by addition of sodium carbonate. The mixture was then stirred for 5 minutes to ensure a homogenous solution. The exemplary compositions were easily pourable and stable at room temperature for extended period.

[0103] According to the above-described method, two formulations were prepared:

HSC Benchmark formulation 1, that contained the di-rhamnolipids described above as the main active ingredient. It was subsequently used as a control formulation.

[0104] HSC Test formulation 1, that contained the mono-rhamnolipids described above as the main active ingredient.

[0105] Compositions of HSC Benchmark formulation 1 and HSC Test formulation 1 evaluated in cleaning performance tests:

	HSC Benchmark formulation 1 /%	HSC Test formulation 1 /%
di-rhamnolipids	1.00	
mono-rhamnolipids		1.00
Sodium citrate	0.7	0.7
Sodium carbonate	~0.2 (to achieve pH 8.7)	~0.2 (to achieve pH 8.7)
Water	to 100	to 100

[0106] Subsequently, cleaning performance of HSC Test formulation 1 was evaluated against the HSC Benchmark formulation 1. The procedure used for the evaluating the cleaning performance is described in the following test protocol.

[0107] Cleaning performance test was conducted according to the internal test methodology, which was adapted from the recommendation of German Cosmetic, Toiletry, Perfumery and Detergent Association (IKW): "IKW Recommendation for the Quality Assessment of the Product Performance of All-Purpose Cleaners 2014" (IKW Test Protocol). The principle of the test was to evaluate the cleaning power of tested formulations by assessing their efficacy in removal of stubborn soil deposited on melamine tiles. White, melamine tiles covered with black, stubborn soil composed of mixture of fat, clay, and carbon black (here called Test Monitors) were purchased from Center for Testmaterials B.V. (available under the name DM-40 Tile). To ensure high reproducibility of the results, all Test Monitors belonged to the same production batch and were conditioned prior to use for 24 hours at 20°C inside a climatic chamber.

[0108] To evaluate cleaning performance of the prepared formulations, Test Monitors were placed in a TQC Sheen washability tester (model AB5000) and locked in a position. One Test Monitor was placed in the Washability Tester at the time, but it was ensured that for each of the cleaning formulations, the test was conducted at least once at each of the four tracks of the Washability Tester. Subsequently, dry, 9 cm by 4.5 cm sponges were first moistened with tap water, and water excess was wrung out from sponges. Thereafter, 10 g of the test solution was loaded onto the sponge and sponge was attached to the cleaning arm of the Washability Tester. Washability Tester was then actuated and controlled to provide 100 cleaning cycles (so 200 linear strokes) over the Test Monitor. The speed of the strokes for 20 cycles per minute and the test was performed at room temperature. After 100 cleaning cycles were completed, the Test Monitor was removed from the Sheen tester, rinsed with tap water, and allowed to dry. The test was repeated several times to provide 5 replicates for each tested composition.

[0109] The treated Test Monitors were visually evaluated by five panelists who were asked to rate the cleaning efficacy achieved by each of the compositions. Panelists ranked the cleaning efficacy on a scale from 0 to 10, with 0 representing no observed cleaning and 10 representing a complete removal of the stain. For comparative purposes, each of the

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panellists was provided with a new, soiled Test Monitor that represented no cleaning as well as with a fully cleaned Test Monitor that represented the score of 10. Additionally, the panellists were provided with the evaluation template according to IKW Test Protocol to enable more accurate assessment of cleanness. The scores were summed and averaged for each of the tested composition and the results are reported.

[0110] Cleaning performance results for tested compositions (average cleaning score, 0 - no cleaning, 10 - complete cleaning):

	HSC Benchmark formulation 1	HSC Test formulation 1
Average cleaning score	4.1	10.0

[0111] As is readily evident from the results reported above, the composition containing object of invention surprisingly delivers superior cleaning performance results to the benchmark. HSC Test formulation 1 achieved an average cleaning score of 10.0 that by far exceeds cleaning result of 4.1 reported for HSC Benchmark formulation 1. Therefore, it becomes evident that mono-rhamnolipid-containing formulation unexpectedly provide better cleaning performance in hard-surface cleaning application than Di-rhamnolipid-based cleaners.

Further formulation examples

[0112] All ingredients are listed in wt.-% active matter. For highly concentrated mono-rhamnolipid compositions the freeze-dried product was incorporated into the formulations.

