(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 3 174 967 B1

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
**13.06.2018 Bulletin 2018/24**

(21) Application number: **15734190.0**

(22) Date of filing: **07.07.2015**

(51) Int Cl.:
***C11D 3/14*** *(2006.01)* ***C11D 3/12*** *(2006.01)*
***C11D 17/06*** *(2006.01)*

(86) International application number:
**PCT/EP2015/065413**

(87) International publication number:
**WO 2016/015956 (04.02.2016 Gazette 2016/05)**

(54) **HARD SURFACE CLEANING COMPOSITION**

REINIGUNGSZUSAMMENSETZUNG FÜR HARTE OBERFLÄCHEN

COMPOSITION DE NETTOYAGE D'UNE SURFACE DURE

(84) Designated Contracting States:
**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR**

(30) Priority: **01.08.2014 EP 14179436**

(43) Date of publication of application:
**07.06.2017 Bulletin 2017/23**

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EP 3 174 967 B1

## Description

### Field of the invention

**[0001]** The present invention is in the field of hard surface cleaning compositions; in particular cleaning compositions that can be used to clean hard surfaces without the use of water.

### Background of the invention

**[0002]** Water is becoming a more and more scarcely available commodity, especially in developing countries, where it is not unusual that people have to walk many kilometres to arrive at a water source. As a result of which, there is an increasing need to save water.

**[0003]** One way of saving water is to reuse the water and another way is to reduce the amount of water being used.

**[0004]** Washing processes, including laundry, dishwashing and other household cleaning processes, require large amounts of water throughout the world. These are daily chores in which the use of water and a detergent cannot be avoided.

**[0005]** The amount of water required for cleaning is entirely dependent on the detergent or the cleaning agent used. Therefore, the use of water can be reduced or controlled based on the detergent or the cleaning agent.

**[0006]** WO 2014/075845 discloses a granular composition with an improved cleaning efficiency comprising a polyacrylic acid based swellable polymer, cellulose fibre and water, which is suitable for use in a cleaning method which requires little or no added water. The composition is majorly comprised of organic materials which is not economical.

**[0007]** WO0068349A1 (Unilever) discloses detergent bars containing 5 to 40 % surfactant, 10 to 85 % abrasive materials, comprising aluminium oxide which has Moh's hardness of 8 to 9.5 and absorbent which preferably is silica gel or precipitated or spray-dried silica. The invention also provides a process for cleaning dishes and cooking utensils which involves the step of applying thereto a cleaning composition described above. All the exemplified compositions have about 12 wt% water.

**[0008]** US4615821A [P&G, 1986] discloses powdered abrasive cleanser composition having 0.1 to 6 wt% surfactant, 0.5 to 40 wt% benzyl alcohol, 20 to 95 wt% water-insoluble abrasive material and 1 to 50 wt% detergency builder. The exemplified composition has 3.1 wt% water. In addition, cleaning effect is attributed to the presence of benzyl alcohol.

**[0009]** It is therefore an object of the present invention to provide water saving in household process, especially dish wash processes.

**[0010]** It is another object of the present invention to provide a hard surface cleaning composition that requires less or no water for cleaning.

**[0011]** It is yet another object of the present invention to provide a hard surface cleaning composition that removes fatty soils without the use of water.

**[0012]** Surprisingly, it has been found that a hard surface cleaning composition for cleaning hard surfaces without the use of water may be obtained by a combination of an inorganic absorbent material having a surface area of more than $50m^2/g$ and an abrasive having a Mohs' hardness of more than 3 when present in a ratio of between 1:2 and 1:20.

### Summary of the invention

**[0013]** Accordingly, in a first aspect, the present invention provides a hard surface cleaning composition comprising 0.1 to 50% by weight of a surfactant, 2 to 35% by weight of an inorganic absorbent material having a surface area of more than $50m^2/g$ and 33 to 96% by weight of an abrasive having a Mohs' index of more than 3, wherein the ratio of the inorganic absorbent material to the abrasive is between 1:2 to 1:20.

**[0014]** In a second aspect, the invention provides a process for cleaning a hard surface without the use of water comprising the steps of applying onto the hard surface a composition according to the invention, scrubbing the hard surface, dusting off the composition using hands and optionally wiping the hard surface with a wet cloth.

**[0015]** In a third aspect, the invention provides use of a composition according to the invention for cleaning hard surfaces without using water.

**[0016]** In the context of the present invention, the reference to "hard surface" or "substrate" typically means utensils or kitchenware, kitchen tops, kitchen floors, sinks and platforms, floors and bathrooms.These and other aspects, features and advantages will become apparent to those of ordinary skill in the art from a reading of the following detailed description and the appended claims. For the avoidance of doubt, any feature of one aspect of the present invention may be utilised in any other aspect of the invention. The word "comprising" is intended to mean "including" but not necessarily "consisting of" or "composed of." In other words, the listed steps or options need not be exhaustive. It is noted that the examples given in the description below are intended to clarify the invention and are not intended to limit the invention to those examples per se. Similarly, all percentages are weight/weight percentages unless otherwise indicated. Except in the

operating and comparative examples, or where otherwise explicitly indicated, all numbers in this description indicating amounts of material or conditions of reaction, physical properties of materials and/or use are to be understood as modified by the word "about". Numerical ranges expressed in the format "from x to y" are understood to include x and y. When for a specific feature multiple preferred ranges are described in the format "from x to y", it is understood that all ranges combining the different endpoints are also contemplated.

