(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) **World Intellectual Property Organization**
International Bureau

(43) **International Publication Date**
25 April 2019 (25.04.2019)

WIPO | PCT

(10) **International Publication Number**
WO 2019/075684 A1

(51) **International Patent Classification:**
C11D 10/04 (2006.01) *C11D 17/06* (2006.01)

(21) **International Application Number:**
PCT/CN2017/106819

(22) **International Filing Date:**
19 October 2017 (19.10.2017)

(25) **Filing Language:** English

(26) **Publication Language:** English

(71) **Applicant: THE PROCTER & GAMBLE COMPANY** [US/US]; One Procter & Gamble Plaza, Cincinnati, OH 45202 (US).

(72) **Inventors; and**

(71) **Applicants** *(for US only)*: **ZHAO, Yuan** [CN/CN]; No. 35, Yu'an Road, B Zone, Tianzhu Konggang Development Zone, Shunyi District, Beijing 101312 (CN). **JIANG, Chunpeng** [CN/CN]; No. 35, Yu'an Road, B Zone, Tianzhu Konggang Development Zone, Shunyi District, Beijing 101312 (CN). **WANG, Dongpeng** [CN/CN]; No. 35, Yu'an Road, B Zone, Tianzhu Konggang Development Zone, Shunyi District, Beijing 101312 (CN). **HOU, Sicong** [CN/CN]; No. 35, Yu'an Road, B Zone, Tianzhu Konggang Development Zone, Shunyi District, Beijing 101312 (CN). **GAO, Qian** [CN/CN]; No. 35, Yu'an Road, B Zone, Tianzhu Konggang Development Zone, Shunyi District, Beijing 101312 (CN).

(74) **Agent: SHANGHAI PATENT & TRADEMARK LAW OFFICE, LLC**; 435 Guiping Road, Shanghai 200233 (CN).

(81) **Designated States** *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) **Designated States** *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:
— *with international search report (Art. 21(3))*

(54) Title: CLEANING COMPOSITIONS CONTAINING FATTY ACID BLEND

(57) **Abstract:** A cleaning composition, preferably a granular laundry detergent composition, containing a mixing of fatty acids or salts thereof in a specific surfactant system containing a C_{10}-C_{20} linear alkylbenzene sulphonate (LAS) and a C_6-C_{18} unalkoxylated alkyl sulphate (AS) at a weight ratio of from 3:1 to 50:1. The mixture of fatty acids or salts contains from 15%to 30%of fatty acids or salts derived from palm kernel oil and/or coconut oil, and from 70%to 85%of fatty acids or salts derived from palm oil. Such a mixture of fatty acids or salts in the specific surfactant system may provide improved sudsing profile during wash and may also reduce undissolvable residues on fabrics after wash.

WO 2019/075684 A1

CLEANING COMPOSITIONS CONTAINING FATTY ACID BLEND

FIELD OF THE INVENTION

The present invention concerns cleaning compositions, preferably granular laundry detergent compositions.

BACKGROUND OF THE INVENTION

Although automatic machine washing has been widely accepted and used in modern day homes, there are still many situations where people need to resort to hand-washing, for example, when delicate garments or tough stains are involved and special care is needed. Indeed, in most developing countries, consumers' washing habit for laundry is still to wash their garments by hand in basins or buckets, which involves the steps of washing with detergent, wringing or spinning, and rinsing one or more times with water.

Sudsing profile of a detergent composition, which includes but is not limited to: the speed and volume of suds generated upon dissolving the detergent composition in a washing solution, look and feel of the suds so generated, retention of suds during the wash cycle, and easiness in rinsing the suds off during the rinse cycle, is particularly important for consumers who still hand wash their garments and fabrics, because their laundering experience is directly impacted thereby.

On one hand, consumers typically view copious suds in the wash cycle as the primary and most desirable signal of cleaning, i.e., an indication that the detergent is "working" and that sufficient fabric cleaning has been achieved. Therefore, rapid generation of suds in high volumes during the wash cycle are especially desirable. On the other hand, high volume of suds generated during the wash cycle typically translates to more residue suds being carried over to the rinse solution. When the consumers observe residue suds during the rinse cycle, they immediately infer from it that there may still be surfactant residue on the fabrics and that the fabrics are not yet "clean." Consequently, the consumers feel the need to rinse the fabrics multiple times in order to make sure that the surfactants are removed thoroughly, which requires additional time, energy and water. For regions where resource is scarce, especially those regions suffering from water shortage, such excessive rinse requirement may render the detergent difficult or expensive to use.

Hence, while fast suds generation and high volume of suds are desirable during the wash cycle, fast collapsing of suds and significant reduction of suds volume are paradoxically desirable during the rinse cycle.

Linear alkylbenzene sulphonate (LAS) is one of the most commonly used anionic surfactants in laundry detergents. Although sufficient cleaning can be achieved by using detergent compositions with relatively lower levels of LAS, e.g., 20 wt% or less, the volume of suds generated by such detergent compositions is significantly reduced, which will inevitably be perceived by the consumers as insufficient cleaning and in turn correlated with inferior quality of the laundry detergents used. In order to avoid such negative consumer perception, one or more co-surfactants can be added into the detergent compositions to boost suds volume during the wash cycle.

Mid-cut alkyl sulphate (MCAS) with a C_8-C_{16} branched or unbranched alkyl group has been discovered as an effective co-surfactant for LAS with suds-boosting. For example, WO2009010911 discloses the use of MCAS for boosting suds in a LAS-based surfactant system and forming a detergent composition with a reduced total surfactant level, but without apparently deteriorating the sudsing profile of the detergent composition. For another example, WO2009149276 discloses a detergent composition containing a specific surfactant system formed of LAS and MCAS with relatively low levels of inorganic builders, such as aluminosilicates and phosphates, while such detergent composition exhibits improved sudsing property while maintaining the cleaning properties of the composition.

However, the sudsing profile of such a LAS and MCAS-based surfactant system is still relatively limited. Therefore, there is a continuing need for improving the sudsing profile of cleaning compositions characterized by a LAS and MCAS-based surfactant system.

SUMMARY OF THE INVENTION

The present invention employs a specific mixture or blend of fatty acids or salts thereof in combination with a specific surfactant system to improve and optimize the sudsing profile of a cleaning composition, preferably a granular laundry detergent composition, during wash. Moreover, the specific mixture or blend of fatty acids or salts thereof may also advantageously reduce undissolvable residues on fabrics after wash.

In one aspect, the present invention relates to a cleaning composition comprising:

(a) from 5% to 40%, by weight of such cleaning composition, of a C_{10}-C_{20} linear alkylbenzene sulphonate (LAS);

(b) from 0.1% to 5%, by weight of such cleaning composition, of an alkyl sulphate (AS) having a branched or linear unalkoxylated alkyl group comprising from 6 to 18 carbon atoms; and

(c) from 0.5% to 1.2%, by weight of such cleaning composition, of a mixture of fatty acids or salts thereof, while from 15% to 30% by weight of such fatty acids or salts thereof are derived from palm kernel oil and/or coconut oil, and wherein from 70% to 85% by weight of such fatty acids or salts thereof are derived from palm oil,

wherein the LAS and AS are present in such cleaning composition at a LAS-to-AS weight ratio of from 3:1 to 50:1.