Powder detergent 1

Mono-rhamnolipids of example 1	12.0%
Linear sodium alkylbenzenesulphonate	5.3%
Fatty alcohol ethoxylate C12-18 (7 EO)	2.0%
Sodium salts of fatty acids	2.1%
Antifoam DC2-4248S	5.0%
Zeolite 4A	36.3%
Sodium carbonate	14.9%
Sodium salt of acrylic-maleic acid copolymer (Sokalan CP5)	3.1%
Sodium silicate	3.8%
Carboxymethylcellulose	1.5%
Dequest 2066 (Phosphonate)	3.6%
Optical brighteners	0.3%
Protease (Savinase 8.0)	0.5%
Sodium perborate monohydrate	1.0%
Sodium sulphate	Remainder

Powder detergent 2

Mono-rhamnolipids of example 1	12.0%
Linear sodium alkylbenzenesulphonate	5.3%
Fatty alcohol ethoxylate C12-18 (7 EO)	2.0%
Sodium salts of fatty acids	2.1%
Antifoam DC2-4248S	5.0%
Zeolite 4A	36.3%

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(continued)

	Sodium carbonate	14.9%
5	Sodium salt of acrylic-maleic acid copolymer (Sokalan CP5)	3.1%
	Sodium silicate	3.8%
	Carboxymethylcellulose	1.5%
	Dequest 2066 (Phosphonate)	3.6%
10	Optical brighteners	0.3%
	Protease (Savinase 8.0)	0.5%
	Sodium perborate monohydrate	1.0%
15	Sodium sulphate	Remainder

Liquid detergent 1

	Mono-rhamnolipids of example 1	6.0%
20	Linear sodium alkylbenzenesulphonate	4.0%
	Fatty alcohol ethoxylate C12-18 (7 EO)	5.0%
	Fatty acid	1.0%
25	Phosphonates	0.5%
	Propanediol	5.0%
	Protease (Alcalase® 2.4 L FG)	1%
	1,2-Benzisothiazoline-3-one ('BIT', e.g. "Proxel")	100 ppm
30	Sodium hydroxide	--> pH 8.5
	Demineralized water	Remainder

Liquid detergent 2

	Mono-rhamnolipids of example 1	6.0%
	Linear sodium alkylbenzenesulphonate	4.0%
40	Fatty alcohol ethoxylate C12-18 (7 EO)	5.0%
	Fatty acid	1.0%
	Phosphonates	0.5%
	Propanediol	5.0%
45	Protease (Alcalase® 2.4 L FG)	1%
	1,2-Benzisothiazoline-3-one ('BIT', e.g. "Proxel")	100 ppm
	Sodium hydroxide	--> pH 8.5
50	Demineralized water	Remainder

Liquid detergent concentrate 1

55	Mono-rhamnolipids of example 1	30.0%
	Sodium lauryl ether sulphate	10.0%
	Linear sodium alkylbenzenesulphonate	5.0%

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(continued)

Phosphonates	0.5%
Sodium metaborate	1.0%
Propanediol	2.0%
Protease (Alcalase® 2.4 L FG)	1%
Lipase	1%
Amylase	1%
Fragrances	0.5%
1,2-Benzisothiazoline-3-one ('BIT', e.g. "Proxel")	100 ppm
Sodium hydroxide	--> pH 8.5
Demineralized water	Remainder

Liquid detergent concentrate 2

Mono-rhamnolipids of example 1	30.0%
Sodium lauryl ether sulphate	10.0%
Linear sodium alkylbenzenesulphonate	5.0%
Phosphonates	0.5%
Sodium metaborate	1.0%
Propanediol	2.0%
Protease (Alcalase® 2.4 L FG)	1%
Lipase	1%
Amylase	1%
Fragrances	0.5%
1,2-Benzisothiazoline-3-one ('BIT', e.g. "Proxel")	100 ppm
Sodium hydroxide	--> pH 8.5
Demineralized water	Remainder

Detergent 3 and 4

Na soap from palm kernel oil	2	2
Sodium Citrate	6	6
Mono-rhamnolipids of example 1	7.5	5
Dissolvine® GLDA	1	1
Phenoxyethanol	0.45	0.45
NaOH (water solution)	1	1
Medley® Brilliant 300 L	2	2
	Add water to 100 %	Add water to 100 %
pH	8.0	8.2

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Detergent 5

Na soap from palm kernel oil	2
Sodium Citrate	6
Mono-rhamnolipids of example 1	15
Dissolvine® GLDA	1
TexCare SNR 170 Terra	1
Phenoxyethanol	0.45
NaOH (water solution)	1
Medley® Brilliant 300 L	2
	Add water to 100 %
pH	8.2

Detergent 6

Na soap from palm kernel oil	2
Sodium Citrate	6
Mono-rhamnolipids of example 1	15
Dissolvine® GLDA	1
TexCare 260 SG Terra	1
Phenoxyethanol	0.45
NaOH (water solution)	1
Medley® Brilliant 300 L	2
	Add water to 100 %
pH	8.2

Detergent 7

Na soap from palm kernel oil	2
Sodium Citrate	6
Mono-rhamnolipids of example 1	15
Dissolvine® GLDA	1
Carboxyline CMI	1
Phenoxyethanol	0.45
NaOH (water solution)	1
Medley® Brilliant 300 L	2
	Add water to 100 %
pH	8.2

Detergent 8

Na soap from palm kernel oil	2
Sodium Citrate	6

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(continued)

	Mono-rhamnolipids of example 1	10
5	SLES 2EO	5
	Dissolvine® GLDA	1
	Phenoxyethanol	0.45
	NaOH (water solution)	1
10	Medley® Brilliant 300 L	2
		Add water to 100 %
	pH	8.2