**Detailed description of the invention**

**[0017]** In a first aspect, the invention relates to a hard surface cleaning composition comprising a surfactant, an inorganic absorbent material and an abrasive.

Surfactants

**[0018]** The composition according to the invention comprises one or more surfactants that are generally selected from anionic, non-ionic, cationic, zwitterionic or amphoteric surfactants.

**[0019]** Suitable classes of anionic surfactants are water-soluble salts of organic sulphuric acid mono-esters and sulphonic acids having in the molecular structure a branched or straight chain alkyl group containing 8 to 22 carbon atoms or an alkylaryl group containing 6 to 20 carbon atoms in the alkyl part.

**[0020]** Examples of such anionic surfactants are water soluble salts of:

- long chain (i.e. 8 to 22 carbon atoms) alcohol sulphates (hereinafter referred to as PAS), especially those obtained by sulphating the fatty alcohols produced from tallow or coconut oil or the synthetic alcohols derived from petroleum;
- alkylbenzene-sulphonates, such as those in which the alkyl group contains from 6 to 20 carbon atoms; and
- secondary alkanesulphonates.

**[0021]** Also suitable are the salts of:

- alkylglyceryl ether sulphates, especially of the ethers of fatty alcohols derived from tallow and coconut oil;
- fatty acid monoglyceride sulphates;
- sulphates of ethoxylated aliphatic alcohols containing 1 to 12 ethyleneoxy groups;
- alkylphenol ethylenoxy-ether sulphates with from 1 to 8 ethyleneoxy units per molecule and in which the alkyl groups contain from 4 to 14 carbon atoms;
- the reaction product of fatty acids esterified with isethionic acid and neutralised with alkali; and
- carboxylic acids from 8-18 carbon chain length.

**[0022]** A suitable class of nonionic surfactants can be broadly described as compounds produced by the condensation of simple alkylene oxides, which are hydrophilic in nature, with an aliphatic or alkyl-aromatic hydrophobic compound having a reactive hydrogen atom. The length of the hydrophilic or polyoxyalkylene chain which is attached to any particular hydrophobic group can be readily adjusted to yield a compound having the desired balance between hydrophilic and hydrophobic elements. This enables the choice of nonionic surfactants with the right HLB. Particular examples include:

- the condensation products of aliphatic alcohols having from 8 to 22 carbon atoms in either straight or branched chain configuration with ethylene oxide, such as a coconut alcohol/ethylene oxide condensates having from 2 to 15 moles of ethylene oxide per mole of coconut alcohol;
- condensates of alkylphenols having C6 to C15 alkyl groups with 5 to 25 moles of ethylene oxide per mole of alkylphenol;
- condensates of the reaction product of ethylene-diamine and propylene oxide with ethylene oxide, the condensates containing from 40 to 80% of ethyleneoxy groups by weight and having a molecular weight of from 5,000 to 11,000.

**[0023]** Other classes of nonionic surfactants are:

- alkyl polyglycosides, which are condensation products of long chain aliphatic alcohols and saccharides;
- tertiary amine oxides of structure RRRNO, where one R is an alkyl group of 8 to 20 carbon atoms and the other R's are each alkyl or hydroxyalkyl groups of 1 to 3 carbon atoms, e.g. dimethyldodecylamine oxide;
- tertiary phosphine oxides of structure RRRPO, where one R is an alkyl group of 8 to 20 carbon atoms and the other R's are each alkyl or hydroxyalkyl groups of 1 to 3 carbon atoms, for instance dimethyl-dodecylphosphine oxide;
- dialkyl sulphoxides of structure RRSO where one R is an alkyl group of from 10 to 18 carbon atoms and the other is methyl or ethyl, for instance methyl-tetradecyl sulphoxide;

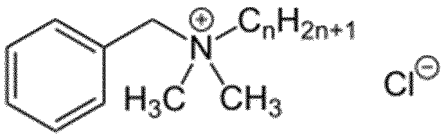
- fatty acid alkylolamides, such as the ethanol amides;
- alkylene oxide condensates of fatty acid alkylolamides;
- alkyl mercaptans.

**[0024]** A specific group of surfactants are the tertiary amines obtained by condensation of ethylene and/or propylene oxide with long chain aliphatic amines. The compounds behave like nonionic surfactants in alkaline medium and like cationic surfactants in acid medium.

**[0025]** Suitable amphoteric surfactants include derivatives of aliphatic secondary and tertiary amines containing an alkyl group of 8 to 18 carbon atoms and an aliphatic radical substituted by an anionic water-solubilizing group, such as sodium 3-dodecylamino-propionate, sodium 3-dodecylaminopropane sulphonate and sodium N-2-hydroxydodecyl-N-methyltaurate.

**[0026]** Suitable cationic surfactants are quaternary ammonium salts according to the present invention are quaternary ammonium salts characterised in that the ammonium salt has the general formula: $R_1R_2R_3R_4N^+ X^-$, wherein $R_1$ is a $C_{12}$-$C_{18}$ alkyl group, each of $R_2$, $R_3$ and $R_4$ independently is a $C_1$-$C_3$ alkyl group and X is an inorganic anion. $R_1$ is preferably a $C_{14}$-$C_{16}$ straight chain alkyl group, more preferably $C_{16}$. $R_2$-$R_4$ are preferably methyl groups. The inorganic anion is preferably chosen from halide, sulphate, bisulphate or $OH^-$. Thus, for the purposes of this invention, a quaternary ammonium hydroxide is considered to be a quaternary ammonium salt. More preferably the anion is a halide ion or sulphate, most preferably a chloride,bromide or sulphate. Cetyl-trimethylammonium bromide is a specific example of a suitable compound and commercially abundantly available.