Preferably, the cleaning composition further comprises from 0% to 1% by weight of a linear or branched alkylalkoxy sulphate having a weight average degree of alkoxylation ranging from 0.1 to 10.

The LAS surfactant is preferably present at an amount ranging from 8% to 30%, more preferably from 10% to 25%, by weight of such composition. The AS surfactant is preferably present at an amount ranging from 0.2% to 3%, more preferably from 0.3% to 2%, by weight of such composition.

The cleaning composition of the present invention may further comprise from 0.3% to 3%, by weight of the composition, of an amphiphilic graft copolymer comprising a polyalkylene oxide backbone grafted with one or more side chains selected from the group consisting of polyvinyl acetate, polyvinyl propionate, polyvinyl butyrate, and combinations thereof, while the weight ratio of the polyalkylene oxide backbone over said one or more side chains ranges from 1:0.2 to 1:10; and while preferably the graph copolymer has a polyethylene oxide backbone grafted with polyvinyl acetate side chains.

In a preferred but not necessary embodiment of the present invention, the cleaning composition is a granular laundry detergent composition that comprises: (1) from 5% to 50%, preferably from 10% to 40%, more preferably from 15% to 30%, by weight of such granular laundry detergent composition, of a water-soluble alkali metal carbonate and/or bicarbonate, which is preferably sodium carbonate and/or sodium bicarbonate; and/or (2) from 10% to 80%, preferably from 20% to 70%, more preferably from 30% to 60%, by weight of such granular laundry detergent composition, of a water-soluble alkali metal sulphate, which is preferably sodium sulphate.

The above-mentioned granular laundry detergent composition is preferably characterized by a moisture content of less than 3% by weight of said composition. More preferably, the granular laundry detergent composition is substantially free of any phosphate builder and comprises from 0% to 15%, preferably from 0% to 10%, more preferably from 0% to 5%, by weight of the granular laundry detergent composition, of a zeolite builder.

In another aspect, the present invention relates to the use of a cleaning composition as mentioned hereinabove for hand-washing fabrics.

DETAILED DESCRIPTION OF THE INVENTION

Features and benefits of the various embodiments of the present invention will become apparent from the following description, which includes examples of specific embodiments intended to give a broad representation of the invention. Various modifications will be apparent to those skilled in the art from this description and from practice of the invention. The scope of the present invention is not intended to be limited to the particular form disclosed and the invention covers all modifications, equivalents, and alternatives falling within the spirit and scope of the invention as defined by the claims.

As used herein, articles such as "a" and "an" when used in a claim, are understood to mean one or more of what is claimed or described. The terms “comprise,” “comprises,” “comprising,” “contain,” “contains,” “containing,” “include,” “includes” and “including” are all meant to be non-limiting.

As used herein, the term "cleaning composition" includes, unless otherwise indicated, granular or powder-form all-purpose or "heavy-duty" washing agents, especially cleaning detergents, for fabrics, as well as cleaning auxiliaries such as bleach, rinse aids, additives, or pre-treat types; hand dishwashing agents or light duty dishwashing agents, especially those of the high-foaming type; machine dishwashing agents; mouthwashes, denture cleaners, car or carpet shampoos, bathroom cleaners; hair shampoos and hair-rinses; shower gels and foam baths and metal cleaners; as well as cleaning auxiliaries such as bleach additives or pre-treat types. In one preferred aspect, the cleaning composition is a solid laundry detergent composition, and more preferably a free-flowing particulate laundry detergent composition (i.e., a granular laundry detergent product).

The terms “essentially free of,” “substantially free of” or “substantially free from” means that the indicated material is present in the amount of from 0 wt% to about 0.5 wt%, or preferably from 0 wt% to about 0.1 wt%, or more preferably from 0 wt% to about 0.01 wt%, and most preferably it is not present at analytically detectable levels. The term “substantially pure” or “essentially pure” means that the indicated material is present in the amount of from about 99.5 wt% to about 100 wt%, preferably from about 99.9 wt% to about 100 wt%, and more preferably from 99.99 wt% to about 100 wt%, and most preferably all other materials are present only as impurities below analytically detectable levels.

As used herein, the term “water-soluble” refers to a solubility of more than about 30 grams per liter (g/L) of deionized water measured at 20°C and under the atmospheric pressure.

As used herein, “suds” indicates a non-equilibrium dispersion of gas bubbles in a relatively smaller volume of a liquid. The terms like “suds”, “foam” and “lather” can be used interchangeably within the meaning of the present invention.

As used herein, “suds profile” or “sudsing profile” refers to the properties of a detergent composition relating to suds character during the wash and rinse cycles. The suds profile of a detergent composition includes, but is not limited to, the speed of suds generation upon dissolution in the laundering liquor, the volume and retention of suds in the wash cycle, and the volume and disappearance of suds in the rinse cycle. Preferably, the suds profile includes the wash suds volume and rinse suds volume. It may further include additional suds-related parameters, such as suds stability measured during the washing cycle and the like.

As used herein, the term “co-surfactant” refers to one or more surfactants in a cleaning composition which is mainly used to improve the sudsing profile of the cleaning composition. Co-surfactants can be categorized into suds-boosting co-surfactants (i.e., those that increase suds volume during both the wash and rinse cycles), suds-suppressing co-surfactants (i.e., those that decrease suds volume during both the wash and rinse cycles), and suds-optimizing co-surfactants (i.e., those that “boost” suds or increase suds volume during the wash cycle but “suppress” suds or decrease suds volume during the rinse cycle).

As used herein, all concentrations and ratios are on a weight basis unless otherwise specified. All temperatures herein are in degrees Celsius (°C) unless otherwise indicated. All conditions herein are at 20°C and under the atmospheric pressure, unless otherwise specifically stated. All polymer molecular weights are determined by weight average number molecular weight unless otherwise specifically noted.

SURFACTANT SYSTEM

The cleaning composition of the invention comprises a surfactant system constituted of anionic surfactants, and optionally one or more non-ionic surfactants, zwitterionic surfactants, and/or cationic surfactants. The fatty acids or salts described hereinabove are not considered a part of the surfactant system for the purpose of the present invention.

The cleaning composition may comprise a surfactant system in the amount ranging anywhere from about 5% to about 90% by total weight of the composition. For example, the composition may comprise such a surfactant system at levels ranging from about 6% to about 70%, typically from about 8% to about 60%, or from about 10% to about 50%, or from about 12% to about 40% by weight. In a preferred embodiment, the cleaning composition is in a concentrated form, especially a concentrated powder or granular form, while the total surfactant level is from about 10% to about 40%, preferably from about 15% to about 40%, by total weight of the composition.