Detergent 9

	Na soap from palm kernel oil	2
	Sodium Citrate	6
20	Mono-rhamnolipids of example 1	10
	SLES 2EO	5
	FAEO C12-18, 7 EO	5
25	Dissolvine® GLDA	1
	Phenoxyethanol	0.45
	NaOH (water solution)	1
30	Medley® Brilliant 300 L	2
		Add water to 100 %
	pH	8.2

Detergent 10

	Na soap from palm kernel oil	2
	Sodium Citrate	6
40	Mono-rhamnolipids of example 1	10
	FAEO C12-18, 7 EO	5
	Dissolvine® GLDA	1
45	Phenoxyethanol	0.45
	NaOH (water solution)	1
	Medley® Brilliant 300 L	2
		Add water to 100 %
50	pH	8.2

Detergent 11

55	Na soap from palm kernel oil	2
	Sodium Citrate	6
	Mono-rhamnolipids of example 1	10

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(continued)

SLES 2EO	5
FAEO C12-18, 7 EO	5
Carboxyline CMI	1
Dissolvine® GLDA	1
Phenoxyethanol	0.45
NaOH (water solution)	1
Medley® Brilliant 300 L	2
	Add water to 100 %
pH	8.2

Detergent 12

Na soap from palm kernel oil	2
Sodium Citrate	6
Mono-rhamnolipids of example 1	10
SLES 2EO	5
FAEO C12-18, 7 EO	5
TexCare 260 SG Terra	1
Dissolvine® GLDA	1
Phenoxyethanol	0.45
NaOH (water solution)	1
Medley® Brilliant 300 L	2
	Add water to 100 %
pH	8.2

Detergent 13

Na soap from palm kernel oil	2
Sodium Citrate	6
Mono-rhamnolipids of example 1	20
Dissolvine® GLDA	1
Phenoxyethanol	0.45
NaOH (water solution)	1
Medley® Brilliant 300 L	2
	Add water to 100 %
pH	8.3
Appearance	clear

Detergent 14

Na soap from palm kernel oil	2
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(continued)

	Sodium Citrate	6
5	Mono-rhamnolipids of example 1	15
	sophorolipids	2.5
	Dissolvine® GLDA	1
	Phenoxyethanol	0.45
10	NaOH (water solution)	1
	Medley® Brilliant 300 L	2
		Add water to 100 %
15	pH	8.0
	Appearance	clear

Detergent 15

20	Na soap from palm kernel oil	2
	Sodium Citrate	6
	Mono-rhamnolipids of example 1	15
25	Dissolvine® GLDA	1
	sophorolipids	2.5
	Carboxyline CMI	1
	Phenoxyethanol	0.45
30	NaOH (water solution)	1
	Medley® Brilliant 300 L	2
		Add water to 100 %
35	pH	8.2

Detergent 16

40	Na soap from palm kernel oil	2
	Sodium Citrate	6
	Mono-rhamnolipids of example 1	10
45	Dissolvine® GLDA	1
	di-rhamnolipids	5
	Phenoxyethanol	0.45
	NaOH (water solution)	1
50	Medley® Brilliant 300 L	2
		Add water to 100 %
	pH	8.2

Detergent 17

	Na soap from palm kernel oil	2
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(continued)

Sodium Citrate	6
Mono-rhamnolipids of example 1	7,5
Dissolvine® GLDA	1
di-rhamnolipids	7,5
Phenoxyethanol	0.45
NaOH (water solution)	1
Medley® Brilliant 300 L	2
	Add water to 100 %
pH	8.2

Detergent 18

Na soap from palm kernel oil	2
Sodium Citrate	6
Mono-rhamnolipids of example 1	5
Dissolvine® GLDA	1
di-rhamnolipids	10
Phenoxyethanol	0.45
NaOH (water solution)	1
Medley® Brilliant 300 L	2
	Add water to 100 %
pH	8.2

Detergent 19

Na soap from palm kernel oil	2.0
Sodium Citrate	6.0
Mono-rhamnolipids of example 1	20
Poly L-Aspartic acid Sodium salt	1.0
Phenoxyethanol	0.45
Protease	1.0
Amylase	0.4
Lipase	0.4
Pectinase	0.2
Carenzyme Premium	0.15
Celluclean 4500T	0.15
Mannanase	0.2
	Add water to 100 %
pH	8.0

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Detergent 20

Na soap from palm kernel oil	2.0
Sodium Citrate	6.0
Mono-rhamnolipids of example 1	20
Poly-L-glutamic acid sodium salt	1.0
Phenoxyethanol	0.45
Protease	1.2
Amylase	0.4
Lipase	0.4
Pectinase	0.2
Carezyme Premium	0.15
Celluclean 4500T	0.15
Mannanase	0.2
	Add water to 100 %
pH	8.0

Detergent 21

Na soap from palm kernel oil	2.0
Sodium Citrate	6.0
Mono-rhamnolipids of example 1	20
Poly-L-glutamic acid sodium salt	1.0
Carboxy methyl inulin	1.0
Phenoxyethanol	0.45
Protease	1.2
Amylase	0.4
Lipase	0.4
Pectinase	0.2
Carezyme Premium	0.15
Celluclean 4500T	0.15
Mannanase	0.2
	Add water to 100 %
pH	8.0