**[0027]** Another type of quaternary ammonium cationic surfactant is the class of benzalkonium halides, also known as alkyldimethylbenzylammonium halides. The most common type being benzalkonium chloride, also known as alkyldimethylbenzylammonium chloride (or ADBAC). A preferred class of bezalkonium chlorides is given in the formula below.




n = 8, 10, 12, 14, 16, 18

**[0028]** Suitable zwitterionic surfactants include derivatives of aliphatic quaternary ammonium, sulphonium and phosphonium compounds having an aliphatic radical of from 8 to 18 carbon atoms and an aliphatic radical substituted by an anionic water-solubilising group, for instance 3-(N-N-dimethyl-N-hexadecylammonium) propane-1-sulphonate betaine, 3-(dodecylmethyl sulphonium) propane-1-sulphonate betaine and 3-(cetylmethylphosphonium) ethane sulphonate betaine. Other betaines include alkylamidopropyl betaines wherein the alkylamido group is derived from coconut oil fatty acids.

**[0029]** Further examples of suitable surfactants are compounds commonly used as surface-active agents given in the well-known textbooks like "Surface Active Agents" Vol. 1, by Schwartz & Perry, Interscience 1949, Vol. 2 by Schwartz, Perry & Berch, Interscience 1958, and/or the current edition of "McCutcheon's Emulsifiers and Detergents" published by Manufacturing Confectioners Company or in "Tenside-Taschenbuch", H. Stache, 2nd Edn., Carl Hauser Verlag, 1981.

**[0030]** The surfactant is present in the composition in a concentration of 0.1 to 50%, preferably not more than 45%, more preferably not more than 40%, still more preferably not more than 35%, even more preferably not more than 30% or even more than 25% but typically not less than 1%, preferably not less than 2%, more preferably not less than 3%, still more preferably not more than 4% by weight of the total composition.

**[0031]** Preferred surfactants of the present invention are sodium linear alkylbenzene sulfonates, sodium dodecyl sulphate, sodium dodecanoate, sodium salt of alpha olefin sulphonate, methyl ester sulfonate, primary alkyl sulphates, sodium dodecylbenzenesulfonate, sodium stearate, amine oxides, non-ionic EO7, EO5, Cetyl trimethylammonium bromide and cetyl trimethylammonium chloride.

**[0032]** The most preferred ones are sodium linear alkylbenzene sulfonates, sodium salt of alpha olefin sulphonate, sodium dodecyl sulphate, amine oxides ad non-ionic EO7.

Inorganic absorbent material

**[0033]** The composition according to the invention comprises an inorganic absorbent material having a surface area of more than $50m^2/g$.

**[0034]** The inorganic absorbent material is selected from the group of materials with high BET (Brunauer, Emmett and Teller) surface area. It is preferred that the surface area of the inorganic absorbent material is between 50 and 1500

$m^2/g$, more preferably between 80 and 1000 $m^2/g$, still more preferably between 100 and 800 $m^2/g$ and even more preferably between 150 and 500 $m^2/g$.

**[0035]** Examples of suitable inorganic absorbent materials include precipitated silica, fumed silica, alumina, titanium dioxide, zinc oxide, clays such as montmorillonite, bentonite, kaolinite/china clay, layered double hydroxides, activated carbon, calcium carbonate, apatites and calcium oxides/hydroxides, having a surface area of more than $50m^2/g$.

**[0036]** The preferred inorganic absorbent materials of the invention are fumed silica, alumina, bentonite clay, titanium dioxide and activated charcoal, having a surface area of more than $50m^2/g$.

**[0037]** The inorganic absorbent material is present in the composition in a concentration of 2 to 35%, preferably not more than 30%, more preferably not more than 25%, still more preferably not more than 20% but typically not less than 4%, more preferably not less than 6%, still more preferably not less than 7% by weight of the total composition.

Abrasive

**[0038]** The composition according to the invention comprises an abrasive having a Mohs' hardness of between 3 and 7.

**[0039]** Mohs' hardness is a scale classifying the relative hardness of minerals on a scale of 1 to 10. The complete scale is given in textbooks like "Novel and Traditional Fillers for Plastics: Technology and Market Developments" by Geoffrey Pritchard, Rapra Technology Ltd., ISBN: 1-85957-183-2, Page-28 and "Minerals of the World" by Walter Schumann, Sterling Publishing Company, Inc., 2008 - Nature, Sterling ISBN: 978-1-4027-5339-8.

**[0040]** Mohs' hardness of the abrasive according to the present invention is preferably between 3 and 7. This includes all the abrasives from calcite (Mohs' hardness of 3) and upwards on the scale.

**[0041]** The abrasive may be soluble or insoluble in water. Water soluble abrasives when used may be present in such excess to any water present in the composition so that the solubility of the abrasive in the aqueous phase is exceeded and consequently the abrasive exists in the composition.

**[0042]** The volume average particle size of the abrasive is between 0.5 and 400 μm, preferably between 10 and 200 μm. Preferably the span is between 2 and 5; and wherein the span is defined as the broadness or width in particle distribution between a 10% limit (D10) and a 90% limit (D90) divided by the mean particle diameter (D50), whereby 10% by volume of the particles have a diameter below the 10% limit and 10% by volume of the particles have a diameter above the 90% limit.