LAS

The surfactant system of the present invention includes at least a first anionic surfactant that is a C_{10}-C_{20} linear alkylbenzene sulphonate (LAS). LAS anionic surfactants are well known in the art and can be readily obtained by sulphonating commercially available linear alkylbenzenes. Exemplary C_{10}-C_{20} linear alkylbenzene sulphonates that can be used in the present invention include alkali metal, alkaline earth metal or ammonium salts of C_{10}-C_{20} linear alkylbenzene sulphonic acids, and preferably the sodium, potassium, magnesium and/or ammonium salts of C_{11}-C_{18} or C_{11}-C_{14} linear alkylbenzene sulphonic acids. More preferred are the sodium or potassium salts of C_{12} linear alkylbenzene sulphonic acids, and most preferred is the sodium salt of C_{12} linear alkylbenzene sulphonic acid, i.e., sodium dodecylbenzene sulphonate.

The amount of LAS used in the cleaning composition may range from about 5% to about 40%, preferably from about 8% to about 30%, and more preferably from about 10% to about 25%, by total weight of the composition. In a most preferred embodiment of the present invention, the cleaning composition contains from about 10% to about 25% by weight of a sodium, potassium, or magnesium salt of C_{12} linear alkylbenzene sulphonic acid.

AS

The surfactant system of the present invention further includes at least a second anionic surfactant, which is an anionic alkyl sulphate (AS) surfactant having a branched or linear unalkoxylated alkyl group containing from about 6 to about 18 carbon atoms. Preferably, the AS has the generic formula of $R\text{-}O\text{-}SO_3^- M^+$, while R is branched or linear unalkoxylated C_6-C_{18} alkyl group, and M is a cation of alkali metal, alkaline earth metal or ammonium. More preferably, the R group of the AS surfactant contains from about 6 to about 16 carbon atoms, and more preferably from about 6 to about 14 carbon atoms. R can be substituted or unsubstituted, and is preferably unsubstituted. R is substantially free of any alkoxylation. M is preferably a cationic of sodium, potassium, or magnesium, and more preferably M is a sodium cation. Such AS surfactant acts as a co-surfactant for the LAS to boost suds volume during the wash.

Preferably, but not necessarily, the surfactant system of the present invention contains a mixture of C_6-C_{18} AS surfactants, in which C_6-C_{14} AS surfactants are present in an amount ranging from about 85% to about 100% by total weight of the mixture. This mixture can be referred to as a "C_6-C_{14}-rich AS mixture." More preferably, such C_6-C_{14}-rich AS mixture contains from about 90 wt% to about 100 wt%, or from 92 wt% to about 98 wt%, or from about 94 wt% to about 96 wt%, or 100 wt% (i.e., pure), of C_6-C_{14} AS.

In a particularly preferred embodiment of the present invention, the surfactant system in the cleaning composition contains a mixture of C_6-C_{18} AS surfactants with from about 30 wt% to about 100 wt% or from about 50 wt% to about 99 wt%, preferably from about 60 wt% to about 95 wt%, more preferably from about 65 wt% to about 90 wt%, and most preferably from about 70 wt% to about 80 wt% of C_{12} AS. Further, such mixture of C_6-C_{18} AS surfactants may contain from about 10 wt% to about 100 wt%, preferably from 15 wt% to about 50 wt%, and more preferably from 20 wt% to about 30 wt% of C_{14} AS. This mixture can be referred to as a "C_{12}-C_{14}-rich AS mixture."

In a most preferred embodiment of the present invention, the surfactant system of the cleaning composition contains a mixture of AS surfactants that consists essentially of C_{12} and/or C_{14} AS surfactants. For example, such mixture of AS surfactant may consist essentially of from about 70 wt% to about 80 wt% of C_{12} AS and from 20 wt% to about 30 wt% of C_{14} AS, with little or no other AS surfactants therein. Such mixture may also consist of substantially pure C_{12} AS, or alternatively, substantially pure C_{14} AS.

A commercially available AS mixture particularly suitable for practice of the present invention is Texapon® V95 G from Cognis (Monheim, Germany).

Further, the surfactant system of the present invention may contain a mixture of C_6-C_{18} AS surfactants comprising more than about 50 wt%, preferably more than about 60 wt%, more preferably more than 70 wt% or 80 wt%, and most preferably more than 90 wt% or even at 100 wt% (i.e., substantially pure), of linear AS surfactants having an even number of carbon atoms, including, for example, C_6, C_8, C_{10}, C_{12}, C_{14}, C_{16}, and C_{18} AS surfactants.

The mixture of C_6-C_{18} AS surfactants as described can be readily obtained by sulphonation of alcohol(s) with the corresponding numbers of carbon atoms. The required carbon chain length distribution can be obtained by using alcohols with the corresponding chain length distribution prepared either synthetically or extracted/purified from natural raw materials or formed by mixing corresponding pure starting materials. For example, the mixture of C_6-C_{18} AS surfactants may be derived from naturally occurring triglycerides, such as those contained in palm kernel oil or coconut oil, by chemically processing such triglycerides to form a mixture of long chain alcohols and then sulphonating such alcohols to form AS surfactants. The mixture of alcohols derived from the naturally occurring triglycerides typically contain more than about 20 wt% of C_{16}-C_{18} alcohols. A mixture containing a lower proportion of C_{16}-C_{18} alcohols may be separated from the original mixture before the sulphonation step, in order to form the desired mixture of C_6-C_{18} AS surfactants as described hereinabove. Alternatively, the desired mixture of C_6-C_{18} AS surfactants can be readily obtained by separating and purifying the already formed AS mixtures. Suitable separation and purification methods include, but are not limited to: distillation, centrifugation, recrystallization and chromatographic separation.

The AS surfactants used in the cleaning composition of the present invention may range from about 0.1% to about 5%, preferably from about 0.2% to about 3%, more preferably from about 0.3% to 2%, by total weight of the composition. In a most preferred embodiment of the present invention, the cleaning composition contains from about 0.3% to about 2% of an AS mixture consisting essentially of from about 70 wt% to about 80 wt% of C_{12} AS and from 20 wt% to about 30 wt% of C_{14} AS.

LAS:AS Ratio

As a co-surfactant for LAS, the AS is the most effective if it is provided in the cleaning composition at an amount to render a weight ratio of LAS to AS within the range of from about 3:1 to about 50:1, preferably from about 3.5:1 to about 45:1, more preferably from about 4:1 to about 40:1, and most preferably from about 5:1 to about 30:1.

The cleaning composition of the present invention with such a LAS-to-AS weight ratio exhibits a right balance between the amounts of wash and rinse suds generated. It also helps to maintain good sudsing profile across different regions with diverse dosing habit.

ALKOXYLATED ALKYL SULPHATE

The cleaning composition of the present invention employs alkyl sulphate or AS instead of alkylalkoxy sulphate as a co-surfactant to boost the suds of LAS. In comparison with alkylalkoxy sulphate, the AS co-surfactant has a significant better rinse suds profile (i.e., reduced rinse suds volume) and is therefore particularly useful for imparting the easy rinse benefit to the cleaning composition so formed. Consequently, the cleaning composition of the present invention is substantially free of alkylalkoxy sulphate, especially alkylethoxy sulphate (AES). In other words, the cleaning composition of the present invention contains alkylalkoxy sulphate, or more specifically AES, in an amount ranging from 0 wt% to about 1 wt%, preferably from 0 wt% to about 0.8 wt%, or more preferably from 0 wt% to about 0.5 wt%, and most preferably at a level that is not analytically detectable. Alkylalkoxy sulphate as used herein refers to any linear or branched alkylalkoxy sulphate having a weight average degree of alkoxylation ranging from about 0.1 to about 10.