Detergent 22

Na soap from palm kernel oil	2.0
Sodium Citrate	6.0
Mono-rhamnolipids of example 1	20
Poly-L-glutamic acid sodium salt	1.0
Carboxy methyl inulin	1.0

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(continued)

Phenoxyethanol	0.45
Protease	1.0
Amylase	0.4
Lipase from <i>Stachybotrys chlorohalonata</i>	0.4
Pectinase	0.2
Carenzyme Premium	0.15
Celluclean 4500T	0.15
Mannanase	0.2
	Add water to 100 %
pH	8.0

Detergent 23

Na soap from palm kernel oil	2.0
Sodium Citrate	6.0
Mono-rhamnolipids of example 1	20
Carboxy methyl inulin	3
Phenoxyethanol	0.45
Protease	1.0
Amylase	0.4
Lipase from <i>Stachybotrys chlorohalonata</i>	0.4
Pectinase	0.2
Carenzyme Premium	0.15
Celluclean 4500T	0.15
Mannanase	0.2
	Add water to 100 %
pH	8.0

Detergent 24

Na soap from palm kernel oil	2.0
Sodium Citrate	6.0
MGDA	1
Mono-rhamnolipids of example 1	20
Poly-L-glutamic acid sodium salt	1.0
Carboxy methyl cellulose	1.0
Phenoxyethanol	0.45
Protease	1.0
Amylase	0.4
Lipase from <i>Stachybotrys chlorohalonata</i>	0.4

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(continued)

Pectinase	0.2
Carenzyme Premium	0.15
Celluclean 4500T	0.15
Mannanase	0.2
	Add water to 100 %
pH	8.3

Detergent 25

Na soap from palm kernel oil	2.0
Sodium Citrate	6.0
Mono-rhamnolipids of example 1	20
Polyitaconic acid	3
Phenoxyethanol	0.45
Protease	1.0
Amylase	0.4
Lipase from <i>Stachybotrys chlorohalonata</i>	0.4
Pectinase	0.2
Carenzyme Premium	0.15
Celluclean 4500T	0.15
Mannanase	0.2
	Add water to 100 %
pH	8.3

Detergent 26

Na soap from palm kernel oil	2.0
Sodium Citrate	6.0
MGDA	1
Sodium lauryl ether sulfate (SLES)	5
Mono-rhamnolipids of example 1	15
Phenoxyethanol	0.45
Medley® Brilliant 300 L	2
	Add water to 100 %
pH	8.3

Detergent 27

Na soap from palm kernel oil	2.0
Sodium Citrate	6.0
MGDA	1

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(continued)

Alkyl benzene sulfonates (LAS)	3
Mono-rhamnolipids of example 1	15
Phenoxyethanol	0.45
Medley® Brilliant 300 L	2
	Add water to 100 %
pH	8.2

Detergent 28

Na soap from palm kernel oil	2
Sodium Citrate	6
Mono-rhamnolipids of example 1	15
Trilon® M	1
Dehyton® PL (lauramine oxide)	1
Phenoxyethanol	0.45
NaOH (water solution)	1,6
Medley® Brilliant 300 L	2
	Add water to 100 %
pH	8.1

Detergent 29

Na soap from palm kernel oil	2
Sodium Citrate	6
Mono-rhamnolipids of example 1	15
Trilon® M	1
REWOFERM SL P	5
Phenoxyethanol	0.45
NaOH (water solution)	1,6
Medley® Brilliant 300 L	2
Preservative	0,5
	Add water to 100 %
pH	8.1

Detergent 30

LAS (Alkylbenzolsulfonate)	15.0
Mono-rhamnolipids of example 1	15.0
SLES 2EO (Sodium laureth sulphate)	7.1
FAEO C12-18. 7 EO (fatty alcohol ethoxylated C12-18, 7EO)	10.0
Coco fatty acid	2.0

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(continued)

	Texcare SRN 170	1.4
5	Methoxy PPG Methacrylcholine	0.5
	Citric acid	3.0
	Sodium citrate	2.0
	HEDP (60% solution)	3.3
10	Perfume	1.0
	Sorbitol (solution)	2.9
	Glycerin	2.0
15	MPG	11.0
	Monoethanolamine	9.0
	Medley® Brilliant 300 L	2
	Preservative	0,5
20		Add water to 100 %
	pH	8.5

Detergent 31

25	Mono-rhamnolipids of example 1	20,0
	SLES 2EO (Sodium laureth sulphate)	5,0
30	FAEO C12-18. 7 EO (fatty alcohol ethoxylated C12-18, 7EO)	5,0
	Coco fatty acid	2.0
	Texcare SRN 170	1.0
	Citric acid	3.0
35	Sodium citrate	2.0
	HEDP (60% solution)	3.3
	Perfume	1.0
40	Sorbitol (solution)	2.9
	Glycerin	2.0
	MPG	11.0
	Monoethanolamine	9.0
45	Medley® Brilliant 300 L	2
		Add water to 100 %
	pH	8.5