**[0043]** The preferred abrasives include feldspar, silica, dolomite, calcite, synthetic aluminium oxide, amalgam, anatase, apatite, cuttlebone, diopside, enamel, enstatite, fluorite, glass bead, glass, hematite, kyanite, magnetite, olivine, orthoclase, petalite, porcelain, feldspathic , pyrite, pumice, quartz (silica sand), spodumene, titanium dioxide, particulate zeolites, silicates, other carbonates, bicarbonates, borates and sulphates.

**[0044]** Examples of the most preferred abrasives include feldspar, synthetic aluminium oxide, dolomite and calcite.

**[0045]** The abrasive is present in the composition in a concentration of 33 to 96%, preferably not more than 90%, more preferably not more 85% but typically not less than 35%, more preferably not less than 40%, still more preferably not less than 45%, even more preferably not less than 50% or even not less than 60% by weight of the total composition.

Ratio of Inorganic absorbent material to Abrasive

**[0046]** Without wishing to be bound by a particular theory, it is thought that when the composition according to the invention is applied on a soiled surface, the inorganic absorbent material with the high surface area quickly starts acting on the oily and/or watery parts to accumulate the soil into its structure and the abrasives help to dislodge the soil from the substrate. Due to the high absorption capacity of the inorganic absorbent material, they form aggregates when pressure is applied which then gets lifted from the surface and carried away swiftly by the action of abrasives, thus resulting in cleaning. However, a critical ratio of inorganic absorbent material to abrasive is required to achieve the desired cleaning action.

**[0047]** The inorganic absorbent material and the abrasive are present in a ratio of between 1:2 and 1:20, preferably between 1:3 and 1:12 or more preferably between 1:4 and 1:10.

**[0048]** The skilled person would understand how the above ratio should be read and interpreted in light of weight ranges applicable to the inorganic absorbent material and the abrasive. However, for the avoidance of doubt, it is clarified that the ratio which is between 1:2 and 1:20 should be read harmoniously with the weight ranges so as to make technical sense out of the two claimed parameters.

**[0049]** For example, at an absorbent content of 2 weight%, the skilled person would not follow the ratio of 1:2, although it falls within the claimed range, because then the abrasive content would fall significantly short of the minimum claimed value. Similarly, if the content of the absorbent is 35 wt%, then the ratio of 1:20 would lead to an impractical value of 700 wt% of the abrasive. The skilled person would know that the maximum absorbent content is 96 wt% and would then accordingly select a suitable ratio from the claimed range.

Water

**[0050]** Water is present in the hard surface cleaning composition of the present invention. Water is in a concentration of less than 2% by weight of the composition.

Optional Ingredients

**[0051]** The composition according to the invention may contain other ingredients which aid in their cleaning or sensory performance. Compositions according to the invention can also contain, in addition to the ingredients already mentioned, various other optional ingredients such as builders, ash, perfume, colourants, electrolytes, structuring agents, fillers and antimicrobial agents.

Process

**[0052]** In a second aspect, the invention relates to a process for cleaning a hard surface without the use of water comprising the steps of applying onto the hard surface a composition according to the invention, scrubbing the hard surface, dusting off the composition using hands; and optionally wiping the hard surface with a wet cloth.

**[0053]** In a different embodiment, the composition may be dusted off using the same scrubbing implement.

**[0054]** In a third aspect, the invention relates to the use of a composition according to the invention for cleaning hard surfaces without using water.

**[0055]** The invention will now be illustrated by means of the following non-limiting examples

**Examples**

Materials

Surfactants

**[0056]**

| | |
|---|---|
| Anionic: | Linear alkylbenzene sulfonic acid-LAS acid (ex Rhodia and Advanced Surfactants) |
| | Sodium dodecyl sulfate-SDS (ex Sigma Aldrich) |
| | Sodium dodecanoate (ex Sigma Aldrich) |
| | Sodium stearate (ex Sigma Aldrich) |
| | Sodium dodecylbenzenesulfonate- SDBS (ex Sigma Aldrich) |
| Cationic: | Cetyltrimethylammonium bromide-CTAB (ex Loba Cheme) |
| Zwitterionic: | Amine oxide Empigen OD (ex Huntsman) |
| Non-ionic: | EO7 (ex Galaxy Surfactants) |

Inorganic absorbent materials

**[0057]**

Sodium bentonite-Low SA (ex Sigma Aldrich)
Sodium bentonite- High SA (ex Sigma Aldrich)
Alumina, DISPERSAL P2 (ex Sasol)
Silica, Aerosil-200 (ex Evonik)
Silica, MFIL-100 special (ex Madhu silica)
Titanium dioxide, MT-600B (ex Tayca Corporation)
Titanium dioxide, MT-150W (ex Tayca Corporation)
Activated Charcoal, DARCO (ex Sigma Aldrich)

Abrasives

**[0058]**

Feldspar (ex Salice Exim, Chennai, India)
Dolomite (ex Exim, Chennai, India)
Calcite 30AV (ex OMYA)
Talc (ex Sigma Aldrich)

Preparation of the compositions:

**[0059]** Each of the sample composition was prepared following the sequence of addition of ingredients as described herein. In a typical experiment, half of the abrasive material was taken in a mortar and pestle to which surfactant was added. The concoction was ground and mixed for 5 minutes. Then, the required amount of absorbent was added and ground thoroughly for another 10 minutes. Finally, the remaining half of the abrasive was added, ground and mixed for another 5 minutes to get the final powder composition.