OTHER SURFACTANTS OF THE SURFACTANT SYSTEM

In addition to LAS and AS described hereinabove, the surfactant system employed by the cleaning composition of the present invention may comprise one or more additional surfactant(s) selected from other anionic surfactants (other than LAS, AS, and AES described hereinabove), nonionic surfactants, cationic surfactants, ampholytic surfactants, zwitterionic surfactants, semi-polar nonionic surfactants and mixtures thereof.

The cleaning compositions of the invention may comprise additional anionic surfactants which comprise one or more moieties selected from the group consisting of carbonate, phosphate, phosphonate, sulphate, sulfonate, carboxylate and mixtures thereof and which do not fall within the above descriptions for the LAS, AS, and AES surfactants.

The cleaning compositions of the present invention may comprise one or more non-ionic surfactants in amounts of from about 0.1% to about 20%, preferably from about 0.2% to about 4%, more preferably from about 0.4% to about 3% by total weight of the composition. Suitable non-ionic surfactants can be selected from the group consisting of: alkyl polyglucoside and/or an alkyl alkoxylated alcohol; C_{10}-C_{18} alkyl ethoxylates, such as, NEODOL® non-ionic surfactants from Shell; C_6-C_{12} alkyl phenol alkoxylates wherein the alkoxylate units are ethyleneoxy units, propyleneoxy units or a mixture thereof; C_{12}-C_{18} alcohol and C_6-C_{12} alkyl phenol condensates with ethylene oxide/propylene oxide block polymers such as Pluronic® from BASF; C_{14}-C_{22} mid-chain branched alcohols; C_{14}-C_{22} mid-chain branched alkyl alkoxylates, BAEx, wherein x = from 1 to 35; alkylcelluloses, specifically alkylpolyglycosides; polyhydroxy fatty acid amides; ether capped poly(oxyalkylated) alcohol surfactants; and mixtures thereof.

The cleaning compositions of the present invention may comprise a cationic surfactant. When present, the composition typically comprises from about 0.05 wt% to about 5 wt%, or from about 0.1 wt% to about 2 wt% of such cationic surfactant. Suitable cationic surfactants are alkyl pyridinium compounds, alkyl quaternary ammonium compounds, alkyl quaternary phosphonium compounds, and alkyl ternary sulfonium compounds. The cationic surfactant can be selected from the group consisting of: alkoxylate quaternary ammonium (AQA) surfactants; dimethyl hydroxyethyl quaternary ammonium surfactants; polyamine cationic surfactants; cationic ester surfactants; amino surfactants, specifically amido propyldimethyl amine; and mixtures thereof. Highly preferred cationic surfactants are mono-C_{8-10} alkyl mono-hydroxyethyl di-methyl quaternary ammonium chloride, mono-C_{10-12} alkyl mono-hydroxyethyl di-methyl quaternary ammonium chloride and mono-C_{10} alkyl mono-hydroxyethyl di-methyl quaternary ammonium chloride. Cationic surfactants such as Praepagen HY (tradename Clariant) may be useful and may also be useful as a suds booster.

FATTY ACIDS OR SALTS THEREOF

The cleaning composition of the present invention employs a specific mixture or blend of fatty acids or salts thereof to help improving the sudsing profile of the cleaning composition during wash and reducing undissolvable residues on fabrics after wash.

Specifically, the fatty acid mixture contains from 15% to 30%, by weight of such mixture, of fatty acids or salts derived from palm kernel oil (PKO) and/or coconut oil (CNO), and from 70% to 85%, by weight of such mixture, of fatty acids or salts derived from palm oil (PO). If the PKO/CNO-derived fatty acids or salts in the mixture is present in an amount lower than 15% by weight of such mixture, the sudsing profile of the cleaning composition during wash is less than optimal, and more undissolvable residues are observed on the treated fabrics after wash. If the PKO/CNO-derived fatty acids or salts in the mixture is present in an amount higher than 30% by weight of such mixture, the particles formed by such fatty acid mixture may be too soft and may affect the overall flowability of the resulting granular composition formed thereby.

Suitable salts of fatty acids include monovalent or divalent alkali metal salts like sodium, potassium, lithium and/or magnesium salts as well as the ammonium and/or alkylammonium salts of fatty acids, preferably the sodium salt.

The total amount of such fatty acids or salts ranges from about 0.5% to about 1.2%, preferably from about 0.8% to about 1.1%, by total weight of the cleaning composition. In a particularly preferred embodiment of the present invention, the cleaning composition of the present invention contains from about 0.8% to about 1.1%, by weight of such composition, of a mixture or blend of fatty acids or salts that contains from about 20% to about 30%, by weight of such mixture or blend, of PKO/CNO-derived fatty acids or salts and from about 70% to about 80%, by weight of such mixture or blend, of PO-derived fatty acids or salts.

WATER-SOLUBLE ALKALI METAL CARBONATE

The cleaning composition of the present invention, when it is in a powder or granular form, may also contain a water-soluble alkali metal carbonate or bicarbonate. Suitable alkali metal carbonate or bicarbonate that can be used for practice of the present invention include, but are not limited to, sodium carbonate, potassium carbonate, sodium bicarbonate, and potassium bicarbonate (which are all referred to as "carbonates" or "carbonate" hereinafter). Sodium carbonate is particularly preferred. Potassium carbonate, sodium bicarbonate, and potassium bicarbonate can also be used. Such water-soluble alkali metal carbonate can be present in the cleaning composition at a level ranging from about 5 wt% to about 50 wt%.

Carbonates have been used in relatively high concentrations (e.g., 25 wt% or more) in cleaning compositions containing a surfactant system formed of LAS and AS anionic surfactants as described hereinabove, in order to provide generate sufficient suds during the wash cycle. However, the high carbonate concentration in the cleaning composition inevitably increase the pH of the wash liquor, rendering it harsher and more damaging to the skin surface of hand-wash consumers. In the present invention, the specific mixture or blend of fatty acids or salts thereof is employed to boost or maintain wash suds, which enables reduction of the carbonate level in the cleaning composition without compromising the overall sudsing profile of such composition, thereby providing a milder formulation more suitable for hand-wash consumers.

Correspondingly, the cleaning composition preferably contains a relatively low level of the water-soluble alkali metal carbonate or bicarbonate, such as, for example, from about 10 wt% to about 40 wt%, and preferably from about 15 wt% to about 30 wt%. In a most preferred embodiment of the present invention, the cleaning composition of the present invention includes from about 15 wt% to about 30 wt% of sodium carbonate or sodium bicarbonate.

AMPHIPHILIC GRAFT COPOLYMER(S)

The amphiphilic graft copolymers employed by the present invention are characterized by a polyalkylene oxide (also referred to as poyalkylene glycol) backbone grafted with one or more side chains.