Detergent 32

50	Na soap from palm kernel oil	2
55	Sodium Citrate	6
	Mono-rhamnolipids of example 1	15
	Trilon® M	1

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(continued)

Caprylyl/Capryl Glucoside	5
Phenoxyethanol	0.45
NaOH (water solution)	1,6
Medley® Brilliant 300 L	2
Preservative	0,5
	Add water to 100 %
pH	8.1

Detergent 33

Mono-rhamnolipids of example 1	5
Laureth-6	25
Propylene Glycol	20
Glycerol	6
Caprylyl/Capryl Glucoside	5
Na soap from palm kernel oil	2
Citric acid	1
NaOH (water solution)	1,6
Medley® Brilliant 300 L	2
Preservative	0,5
	Add water to 100 %
pH	8.1

Detergent 34

Mono-rhamnolipids of example 1	5
Laureth-6	8
Propylene Glycol	2
SLS (Sodium lauryl sulfate)	7
Glycerol	2
Caprylyl/Capryl Glucoside	2
Na soap from palm kernel oil	2
Citric acid	1
NaOH (water solution)	1,6
Medley® Brilliant 300 L	2
Preservative	0,5
	Add water to 100 %
pH	8.1

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Detergent 35

Mono-rhamnolipids of example 1	5
Laureth-6	8
Propylene Glycol	2
SLES (Sodium laureth sulfate)	7
Glycerol	2
Na soap from palm kernel oil	2
Citric acid	1
NaOH (water solution)	1,6
Medley® Brilliant 300 L	2
	Add water to 100 %
pH	8.1

Detergent 36

Mono-rhamnolipids of example 1	5.0
TEA Dodecylbenzensulfonate	12
TEA Etidronate/TEA EHDP	8,0
Alcohols C12-15 ethoxylated	8.0
SLES (Sodium laureth sulfate)	5.0
TEA Citrate	2.0
Aziridine homopolymer ethoxylated	2.0
Glycerol	2.0
1,4 Benzenedicarboxylic acid, 1,4, dimethyl Ester, polymer	1.0
Propylene Glycol	1.0
Styrene acrylates copolymer	0.5
TEA sulfate	0,2
TEA cocoate hydrogenated	0.2
Medley® Brilliant 300 L	2
Preservative	0,4
	Add water to 100 %
pH	9

Detergent 37

Mono-rhamnolipids of example 1	5.0
Alcohols C12-18 ethoxylated	10
SLES (Sodium laureth sulfate)	5.0
Potassium Oleate	8.0
Ethanol	4.0
Sodium Citrate	4.0

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(continued)

Glycerol	2.0
Medley® Brilliant 300 L	2
Preservative	0,4
	Add water to 100 %
pH	9

Detergent 38

Mono-rhamnolipids of example 1	5.0
Alcohols C12-18 ethoxylated	10
SLES (Sodium laureth sulfate)	5.0
Potassium Oleate	8.0
Ethanol	4.0
Sodium Citrate	4.0
Glycerol	2.0
Polyquaternium 6	0.5
Medley® Brilliant 300 L	2
Preservative	0,4
	Add water to 100 %
pH	9

Detergent 39

Mono-rhamnolipids of example 1	5.0
Alcohols C12-18 ethoxylated	10
SLES (Sodium laureth sulfate)	5.0
Potassium Oleate	8.0
Ethanol	4.0
Sodium Citrate	4.0
Glycerol	2.0
Carboxymethyl inulin	0.5
Medley® Brilliant 300 L	2
Preservative	0,4
	Add water to 100 %
pH	9

Bio pre-spotter 1

Sodium Citrate	6.0
Mono-rhamnolipids of example 1	10
Monopropylene glycol	2

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(continued)

Phenoxyethanol	0.45
Protease	1.2
Amylase	0.4
Lipase	0.4
Pectinase	0.2
Carenzyme Premium	0.15
Celluclean 4500T	0.15
Mannanase	0.2
	Add water to 100 %
pH	8.0

Bio pre-spotter 1

Sodium Citrate	6.0
Mono-rhamnolipids of example 1	10
Monopropylene glycol	2
Phenoxyethanol	0.45
Medley® Brilliant 300 L	2
	Add water to 100 %
pH	8.0

Pre-spotter 1

Sodium Citrate	1
Mono-rhamnolipids of example 1	4
SLES (Sodium laureth sulfate)	1
Marlipal 24/70	10
Monopropylene glycol	2
Phenoxyethanol	0.45
Medley® Brilliant 300 L	2
	Add water to 100 %
pH	8.0

Green Hand Dish Wash Formulation 1

Mono-rhamnolipids of example 1	4,0
SLES (sodium lauryl sulphate)	6,5
Tego Betain C 60	2,3
REWOFORM SL ONE	2,4
Xanthan Gum	3,0
NaOH, 50% (Sodium Hydroxide)/Citric acid	To pH 5,3

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(continued)

Water (Dye, Perfume)	Add to 100
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Green Hand Dish Wash Formulation 2