**[0060]** For the preparation of the anionic surfactant sodium LAS, the LAS acid was pre-neutralized with a stoichiometric amount of base (eg, soda) and catalytic water and added into the mortar and pestle at the specified step.

Test for Cleaning

**[0061]** 0.5 g of sunflower oil was spread on a substrate (porcelain plate if not otherwise mentioned, with ~8-10 cm radius). 1.25 g of cleaning powder sample was sprinkled on top of it. It was scrubbed with a plastic paper with 10X15 $cm^2$ dimension for 30 seconds. The soil along with powder was dusted off with the plastic implement itself. The substrate was thereafter set under a hair-dryer for 10 seconds to remove any additional loosely bound particles. A pre-weighed tissue paper was used then to remove the soil left on the substrate. The difference between the initial and final weight of the tissue paper was calculated which equals to the residual amount of soil on each plate. Cleaning of ≥85% is considered to be good.

**Example 1:** Effect of ratio of the inorganic absorbent material and the abrasive on cleaning

**[0062]** In this example, Ex 1 to Ex 9 comprising the inorganic absorbent material and the abrasive in a ratio within the scope of the invention are compared to C1 to C4 comprising the inorganic absorbent material and the abrasive in a ratio outside the scope of the present invention.

**[0063]** The amount of initial oil in this example is 0.5 grams.

Table 1

| Set | Surfactant (NaLAS) wt% | Absorbent (Silica-Aerosil-200) wt% | Abrasive (Feldspar) wt% | *Ratio | Left Over (g) | | Average (g) | Cleaning % |
|---|---|---|---|---|---|---|---|---|
| C1 | 3 | 4 | 93 | 1:23.3 | 0.0810 | 0.0901 | 0.0856 | 82.9 |
| C2 | 3 | 4.4 | 92.6 | 1:21.0 | 0.0987 | 0.0748 | 0.0868 | 82.7 |
| Ex 1 | 3 | 4.65 | 92.35 | 1:19.9 | 0.0689 | 0.0658 | 0.0674 | 86.5 |
| Ex 2 | 3 | 5 | 92 | 1:18.4 | 0.0590 | 0.0552 | 0.0571 | 88.6 |
| Ex 3 | 3 | 7.5 | 89.5 | 1:11.9 | 0.0027 | 0.0029 | 0.0028 | 99.4 |
| Ex 4 | 3 | 10 | 87 | 1:8.7 | 0.0025 | 0.0027 | 0.0026 | 99.5 |
| Ex 5 | 3 | 15 | 82 | 1:5.5 | 0.0032 | 0.0030 | 0.0031 | 99.4 |
| Ex 6 | 3 | 20 | 77 | 1:3.9 | 0.0036 | 0.0035 | 0.0036 | 99.3 |
| Ex 7 | 3 | 25 | 72 | 1:2.9 | 0.0141 | 0.0145 | 0.0143 | 97.1 |

(continued)

| Set | Surfactant (NaLAS) wt% | Absorbent (Silica-Aerosil-200) wt% | Abrasive (Feldspar) wt% | *Ratio | Left Over (g) | | Average (g) | Cleaning % |
|---|---|---|---|---|---|---|---|---|
| Ex 8 | 3 | 30 | 67 | 1:2.2 | 0.0175 | 0.0164 | 0.0170 | 96.6 |
| Ex 9 | 3 | 32 | 65 | 1:2.0 | 0.0580 | 0.0474 | 0.0527 | 89.5 |
| C3 | 3 | 35 | 62 | 1:1.8 | 0.0790 | 0.0855 | 0.0822 | 83.6 |
| C4 | 3 | 40 | 57 | 1:1.4 | 0.0941 | 0.0853 | 0.0897 | 82.1 |
| **Note:** * Inorganic absorbent material to Abrasive | | | | | | | | |

**[0064]** The table above shows that the desired cleaning of more than 85% is obtained when the inorganic absorbent material and the abrasive is present in a ratio according to the invention.

**Example 2:** Effect of the surface area of the inorganic absorbent material on cleaning

**[0065]** In this example, inorganic absorbent materials with various surface areas are compared. Ex 10 to Ex 15 are compositions according to the invention comprising an inorganic absorbent material having a surface area of more than 50 $m^2/g$ and C5 and C6 are comparative compositions comprising an inorganic absorbent material having a surface area of less than 50 $m^2/g$.

**[0066]** The amount of initial oil in this example is 0.5 grams.

Table 1

| Set | Surfactant (NaL AS) wt% | Absorbent (10 wt%) | Abrasive (Feldspar) wt% | Surface Area of Absorbent $m^2/g$ | Left Over (g) | | Average (g) | Cleaning % |
|---|---|---|---|---|---|---|---|---|
| C5 | 3 | Na-bentonite, Low SA | 87 | 20-40 | 0.0920 | 0.105 | 0.0985 | 80.3 |
| C6 | 3 | Titanium Dioxide, MT-600B | 87 | 25-35 | 0.1124 | 0.1214 | 0.1169 | 76.6 |
| Ex10 | 3 | Na-bentonite, High SA | 87 | 220-270 | 0.0103 | 0.0091 | 0.0097 | 98.1 |
| Ex11 | 3 | Alumina, DISPERAL P2 | 87 | 260 | 0.0224 | 0.0212 | 0.0218 | 95.6 |
| Ex12 | 3 | Silica, Aerosil-200 | 87 | 200 ± 25 | 0.0025 | 0.0027 | 0.0026 | 99.5 |
| Ex13 | 3 | Silica, MFIL-100 (Special) | 87 | 205 | 0.0224 | 0.0212 | 0.0218 | 95.6 |
| Ex 14 | 3 | Titanium Dioxide, MT-150W | 87 | 80-110 | 0.0511 | 0.0539 | 0.0525 | 89.5 |
| Ex15 | 3 | Activated Charcoal, Darco | 87 | 600 | 0.0164 | 0.0158 | 0.0161 | 96.8 |

**[0067]** The table above shows that the desired cleaning of more than 85% is obtained when the inorganic absorbent material has a surface area of more than $50m^2/g$.