The polyalkylene oxide backbone of the amphiphilic graft copolymers of the present invention may comprise repeated units of C_2-C_{10}, preferably C_2-C_6, and more preferably C_2-C_4, alkylene oxides. For example, the polyalkylene oxide backbone may be a polyethylene oxide (PEO) backbone, a polypropylene oxide (PPO) backbone, a polybutylene oxide (PBO) backbone, or a polymeric backbone that is a linear block copolymer of PEO, PPO, and/or PBO, while the PEO backbone is preferred. Such a polyalkylene oxide backbone preferably has a number average molecular weight of from about 2,000 to about 100,000 Daltons, more preferably from about 4,000 to about 50,000 Daltons, and most preferably from about 5,000 to about 10,000 Daltons.

The one or more side chains of the amphiphilic graft copolymers of the present invention are formed by polymerizations of vinyl esters of C_2-C_{10}, preferably C_2-C_6, and more preferably C_2-C_4, carboxylic acids. For example, the one or more side chains may be selected from the group consisting of polyvinyl acetate, polyvinyl propionate, polyvinyl butyrate, and combinations thereof, while polyvinyl acetate is preferred. The polyvinyl ester side chains may be partially saponified, for example, to an extent of up to 15%. The amphiphilic graft copolymer is preferably characterized by an average of no more than 1 graft site (i.e., the site on the polymeric backbone where a polyvinyl ester side chain is grafted thereto) per 50 alkyleneoxide units on the backbone.

The amphiphilic graft copolymers of the present invention may have an overall mean molar masses (M_w) of from about 3000 to about 100,000 Daltons, preferably from about 10,000 to about 50,000 Daltons, and more preferably from about 20,000 to about 40,000 Daltons.

Particularly preferred amphiphilic graft copolymers of the present invention have a polyethylene oxide backbone grafted with one or more side chains of polyvinyl acetate. More preferably, the weight ratio of the polyethylene oxide backbone over the polyvinyl acetate side chains ranges from about 1:0.2 to about 1:10, or from about 1:0.5 to about 1:6, and most preferably from about 1:1 to about 1:5. One example of such preferred amphiphilic graft copolymers is the Sokalan^{TM} HP22 polymer, which is commercially available from BASF Corporation. This polymer has a polyethylene oxide backbone grafted with polyvinyl acetate side chains. The polyethylene oxide backbone of this polymer has a number average molecular weight of about 6,000 Daltons (equivalent to about 136 ethylene oxide units), and the weight ratio of the polyethylene oxide backbone over the polyvinyl acetate side chains is about 1:3. The number average molecular weight of this polymer itself is about 24,000 Daltons.

Preferably, but not necessarily, the amphiphilic graft copolymers of the present invention have the following properties: (i) the surface tension of a 39 ppm by weight polymer solution in distilled water is from about 40 mN/m to about 65 mN/m as measured at 25°C by a tensiometer; and (ii) the viscosity of a 500 ppm by weight polymer solution in distilled water is from about 0.0009 to about 0.003 Pa·S as measured at 25°C by a rheometer. The surface tension of the polymer solution can be measured by any known tensiometer under the specified conditions. Non-limiting tensiometers useful herein include Kruss K12 tensiomerter available from Kruss, Thermo DSCA322 tensiometer from Thermo Cahn, or Sigma 700 tensiometer from KSV Instrument Ltd. Similarly, the viscosity of the polymer solution can be measured by any known rheometer under the specified conditions. The most commonly used rheometer is a rheometer with rotational method, which is also called a stress/strain rheometer. Non-limiting rheometers useful herein include Hakke Mars rheometer from Thermo, Physica 2000 rheometer from Anton Paar.

The amphiphilic graft copolymer(s) may be present in the cleaning composition of the present invention in an amount ranging from about 0.3 wt% to about 3 wt% or from about 0.35 wt% to about 2 wt% by total weight of the composition. They are found to provide excellent hydrophobic soil suspension even in the presence of cationic coacervating polymers.

ADJUNCT COMPONENTS

The cleaning composition of the present invention may comprise one or more additional adjunct components. The precise nature of these additional adjunct components, and levels of incorporation thereof, will depend on the physical form of the composition and the nature of the operation for which it is to be used. Suitable adjunct materials include, but are not limited to, builders, carriers, structurants, flocculating aid, chelating agents, dye transfer inhibitors, enzymes, enzyme stabilizers, catalytic materials, bleach activators, hydrogen peroxide, sources of hydrogen peroxide, preformed peracids, polymeric dispersing agents, clay soil removal/anti-redeposition agents, brighteners, suds suppressors, dyes, perfumes, structure elasticizing agents, fabric softeners, hydrotropes, processing aids, and/or pigments.

In a preferred embodiment of the present invention, the cleaning composition of the present invention is a granular laundry detergent composition comprising one or more builders (not including the carbonate as described hereinabove) in the amount ranging from about 1 wt% to about 40 wt%, typically from 2 wt% to 25 wt%, or even from about 5 wt% to about 20 wt%, or from 8 wt to 15 wt% by total weight of such composition. Builders as used herein refers to any ingredients or components that are capable of enhancing or improving the cleaning efficiency of surfactants, e.g., by removing or reducing "free" calcium/magnesium ions in the wash solution to "soften" or reducing hardness of the washing liquor.

It is particularly desirable that such granular laundry detergent composition has relatively low levels of phosphate builder, zeolite builder, and silicate builder. For example, it may contain at most 15 wt% by weight of phosphate builder, zeolite builder, and silicate builder in total. Preferably, such granular laundry detergent composition is substantially free of phosphate builder. More preferably, it comprises from 0 wt% to about 5 wt% of zeolite builder and/or from 0 wt% to about 10 wt% of silicate builder, while the total amounts of such zeolite and silicate builders add up to no more than 10 wt% by total weight of the composition. Still more preferably, the granular laundry detergent composition contains from 0 wt% to about 2 wt% of zeolite builder and from 0 wt% to about 2 wt% of silicate builder, while the total amounts of such builders add up to no more than 5 wt% by total weight of the composition. Most preferably, the granular laundry detergent composition contains from 0 wt% to about 1 wt% of zeolite builder and from 0 wt% to about 1 wt% of silicate builder, while the total amounts of these builders add up to no more than 2 wt% by total weight of the composition. The composition may further comprise any other supplemental builder(s), chelant(s), or, in general, any material which will remove calcium ions from solution by, for example, sequestration, complexation, precipitation or ion exchange. In particular, the composition may comprise materials having at a temperature of 25°C and at a 0.1M ionic strength a calcium binding capacity of at least 50 mg/g and a calcium binding constant log K Ca^{2+} of at least 3.50.

The granular laundry detergent composition of the present invention may contain one or more solid carriers selected from the group consisting of sodium chloride, potassium chloride, sodium sulphate, and potassium sulphate. In a preferred, but not necessary embodiment, such granular laundry detergent composition includes from about 10 wt% to about 80 wt% of sodium chloride and/or from about 10 wt% to about 80 wt% of sodium sulphate. More preferably, such granular laundry detergent composition comprises from about 10 wt% to about 80 wt%, preferably from about 20 wt% to about about 70 wt%, more preferably from about 30 wt% to about 60 wt% of sodium sulphate.