Mono-rhamnolipids of example 1	10,0
Tego Betain C 60	2,3
REWOFORM SL ONE	2,4
Xantham Gum	3,0
NaOH, 50% (Sodium Hydroxide)/Citric acid	To pH 5,3
Water (Dye, Perfume)	Add to 100

Green Hand Dish Wash Formulation 3

Mono-rhamnolipids of example 1	10
REWOFORM SL ONE	6
Xantham Gum	3,00
NaOH, 50% (Sodium Hydroxide)/Citric acid	To pH 5,3
Water (Dye, Perfume)	Add to 100

Car Shampoo, High Degreasing

Mono-rhamnolipids of example 1	4,00
Laureth-12, 80%	9,40
Sodium Metasilicate	3,00
Tetrasodium salt of EDTA	3,00
NaOH, 50% (Sodium Hydroxide)	4,00
Water (Dye, Perfume)	76,60
	100,00

Car Shampoo

Citric Acid Monohydrate	0,10
Trisodium salt of methylglycinediacetic acid (Na ₃ MGDA), 40%	6,00
Mono-rhamnolipids of example 1	10,00
Water (Dye, Perfume)	83,90

Car Shampoo, Triple Foam

Sodium C14-16 alpha Olefin Sulfonate, 40%	45,00
Mono-rhamnolipids of example 1	10,00
Water (Dye, Perfume)	45,00

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Traffic Film Remover

REWOPOL® SC 200 MB	6,00
Mono-rhamnolipids of example 1	2,00
Trisodium salt of methylglycinediacetic acid (Na3MGDA), 40%	15,00
Citric Acid Monohydrate	0,50
Water (Dye, Perfume)	76,50

Traffic Film Remover for Road Signs

Water (Dye, Perfume)	78,50
Trisodium salt of methylglycinediacetic acid (Na3MGDA), 40%	8,00
Monoethanolamine	3,00
Citric Acid Monohydrate	0,50
REWOPOL® SC 200 MB	4,00
Mono-rhamnolipids of example 1	2,00
REWOCARE® 755	4,00

Windshield Cleanser, Winter

Water, demineralized (Aqua)	29,30
Isopropanol	70,00
Mono-rhamnolipids of example 1	0,70

Truck and Canvas Cleanser, Dilutable

Water (Dye, Perfume)	80,10
Citric Acid Monohydrate	1,50
Gluconic acid, 50%	6,00
Sequion 40 Na 32 (Sodium salt of DTPMP)	3,00
NaOH, 50% (Sodium Hydroxide)	3,40
REWOPOL® SC 200 MB	4,00
Mono-rhamnolipids of example 1	2,00

Carpet Cleaner with Odor Removal

Mono-rhamnolipids of example 1	16,00
REWOPOL® D 510 NC	2,00
TEGO SORB A 30	3,00
Phosphonic acid (DTPMP), 32%	3,20
Water (Dye, Perfume)	75,80

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Metal Cleaner

Water (Dye, Perfume)	82,00
TOMADOL® 91-6	6,00
Propylenglycol-n-Propylether	6,00
Mono-rhamnolipids of example 1	1,50
TEGOTENS® SD 100 MB	1,50
Triethanolamine (Tris(2-hydroxyethyl)-amine)	3,00

Alkaline Metal Cleaner 1

Water (Dye, Perfume)	85,50
TOMADOL® 91-8	0,60
Trisodium salt of Methylglycinediacetic acid (MGDA-Na3)	4,00
Mono-rhamnolipids of example 1	3,50
TEGOTENS® SD 100 MB	0,40
Na2CO3	6,00

Alkaline Metal Cleaner 2

Water (Dye, Perfume)	85,50
TOMADOL® 91-8	0,60
Trisodium salt of Methylglycinediacetic acid (MGDA-Na3)	4,00
Mono-rhamnolipids of example 1	3,50
TEGOTENS® SD 100 MB	0,40
Na2CO3	6,00

Mild Metal Cleaner

Water (Dye, Perfume)	94,65
Mono-rhamnolipids of example 1	3,50
Citric Acid	0,20
Sodium citrate	1,00
Sodium carbonate	0,55
2-Phenoxyethanol	0,1

Bathroom Cleanser

Water (Dye, Perfume)	91,50
Citric Acid Monohydrate	0,50
Mono-rhamnolipids of example 1	2,00
Isopropanol	5,00
Propylenglycol-n-butylether	1,00

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Mild All-Purpose Cleaner 1

Water (Dye, Perfume)	75,20
TOMADOL® 91-6	4,00
Sodium Lauryl Ether Sulfate, 70%	12,10
Mono-rhamnolipids of example 1	8,00
TEGOTENS® SD 100 MB	0,50
NaOH, 50% (Sodium Hydroxide)	0,20

Mild All-Purpose Cleaner 2

Water (Dye, Perfume)	95,15
Mono-rhamnolipids of example 1	0,50
REWOFORM® SL One	2,50
Citric Acid	0,20
Sodium citrate	1,00
Sodium carbonate	0,55
2-Phenoxyethanol	0,1