**Example 3:** Effect of Mohs' hardness of the abrasive on cleaning

**[0068]** This example demonstrates the effect of Mohs' hardness of the abrasive on cleaning. Ex 16, Ex 17 and Ex 17A, compositions comprising abrasives having a Mohs' hardness according to the invention are compared to C7, a composition comprising an abrasive having a Mohs' hardness outside the scope of the invention.

**[0069]** The amount of initial oil in this example is 0.5 grams.

Table 3

| Set | Surfactant (NaLAS) wt% | Absorbent (Aerosil -200) wt% | Abrasive (87 wt%) | Moh s' Hard ness | Left Over (g) | | Average (g) | Cleaning % |
|---|---|---|---|---|---|---|---|---|
| Ex16 | 3 | 10 | Feldspar | 6-6.5 | 0.0025 | 0.0027 | 0.0026 | 99.5 |
| Ex17 | 3 | 10 | Dolomite | 3.5-4 | 0.0065 | 0.0061 | 0.0063 | 98.7 |
| C7 | 3 | 10 | Talc | 1 | 0.0881 | 0.0814 | 0.0848 | 83.1 |
| Ex17 A | 3 | 10 | Calcite | 3 | 0.0151 | 0.0163 | 0.0157 | 96.9 |

**[0070]** The results in the above table indicate that the desired cleaning of more than 85% is obtained when the abrasive has a Mohs' hardness according to the invention.

**Example 4:** Effect of concentration of the surfactant on cleaning

**[0071]** In this example, different concentrations of the surfactant are compared. Ex 18 to Ex 20 are compositions comprising the surfactant in a concentration according to the invention and C8 and C9 are compositions comprising the surfactant in a concentration outside the scope of the invention.

**[0072]** The amount of initial oil in this example is 0.5 grams.

Table 4

| Set | Surfactant (SDBS) wt% | Absorbent (Aerosil-200) wt% | Abrasive (Feldspar) wt% | *Ratio | Left Over (g) | | Average (g) | Cleaning % |
|---|---|---|---|---|---|---|---|---|
| C8 | 0.05 | 7 | 92.95 | 1:13.3 | 0.0756 | 0.0859 | 0.0808 | 83.9 |
| Ex18 | 0.1 | 7 | 92.9 | 1:13.3 | 0.0547 | 0.0611 | 0.0579 | 88.4 |
| Ex19 | 2 | 7 | 91 | 1:13.0 | 0.0040 | 0.0038 | 0.0039 | 99.2 |
| Ex20 | 50 | 7 | 43 | 1:6.1 | 0.0489 | 0.0471 | 0.0480 | 90.4 |
| C9 | 55 | 7 | 38 | 1:5.4 | 0.0811 | 0.0789 | 0.0800 | 84.0 |
| **Note:** * Inorganic absorbent material to Abrasive | | | | | | | | |

**[0073]** The table above shows that the desired cleaning of more than 85% is obtained when the surfactant is present in the composition in a concentration according to the invention.

**Example 5:** Effect of different surfactants on cleaning

**[0074]** This example demonstrates the cleaning performance of the compositions according to invention comprising different surfactants (Ex 21 to Ex 27).

**[0075]** The amount of initial oil in this example is 0.5 grams.

Table 5

| Set | Surfactant (3 wt%) | Absorbent (Silica-Aerosil-200) wt% | Abrasive (Feldspar) wt% | Left Over (g) | | Average (g) | Cleaning % |
|---|---|---|---|---|---|---|---|
| Ex 21 | Anionic-NaLAS | 10 | 87 | 0.0025 | 0.0027 | 0.0026 | 99.5 |
| Ex 22 | Anionic-SDS | 10 | 87 | 0.0045 | 0.0041 | 0.0043 | 99.1 |
| Ex 23 | Cation ic-CTAB | 10 | 87 | 0.012 | 0.0131 | 0.0126 | 97.5 |
| Ex 24 | Zwitterionic-Amine Oxide | 10 | 87 | 0.019 | 0.021 | 0.0200 | 96.0 |
| Ex 25 | Non Ionic-EO7 | 10 | 87 | 0.0057 | 0.0071 | 0.0064 | 98.7 |
| Ex 26 | Anionic-Sodium Dodecanoate | 10 | 87 | 0.0065 | 0.0056 | 0.00605 | 98.8 |
| Ex 27 | Anionic-Sodium Stearate | 10 | 87 | 0.0078 | 0.0071 | 0.00745 | 98.5 |

**[0076]** The table above shows that the desired cleaning of more than 85% is obtained when the composition comprises a surfactant selected from anionic, cationic, non-ionic, zwitterionic, sodium salts of carboxylic acids.

**Example 6:** Cleaning performance of the composition according to the invention on different substrates

**[0077]** This example illustrates the cleaning performance of the composition according to the invention on different substrates (Ex 28 to Ex 31).