The cleaning composition of the present invention may further comprise one or more suitable detergent ingredients such as transition metal catalysts; imine bleach boosters; enzymes such as amylases, carbohydrases, cellulases, laccases, lipases, bleaching enzymes such as oxidases and peroxidases, proteases, pectate lyases and mannanases; source of peroxygen such as percarbonate salts and/or perborate salts, preferred is sodium percarbonate, the source of peroxygen is preferably at least partially coated, preferably completely coated, by a coating ingredient such as a carbonate salt, a sulphate salt, a silicate salt, borosilicate, or mixtures, including mixed salts, thereof; bleach activator such as tetraacetyl ethylene diamine, oxybenzene sulphonate bleach activators such as nonanoyl oxybenzene sulphonate, caprolactam bleach activators, imide bleach activators such as N-nonanoyl-N-methyl acetamide, preformed peracids such as N,N-pthaloylamino peroxycaproic acid, nonylamido peroxyadipic acid or dibenzoyl peroxide; suds suppressing systems such as silicone based suds suppressors; brighteners; hueing agents; photobleach; fabric-softening agents such as clay, silicone and/or quaternary ammonium compounds; flocculants such as polyethylene oxide; dye transfer inhibitors such as polyvinylpyrrolidone, poly 4-vinylpyridine N-oxide and/or co-polymer of vinylpyrrolidone and vinylimidazole; fabric integrity components such as oligomers produced by the condensation of imidazole and epichlorhydrin; soil dispersants and soil anti-redeposition aids such as alkoxylated polyamines and ethoxylated ethyleneimine polymers; anti-redeposition components such as polyesters and/or terephthalate polymers, polyethylene glycol including polyethylene glycol substituted with vinyl alcohol and/or vinyl acetate pendant groups; perfumes such as perfume microcapsules, polymer assisted perfume delivery systems including Schiff base perfume/polymer complexes, starch encapsulated perfume accords; soap rings; aesthetic particles including coloured noodles and/or needles; dyes; co-polyesters of di-carboxylic acids and diols; cellulosic polymers such as methyl cellulose, carboxymethyl cellulose, hydroxyethoxycellulose, or other alkyl or alkylalkoxy cellulose, and hydrophobically modified cellulose; carboxylic acid and/or salts thereof, including citric acid and/or sodium citrate; and any combination thereof.

CLEANING COMPOSITION

The detergent composition is typically a laundry detergent composition or a dish washing detergent composition. Typically, the composition is a laundry detergent composition.

The laundry detergent composition may be in the form of a liquid, gel, paste, dispersion, typically a colloidal dispersion or any combination thereof. Liquid compositions typically have a viscosity of from 500 mPa.s to 3,000 mPa.s, when measured at a shear rate of 20 s^{-1} at ambient conditions (20°C and 1 atmosphere), and typically have a density of from 800 g/l to 1300 g/l. If the composition is in the form of a dispersion, then it will typically have a volume average particle size of from 1 micrometer to 5,000 micrometers, typically from 1 micrometer to 50 micrometers. Typically, a Coulter Multisizer is used to measure the volume average particle size of a dispersion. Preferably, the laundry detergent composition is in a liquid form containing cleaning actives solubilised or dispersed in a solvent. Suitable solvents include water and other solvents such as lipophilic fluids. Examples of suitable lipophilic fluids include siloxanes, other silicones, hydrocarbons, glycol ethers, glycerine derivatives such as glycerine ethers, perfluorinated amines, perfluorinated and hydrofluoroether solvents, low-volatility nonfluorinated organic solvents, diol solvents, other environmentally-friendly solvents and mixtures thereof.

The laundry detergent composition can also be, and is preferably, in a solid or a particulate form, typically in a free-flowing particulate form. The composition in solid form can be in the form of an agglomerate, granule, flake, extrudate, bar, tablet or any combination thereof. The solid composition can be made by methods such as dry-mixing, agglomerating, compaction, spray drying, pan-granulation, spheronization or any combination thereof. The solid composition typically has a bulk density of from 300 g/l to 1,500 g/l, typically from 500 g/l to 1,000 g/l.

The laundry detergent composition may be in unit dose form, including not only tablets, but also unit dose pouches wherein the composition is at least partially enclosed, typically completely enclosed, by a film such as a polyvinyl alcohol film.

The laundry detergent composition may also be in the form of an insoluble substrate, for example a non-woven sheet, impregnated with detergent actives.

The laundry detergent composition may be capable of cleaning and/or softening fabric during a laundering process. Typically, the composition is formulated for use in an automatic washing machine or for hand-washing use, and preferably for hand-wash.

Methods of Using the Cleaning or Laundry Detergent Composition

The compositions are typically used for cleaning and/or treating a situs *inter alia* a surface or fabric. As used herein, "surface" may include such surfaces such as dishes, glasses, and other cooking surfaces, hard surfaces, hair or skin. Such method includes the steps of contacting an embodiment of the laundry detergent or cleaning composition, in neat form or diluted in a wash liquor, with at least a portion of a surface or fabric, then optionally rinsing such surface or fabric. The surface or fabric may be subjected to a washing step prior to the aforementioned rinsing step. For purposes of the present invention, "washing" includes but is not limited to, scrubbing, wiping, and mechanical agitation.

The composition solution pH is chosen to be the most complimentary to a target surface to be cleaned spanning broad range of pH, from about 5 to about 11. For personal care such as skin and hair cleaning pH of such composition preferably has a pH from about 5 to about 8 for laundry cleaning compositions pH of from about 8 to about 10. The compositions are preferably employed at concentrations of from about 200 ppm to about 10,000 ppm in solution. The water temperatures preferably range from about 5°C to about 100°C.

As will be appreciated by one skilled in the art, the laundry detergent of the present invention is ideally suited for use in laundry applications. Accordingly, the present invention includes a method for laundering a fabric. The method may comprise the steps of contacting a fabric to be laundered with a laundry detergent comprising the carboxyl group-containing polymer. The fabric may comprise most any fabric capable of being laundered in normal consumer use conditions. The solution preferably has a pH of from about 8 to about 10.5. The laundry detergent may be employed at concentrations of from about 500 ppm to about 15,000 ppm in solution, and optionally, more dilute wash conditions can be used. The water temperatures typically range from about 5ºC to about 90ºC. The water to fabric ratio is typically from about 1:1 to about 30:1.

The method of laundering fabric may be carried out in a top-loading or front-loading automatic washing machine, or can be used in a hand-wash laundry application. In these applications, the wash liquor formed and concentration of laundry detergent composition in the wash liquor is that of the main wash cycle. Any input of water during any optional rinsing step(s) is not included when determining the volume of the wash liquor.

The wash liquor may comprise 40 litres or less of water, or 30 litres or less, or 20 litres or less, or 10 litres or less, or 8 litres or less, or even 6 litres or less of water. The wash liquor may comprise from above 0 to 15 litres, or from 2 litres, and to 12 litres, or even to 8 litres of water. For dilute wash conditions, the wash liquor may comprise 150 litres or less of water, 100 litres or less of water, 60 litres or less of water, or 50 litres or less of water, especially for hand washing conditions, and can depend on the number of rinses.