Mild All-Purpose Cleaner 3

Water (Dye, Perfume)	95,15
Mono-rhamnolipids of example 1	0,50
Capryl/caprylyl Glucoside	2,50
Citric Acid	0,20
Sodium citrate	1,00
Sodium carbonate	0,55
2-Phenoxyethanol	0,1

Mild All-Purpose Cleaner with Cleaning Booster

Water (Dye, Perfume)	95,15
Mono-rhamnolipids of example 1	2,70
TEGOTENS® SD 100 MB	0,30
Citric Acid	0,20
Sodium citrate	1,00
Sodium carbonate	0,55
2-Phenoxyethanol	0,1

F&B All purpose Spray

Water	95,00
Mono-rhamnolipids of example 1	1,00

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(continued)

REWOPOL® SB CS 50	1,00
Alcohol	3,00
Perfume, Preservative	qs

All-Purpose Cleaner, dilutable

Water (Dye, Perfume)	92,65
Mono-rhamnolipids of example 1	5,00
Sodium hydroxide (50%)	0,50
Citric Acid	0,20
Sodium citrate	1,00
Sodium carbonate	0,55
2-Phenoxyethanol	0,1

All-Purpose Cleaner, Ready to Use

Water (Dye, Perfume)	97,80
Mono-rhamnolipids of example 1	1,00
Sodium citrate	0,70
Sodium carbonate	0,20
Sodium hydroxide (50%)	0,20
2-Phenoxyethanol	0,1

Alkaline Cleanser

Water (Dye, Perfume)	85,50
Sodium Carbonate (Na ₂ CO ₃)	6,00
Trisodium salt of methylglycinediacetic acid (Na ₃ MGDA), 40%	4,00
TOMADOL® 91-6	0,60
Mono-rhamnolipids of example 1	3,50
TEGOTENS® SD 100 MB	0,40

Hard Surface Degreaser

C9-11 Fatty Alcohol · 8 EO (C9-11 Fatty Alcohol · 8 EO)	3,00
Mono-rhamnolipids of example 1	2,50
TEGOTENS® SD 100 MB	1,00
Trisodium salt of methylglycinediacetic acid (Na ₃ MGDA), 40%	10,00
Water (Dye, Perfume)	83,50

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Degreaser spray 1

Water (Dye, Perfume)	95,00
Mono-rhamnolipids of example 1	3,00
Trisodium salt of methylglycinediacetic acid (Na3MGDA), 40%	1,20
Monoethanolamine	0,30

Degreaser spray 2

Water (Dye, Perfume)	95,00
Mono-rhamnolipids of example 1	2,50
Caprylyl/Capryl glucoside	0,50
Trisodium salt of methylglycinediacetic acid (Na3MGDA), 40%	1,20
Monoethanolamine	0,30

F&B Degreasing Spray

Water (Dye, Perfume)	89,50
TEGOTENS® SD 100 MB	1,00
Mono-rhamnolipids of example 1	0,50
TOMAKLEEN® G-14	2,00
Triethanolamine	4,00
Trisodium salt of methylglycinediacetic acid	3,00

F&B Membrane Cleaning 1

Water (Dye, Perfume)	94,5
Protease	1,00
Mono-rhamnolipids of example 1	2,00
Lipase	0,50
Sodium carbonate	1,00
Trisodium salt of methylglycinediacetic acid	1,00

F&B Membrane Cleaning 2

Water (Dye, Perfume)	94,5
Protease	1,00
Rewoform SL ONE	1,00
Mono-rhamnolipids of example 1	2,00
Lipase	0,50
Sodium carbonate	1,00
Trisodium salt of methylglycinediacetic acid	1,00

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Kitchen Cleaning Spray

	Mono-rhamnolipids of example 1	0,50
5	TEGOTENS® SD 100 MB	1,00
	TOMAKLEEN® G-14	2,00
	C9-11 Fatty Alcohol · 8 EO (C9-11 Fatty Alkohol · 8 EO)	2,00
10	Water (Dye, Perfume)	89,50
	Trisodium salt of methylglycinediacetic acid (Na3MGDA), 40%	3,00
	Dipropylene Glycol n-Butyl Ether	2,00
15	Triethanolamine	4,00

High Performance Kitchen Cleaner

	Water (Dye, Perfume)	92,20
20	Mono-rhamnolipids of example 1	3,00
	REWOPOL® SC 200	2,50
	Monoethanolamine	2,00
25	Trisodium salt of methylglycinediacetic acid (Na3MGDA), 40%	0,20
	2-Phenoxyethanol	0,10

Ready to Use Kitchen Cleaner

30	Water (Dye, Perfume)	93,60
	Mono-rhamnolipids of example 1	1,00
	REWOPOL® SC 200	2,00
35	Monoethanolamine	1,00
	Trisodium salt of methylglycinediacetic acid (Na3MGDA), 40%	0,20
	Citric acid	2,10
40	2-Phenoxyethanol	0,10