**[0078]** The amount of initial oil in this example is 0.5 grams.

Table 6

| Set | Surfactant (NaLA S) wt% | Absorbent (Aerosil-200) wt% | Abrasive (Feldsp ar) wt% | Substrate | Left Over (g) | | Average (g) | Cleaning % |
|---|---|---|---|---|---|---|---|---|
| Ex28 | 3 | 10 | 87 | Ceramic | 0.002 5 | 0.002 7 | 0.002 6 | 99.5 |
| Ex29 | 3 | 10 | 87 | Stainless Steel | 0.011 2 | 0.022 1 | 0.016 7 | 96.7 |
| Ex30 | 3 | 10 | 87 | Plastic | 0.022 4 | 0.021 7 | 0.022 1 | 95.6 |
| Ex31 | 3 | 10 | 87 | Aluminiu m | 0.058 1 | 0.057 8 | 0.058 0 | 88.4 |

**[0079]** It is apparent from the above table that a cleaning of more than 85% is obtained with the composition according to the inventions on any kind of substrate.

**Example 7:** Effect of high concentration of the abrasive (when taken alone) on cleaning

**[0080]** This example illustrates that cleaning performance of the composition according to the invention (Ex 17A) cannot be achieved even if a high concentration of the abrasive is used alone (C10).

**[0081]** The amount of initial oil in this example is 0.5 grams.

Table 7

| Set | Surfactant (NaLAS) wt% | Absorbent (Aerosil -200) wt% | Abrasive (Calcite) wt% | Moh s' Hardness | Left Over (g) | | Average (g) | Cleaning % |
|---|---|---|---|---|---|---|---|---|
| C10 | 3 | - | 97 | 3 | 0.1896 | 0.2009 | 0.1953 | 61.0 |
| Ex 17A | 3 | 10 | 87 | 3 | 0.0151 | 0.0163 | 0.0157 | 96.9 |

**[0082]** The above table shows that even if an abrasive like calcite is used at high concentrations alone, a cleaning of more than 85% is still not obtained.

**Example 8:** The effect of water

**[0083]** Three dish-wash compositions were prepared with varying level of water content in them. For precise control over water level, all the ingredients were dried previously in a hot air oven at 85 °C for 6 hours. After that the ingredients were mixed following the sequence of addition mentioned earlier. In this step it was ensured that the moisture content remained <0.5% in the prepared compositions.

**[0084]** After this step, calculated amount of water was added externally to each formulation to match up the final required moisture level.

**[0085]** Details of the compositions are mentioned below in table 8. The cleaning procedure is as described earlier under the heading of test for cleaning. The cleaning data is also included in table 8.

Table 8

| Code | Ingredient/wt% | | | | % cleaning |
|---|---|---|---|---|---|
| | NaLAS | $TiO_2$ MT-150W | Feldspar | Water | |
| Ex 32 (inside the scope) | 3 | 10 | 85 | 1.8 | 86.0 |
| C11 (outside the scope) | 3 | 10 | 84 | 3 | 73.7 |
| C12 (outside the scope) | 3 | 10 | 82 | 5 | 68.2 |

**[0086]** From the data in table 8 it can be concluded that the content of water has an effect on efficacy of the formulation. For a given surface area of the chosen absorbent (80-100 $m^2/g$) it was observed that an increase in the water level from 1.8 wt% to 3 wt% resulted in reduction in the cleaning performance by about 12 units i.e., 12% (drop from 86% to about 74%) and beyond the threshold value defined elsewhere in the description. This effect is further confirmed by the drop in cleaning efficacy in the case of the composition C12.

**Claims**

**1.** A hard surface cleaning composition comprising

a) 0.1 to 50% by weight of a surfactant;
b) 2 to 35% by weight of an inorganic absorbent material having a surface area of more than $50m^2/g$; and
c) 33 to 96% by weight of an abrasive having a Mohs' hardness of between 3 and 7;

wherein the ratio of the inorganic absorbent material to the abrasive is between 1:2 to 1:20 and wherein water is in a concentration of less than 2% by weight of the composition.

**2.** A composition according to claim 1, wherein the inorganic absorbent material has a surface area of between 50 and 1500 $m^2/g$.

**3.** A composition according to claim 1 or 2, wherein the inorganic absorbent material is selected from precipitated silica, fumed silica, alumina, titanium dioxide, zinc oxide, clays such as montmorillonite, bentonite, kaolinite/china clay, layered double hydroxides, activated carbon, calcium carbonate, apatites and calcium oxides/hydroxides.

4. A composition according to any of the preceding claims, wherein the abrasive is selected from feldspar, silica, dolomite, calcite, synthetic aluminium oxide, amalgam, anatase, apatite, cuttlebone, diopside, enamel, enstatite, fluorite, glass bead, glass, hematite, kyanite, magnetite, olivine, orthoclase, petalite, porcelain, feldspathic , pyrite, pumice, quartz (silica sand), spodumene, titanium dioxide, particulate zeolites, silicates, other carbonates, bicarbonates, borates and sulphates.

5. A composition according to any of the preceding claims wherein the composition is in granular or powder form.

6. A process for cleaning a hard surface without the use of water comprising the steps of:

    a) applying onto the hard surface a composition according to anyone of claims 1 to 5;
    b) scrubbing the hard surface;
    c) dusting off the composition using hands; and
    d) optionally wiping the hard surface with a wet cloth.