Typically, from 0.01 Kg to 2 Kg of fabric per litre of wash liquor is dosed into the wash liquor. Typically, from 0.01 Kg, or from 0.05 Kg, or from 0.07 Kg, or from 0.10 Kg, or from 0.15 Kg, or from 0.20 Kg, or from 0.25 Kg fabric per litre of wash liquor is dosed into the wash liquor.

Optionally, 50 g or less, or 45 g or less, or 40 g or less, or 35 g or less, or 30 g or less, or 25 g or less, or 20 g or less, or even 15 g or less, or even 10 g or less of the composition is contacted to water to form the wash liquor.

Test Methods

Various techniques are known in the art to determine the properties of the compositions of the present invention comprising the cationic polymer. However, the following assays must be used in order that the invention described and claimed herein may be fully understood.

Test 1: Sudsing Profile Test

The wash suds height of a test cleaning composition herein is measured by employing a suds cylinder tester (SCT). The SCT has a set of 8 cylinders. Each cylinder is typically 60 cm long and 9 cm in diameter and may be together rotated at a rate of 20-22 revolutions per minute (rpm). This method is used to assay the performance of laundry detergent to obtain a reading on ability to generate suds as well as its suds stability. The rinse suds height of the test cleaning composition is measured from a 1/4 dilute solution in the cylinder by using a SITA Foam Tester R-2000 manufactured by SITA Lab Solutions (Stuttgart, Germany).

1. Weigh a 6-gram sample of the test cleaning composition and dissolve it in 2 liters of water with a water hardness of about 16gpg for at least 15 minutes to form a sample solution containing the test cleaning composition product at a concentration of about 3000ppm;
2. Pour 300ml of the sample solution into the SCT cylinders. Put in the rubber stoppers and lock the cylinders in place.
3. Spin for 10 revolutions. Lock in an upright position. Wait 1 min and check the suds height very quickly (~ 10 sec) left to right. Record the total suds height (i.e., height of the suds plus wash liquor) and the height of the wash liquor alone. The height of suds generated by each test detergent composition is calculated by deducting the height of the wash liquor alone out of the total suds height. This marks the after 10 revolutions data, and represents the Suds Generation.
4. Open the cylinders. Add 1 piece of fabric with clay and ¼ piece of fabric with dirty cooking oil (DCO) into each cylinder. Put in the rubber stoppers. Spin for 20 revolutions.
5. Repeat Step (4). Lock in an upright position. Wait 1 min and check the suds height very quickly (~ 10 sec) left to right. Record the total suds height (i.e., height of the suds plus wash liquor) and the height of the wash liquor alone. The height of suds generated by each test detergent composition is calculated by deducting the height of the wash liquor alone out of the total suds height. This marks the after 50 revolutions data, and represents the Wash Suds.
6. The addition of the artificial soil is intended to mimic the real world washing conditions where more soils dissolve into the wash liquor from the fabrics being wash. Therefore, this test is relevant for determing the initial sudsing profile of a composition and its sudsing profile in a washing cycle.

   (Note: Preparation of fabric with clay is conduted as follows:

   - Disperse 20g of BJ-clay (clay collected from 15cm below the earth surface in Beijing, China) into 80 ml of DI water via agitation to make a clay suspension.
   - Keep agitating the suspension during the preparation process, while brushing 2g of such clay suspension onto the center of a 10cm*10cm cotton fabric to form a round shape stain (d=5cm).
   - The cotton fabric with clay is left dry at room temperature and then used for the performance evaluation.

   Preparation of fabric with DCO is conducted as follows:

   - 100 grams of peanut oil is used to fry 20 grams of salty fish for 2 hrs at 150-180°C to form the dirty cooking oil (DCO).
   - Brush 0.6ml of the DCO onto the center of a 10cm*10cm cotton fabric to form a round shape stain (d=5cm).
   - Cut the 10cm*10cm cotton fabric into 4 equal pieces and use one for the performance evaluation.)

7. Pour 250 ml of the sample solution out of the cylinders gently into a beaker, and add 750 ml of water with the above-mentioned water hardness level into the beaker to form a 1/4 diluted solution with a total volume of about 1 liter.
8. Pour 250 ml of the 1/4 diluted solution into a beaker of the SITA Foam Tester R-2000.
9. SITA measurement parameters are set as follows
   a. Foam build up measurement;
      i. Stir count: 15;
      ii. Stir time: 15s;
      iii. Revolutions: 1000 rpm;
   b. Foam decay measurement:
      i. Interval: 30s;
      ii. Maximum time: 3 minutes;
      iii. Min volume: 0ml.

   The suds volume is read at about 1s-15s.
10. In a typical sudsing profile test, Steps (1)-(9) are repeated at least twice (i.e., 3 replications) to obtain the average suds volume and ensure repeatibility of the results.
11. Data Analysis: Breakdown of the Suds Category

Suds Generation Height (cm)	10 revolutions data	Washing Cycle Wash data analysis is focused on Suds stability
Wash Suds Height (cm)	50 revolutions data	
1/4 Rinse Suds Volume (ml)	Ave. 12s-15s suds volume	Rinsing Cycle: Rinse data analysis is focused on Rinse (1:4)

Average suds height of different categories described above are calculated by average the height data of each replicate.

Test 2: Fabric Residue Test (Wet Sieve)

This test method is used herein to determine the solubility of a cleaning composition by measuring the weight percentage (Wt%) of undissolved residue left by such cleaning composition on a 250-micron sieve after such cleaning composition is dissolved in water for about 10 minutes.

(1) Measure the dry weight of the 250-micron sieve (M_0);

(2) Weigh three (3) samples of a test cleaning composition at 30 grams each (i.e., a total sample weight of 90 grams);

(3) Dissolve each sample in about 2L distilled water under constant magnetic stirring (for about 10 minutes, thereby forming three (3) sample solutions. The magnetic stirring is conducted in a 2-liter beaker with a height of approximately 18 cm by using a C-MAG HS 7 S25 magnetic stirrer manufactured by IKA (Staufen, Germany);

(4) Pour the three sample solutions onto the 250-micron sieve at the same time to filter out any undissolved residue from such solutions;

(5) Dry the 250-micron sieve in a DHG-9145A oven manufactured by Shanghai YiHeng Scientific Instrument Co., Ltd. (Shanghai, China) at about 150°C for about 50 minutes;

(6) After the sieve cools down, weigh the sieve (M_1);

(7) Calculate the residue weight percentage as follows:

$$Wt\% = (M_1 - M_0)/(30g \times 3) \times 100\%$$

(8) Repeat Steps (1) to (7) three (3) times to ensure test repeatability, and take the average value as the final residue weight percentage (Wt%) of the test cleaning composition.

EXAMPLES

The following examples are given by way of illustration only and therefore should not be construed to limit the scope of the invention.