Floor Cleaner, Superspreading

45	Water (Dye, Perfume)	90,25
	Isopropanol	3,50
	Mono-rhamnolipids of example 1	5,00
50	REWOCARE® BDS 15	1,25

Floor Cleanser, Highly Efficient

55	Water (Dye, Perfume)	73,00
	Mono-rhamnolipids of example 1	6,00
	TEGOTENS® SD 100 MB	2,00
	REWOPOL® D 510 NC	5,00

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(continued)

TOMADOL® 91-6	3,00
Potassium Hydroxide, 50%	5,00
Trisodium salt of methylglycinediacetic acid (Na ₃ MGDA), 40%	6,00

Plastic Cleanser

Mono-rhamnolipids of example 1	5,00
Ethylene Glycol (1,2 Ethanediol)	1,00
Citric Acid Monohydrate	1,00
Water (Dye, Perfume)	93,00

Glass Cleaner 1

Water (Dye, Perfume)	82,50
Ethanol	15,00
Mono-rhamnolipids of example 1	2,00
REWOCARE® BDS 15	0,50
Preservative	q.s.

Glass Cleaner 2

Water (Dye, Perfume)	82,50
Ethanol	15,00
Mono-rhamnolipids of example 1	2,00
Preservative	q.s.

Glass Cleaner 3

Water (Dye, Perfume)	82,50
Ethanol	15,00
Mono-rhamnolipids of example 1	1,00
Caprylyl/Capryl Glucoside	0,5
Preservative	q.s.

Claims

- Use of a composition comprising at least 92 wt.-%, preferably at least 95 wt.-%, more preferably at least 99 wt.-%, mono-rhamnolipids, wherein the weight percentages refer to all rhamnolipids comprised in the composition, for the preparation of a non-cosmetic cleaning formulation.
- Use according to claim 1, **characterized in that** the mono-rhamnolipids comprise
 - 12 wt.-% to 32 wt.-% monoRL-C8C10,
 - 51 wt.-% to 81 wt.-% monoRL-C10C10,

1 wt.-% to 9 wt.-% monoRLC-10C12,
1 wt.-% to 9 wt.-% monoRLC-10C12:1,

wherein the weight percentages refer to all mono-rhamnolipids comprised in the composition.

3. Use according to claim 1 or 2, **characterized in that** the cleaning formulation is laundry formulation, a dish washing formulation, a car cleaning formulation, a hard floor cleaning formulation, a glass cleaner, a bathroom cleaner, a kitchen cleaner, an over cleaner, an all purpose cleaner, a wet wipe, a metal cleaner, a membrane cleaner for food and beverage applications, a CIP (cleaning in place) cleaner, a big kitchen cleaner, a traffic film remover, a carpet cleaner, an alkaline cleaner, a prespotter, a mild cleaner or a neutral cleaner.

4. Use of a composition comprising at least 92 wt.-%, preferably at least 95 wt.-%, more preferably at least 99 wt.-%, mono-rhamnolipids, wherein the weight percentages refer to all rhamnolipids comprised in the composition, as anti-deposition aid, preferably on textiles, and/or for preventing the greying of a textile.

5. Use according to claim 4, **characterized in that** the mono-rhamnolipids comprise

12 wt.-% to 32 wt.-% monoRL-C8C10,
51 wt.-% to 81 wt.-% monoRL-C10C10,
1 wt.-% to 9 wt.-% monoRLC-10C12,
1 wt.-% to 9 wt.-% monoRLC-10C12:1,

wherein the weight percentages refer to all mono-rhamnolipids comprised in the composition.

6. Use of a composition comprising at least 92 wt.-%, preferably at least 95 wt.-%, more preferably at least 99 wt.-%, mono-rhamnolipids, wherein the weight percentages refer to all rhamnolipids comprised in the composition, for fatty stain removal preferably from hard surfaces.

7. Use according to claim 4, **characterized in that** the mono-rhamnolipids comprise

12 wt.-% to 32 wt.-% monoRL-C8C10,
51 wt.-% to 81 wt.-% monoRL-C10C10,
1 wt.-% to 9 wt.-% monoRLC-10C12,
1 wt.-% to 9 wt.-% monoRLC-10C12:1,

wherein the weight percentages refer to all mono-rhamnolipids comprised in the composition.



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Y	* claims * * examples *	2, 5, 7	
X	WO 2022/128781 A1 (UNILEVER IP HOLDINGS B V [NL]; UNILEVER GLOBAL IP LTD [GB] ET AL.) 23 June 2022 (2022-06-23)	1, 3, 4, 6	
Y	* claims 1-6, 8-14 * * example 1 * * page 4, line 30 - page 8, line 19 * * page 9, line 5 - line 19 *	2, 5, 7	
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Y	* claims *	2, 5, 7	
X	WO 2016/134958 A1 (EVONIK DEGUSSA GMBH [DE]; SCHEUERMANN RALPH [DE] ET AL.) 1 September 2016 (2016-09-01)	1-5	TECHNICAL FIELDS SEARCHED (IPC)
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Place of search The Hague		Date of completion of the search 15 February 2023	Examiner Neys, Patricia
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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO.

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