7. Use of a composition according to claim 1 for cleaning hard surfaces without using water.

**Patentansprüche**

1. Reinigungszusammensetzung für harte Oberflächen, umfassend

    a) 0,1 bis 50 Gewichts-% eines Tensids,
    b) 2 bis 35 Gewichts-% eines anorganischen absorbierenden Materials mit einem Oberflächenbereich von mehr als 50 $m^2/g$ und
    c) 33 bis 96 Gewichts-% eines Schleifmittels mit einer Mohs-Härte zwischen 3 und 7,

    wobei das Verhältnis des anorganischen absorbierenden Materials zu dem Schleifmittel zwischen 1:2 bis 1:20 liegt und wobei Wasser in einer Konzentration von weniger als 2 Gewichts-% der Zusammensetzung vorliegt.

2. Zusammensetzung nach Anspruch 1, wobei das anorganische absorbierende Material einen Oberflächenbereich zwischen 50 und 1500 $m^2/g$ aufweist.

3. Zusammensetzung nach Anspruch 1 oder 2, wobei das anorganische absorbierende Material aus gefällter Kieselsäure, pyrogener Kieselsäure, Aluminiumoxid, Titandioxid, Zinkoxid, Tonen, wie Montmorillonit, Bentonit, Kaolinit/Porzellanerde, geschichteten Doppelhydroxiden, aktiviertem Kohlenstoff, Calciumcarbonat, Apatiten und Calciumoxiden/-hydroxiden ausgewählt ist.

4. Zusammensetzung nach irgendeinem der vorhergehenden Ansprüche, wobei das Schleifmittel aus Feldspat, Siliciumdioxid, Dolomit, Calcit, synthetischem Aluminiumoxid, Amalgam, Anatas, Apaptit, Sepiaschalen, Diopsid, Emaille, Enstatit, Fluorit, Glasperlen, Glas, Hematit, Kyanit, Magnetit, Olivin, Orthoklas, Petalit, Porzellan, Feldspat, Pyrit, Bimsstein, Quarz (Quarzsand), Spodumen, Titandioxid, teilchenförmigen Zeolithen, Silikaten, anderen Carbonaten, Bicarbonaten, Boraten und Sulfaten ausgewählt ist.

5. Zusammensetzung nach irgendeinem der vorhergehenden Ansprüche, wobei die Zusammensetzung in granulierter oder pulveriger Form vorliegt.

6. Verfahren zum Reinigen einer harten Oberfläche ohne Verwendung von Wasser, umfassend die Schritte:

    a) Auftragen einer Zusammensetzung nach irgendeinem der Ansprüche 1 bis 5 auf die harte Oberfläche,
    b) Scheuern der harten Oberfläche,
    c) Abstauben der Zusammensetzung mit der Hand und
    d) optional Abwischen der harten Oberfläche mit einem feuchten Tuch.

7. Verwendung einer Zusammensetzung nach Anspruch 1 zum Reinigen von harten Oberflächen ohne Verwendung von Wasser.

## Revendications

1. Composition de nettoyage de surface dure comprenant

    a) de 0,1 à 50 % en masse d'un tensioactif ;
    b) de 2 à 35 % en masse d'un matériau absorbant inorganique ayant une surface spécifique supérieure à 50 $m^2/g$ ; et
    c) de 33 à 96 % en masse d'un abrasif ayant une dureté de Mohs de 3 à 7 ;

    où le rapport du matériau absorbant inorganique à l'abrasif est de 1:2 à 1:20 et où l'eau est dans une concentration inférieure à 2 % en masse de la composition.

2. Composition selon la revendication 1, où le matériau absorbant inorganique présente une surface spécifique de 50 à 1 500 $m^2/g$.

3. Composition selon la revendication 1 ou 2, où le matériau absorbant inorganique est choisi parmi de la silice précipitée, de la silice pyrogénée, de l'alumine, du dioxyde de titane, de l'oxyde de zinc, des argiles, telles que la montmorillonite, la bentonite, la kaolinite/argile de Chine, des hydroxydes doubles lamellaires, du charbon actif, du carbonate de calcium, des apatites et des oxydes/hydroxydes de calcium.

4. Composition selon l'une quelconque des revendications précédentes, où l'abrasif est choisi parmi le feldspath, la silice, la dolomite, la calcite, l'oxyde d'aluminium synthétique, un amalgame, l'anatase, l'apatite, l'os de seiche, le diopside, l'émail, l'enstatite, le fluorite, des billes de verre, le verre, l'hématite, la cyanite, la magnétite, l'olivine, l'orthoclase, la pétalite, la porcelaine, le feldspathique, la pyrite, la pumice, le quartz (sable de silice), le spodumène, le dioxyde de titane, des zéolithes particulaires, des silicates, d'autres carbonates, bicarbonates, borates et sulfates.

5. Composition selon l'une quelconque des revendications précédentes, où la composition est dans une forme granulaire ou pulvérulente.

6. Procédé de nettoyage d'une surface dure sans l'utilisation d'eau comprenant les étapes de :

    a) application sur la surface dure d'une composition selon l'une quelconque des revendications 1 à 5 ;
    b) gommage de la surface dure ;
    c) élimination des poussières de la composition en utilisant les mains ; et
    d) essuyage éventuel de la surface dure avec un chiffon humide.

7. Utilisation d'une composition selon la revendication 1 pour le nettoyage de surfaces dures sans utiliser d'eau.

## REFERENCES CITED IN THE DESCRIPTION

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