Example 1: Comparative Tests Showing Sudsing Profiles

Two sample granular laundry detergent formulations with two different blends of fatty acids are prepared to demonstrate the impact of fatty acid constitutions on the sudsing performance of the laundry detergent formulations. The first, comparative granular laundry detergent composition employs a fatty acid blend containing about 10 wt% of PKO-derived fatty acid salt (sodium) and about 90 wt% of PO-derived fatty acid salt (sodium). The second, inventive granular laundry detergent composition employs a fatty acid blend containing about 20 wt% of PKO-derived fatty acid salt (sodium) and about 80 wt% of PO-derived fatty acid salt (sodium). The compositional breakdown of these two formulations are shown in Table I:

TABLE I

Ingredients (wt%)	1st (Comparative)	2nd (Inventive)
90/10 PO/PKO fatty acid blend (Na salt)	2.7	--
80/20 PO/PKO fatty acid blend (Na salt)	--	0.8
C_{11}-C_{13} LAS	13.1	13.1
C_{12}-C_{14} AS	0.5	0.5
Nonionic surfactants	0.7	0.7
Silicate	3.5	3.5
Zeolite	3.2	3.2
Sodium carbonate	20.5	20.5
Enzymes	0.3	0.3
Carboxymethyl cellulose	0.3	0.3
Polyacrylate-co-Polymaleate	2	2
Polyethyleneglycol-co-Polyvinylacetate	0.5	0.5
Starch	0.1	0.1
C_{11}-C_{12} alkyl benzene	0.2	0.2
Water	2	2
Misc. (e.g., brighteners, dyes, perfumes, citric acid, silica, glycerol, triporopylene glycol, NaOH, NaCl)	1	1
Sodium Sulfate	Balance	Balance

The sudsing profile of the inventive composition hereinabove that contain a blend of fatty acids containing about 20 wt% of PKO-derived fatty acid salt (sodium) and about 80 wt% of PO-derived fatty acid salt (sodium) is measured by the Sudsing Profile Test as mentioned hereinabove, and is compared with that of the comparative composition containing about 10 wt% of PKO-derived fatty acid salt (sodium) and about 90 wt% of PO-derived fatty acid salt (sodium).

Following are the measured sudsing profiles of the two sample formulations:

TABLE II

Formulations	**Comparative (2.7% 90/10 PO/PKO Soap)**	**Inventive (0.8% 80/20 PO/PKO Soap)**
Suds Generation Height	23.5 cm	23.5 cm
Wash Suds Height	23.6 cm	26.4 cm
1/4 Rinse Suds Volume	14 ml	13 ml

It is clear from the above results that even when used at a significantly smaller amount (0.8% only) in the inventive granular laundry detergent composition, the 80/20 PO/PKO soap blend can generate a higher wash suds height and a comparative rinse suds volume after the first rinse, in comparison with the 90/10 PO/PKO soap blend that is used at a much greater amount (2.96%)

in the comparative granular laundry detergent composition. This indicates that the 80/20 PO/PKO soap blend can provide a satisfactory sudsing profile while used at a much lower concentration, in comparison with the 90/10 PO/PKO soap blend.

Example 2: Comparative Tests Showing After-Wash Fabric Residues

Four (4) sample granular laundry detergent formulations with two different blends of fatty acids are prepared to demonstrate the impact of fatty acid constitutions on the undissolvable fabric residues of the laundry detergent formulations after wash. The compositional breakdown of these four formulations are shown in Table III:

TABLE III

Ingredients (wt%)	**A**	**B**	**C**	**D**
90/10 PO/PKO fatty acid blend (Na salt)	2.7	--	0.8	--
80/20 PO/PKO fatty acid blend (Na salt)	--	2.7	--	1.4
C_{11}-C_{13} LAS	13.1	13.1	13.1	13.1
C_{12}-C_{14} AS	0.5	0.5	0.5	0.5
Nonionic surfactants	0.7	0.7	0.7	0.7
Silicate	3.5	3.5	3.5	3.5
Zeolite	3.2	3.2	3.2	3.2
Sodium carbonate	20.5	20.5	20.5	20.5
Enzymes	0.3	0.3	0.3	0.3
Carboxymethyl cellulose	0.3	0.3	0.3	0.3
Polyacrylate-co-Polymaleate	2	2	2	2
Polyethyleneglycol-co-Polyvinylacetate	0.5	0.5	0.5	0.5
C_{11}-C_{12} alkyl benzene	0.2	0.2	0.2	0.2
Water	2	2	2	2
Misc. (e.g., brighteners, dyes, perfumes, citric acid, silica, glycerol, triporopylene glycol, NaOH, NaCl)	1	1	1	1
Sodium Sulfate	Balance	Balance	Balance	Balance

The fabric residues left by the above-mentioned four sample laundry detergent composition after wash are measured by the Fabric Reside Test as mentioned hereinabove, and the test results are as follows.

TABLE IV

Sample	**Soap Blend Type**	**Soap Content (wt%)**	**Residue (Wt%)**
A	90/10 PO/PKO fatty acid blend (Na salt)	2.7	1.57
B	80/20 PO/PKO fatty acid blend (Na salt)	2.7	0.92
C	90/10 PO/PKO fatty acid blend (Na salt)	0.8	0.48
C	80/20 PO/PKO fatty acid blend (Na salt)	1.4	0.46

It is clear from the above results that when used at the same amount (2.7%), the 80/20 PO/PKO soap blend leaves significantly less residue on the fabric after wash than the 90/10

PO/PKO soap blend. In order to achieve a fabric residue percentage (%) of less than 0.5%, the amount of 90/10 PO/PKO soap blend used in the laundry detergent composition needs to be reduced to about 0.8%, while the amount of 80/20 PO/PKO soap blend used can remain at about 1.4%.

The dimensions and values disclosed herein are not to be understood as being strictly limited to the exact numerical values recited. Instead, unless otherwise specified, each such dimension is intended to mean both the recited value and a functionally equivalent range surrounding that value. For example, a dimension disclosed as “40 mm” is intended to mean “about 40 mm.”

Every document cited herein, including any cross referenced or related patent or application and any patent application or patent to which this application claims priority or benefit thereof, is hereby incorporated herein by reference in its entirety unless expressly excluded or otherwise limited. The citation of any document is not an admission that it is prior art with respect to any invention disclosed or claimed herein or that it alone, or in any combination with any other reference or references, teaches, suggests or discloses any such invention. Further, to the extent that any meaning or definition of a term in this document conflicts with any meaning or definition of the same term in a document incorporated by reference, the meaning or definition assigned to that term in this document shall govern.

While particular embodiments of the present invention have been illustrated and described, it would be obvious to those skilled in the art that various other changes and modifications can be made without departing from the spirit and scope of the invention. It is therefore intended to cover in the appended claims all such changes and modifications that are within the scope of this invention.

CLAIMS

What is claimed is:

1. A cleaning composition comprising:

   (a) from 5% to 40%, by weight of said cleaning composition, of a C_{10}-C_{20} linear alkylbenzene sulphonate (LAS);

   (b) from 0.1% to 5%, by weight of said cleaning composition, of an alkyl sulphate (AS) having a branched or linear unalkoxylated alkyl group comprising from 6 to 18 carbon atoms; and

   (c) from 0.5% to 1.2%, by weight of said cleaning composition, of a mixture of fatty acids or salts thereof, wherein from 15% to 30% by weight of said fatty acids or salts thereof are derived from palm kernel oil and/or coconut oil, and wherein from 70% to 85% by weight of said fatty acids or salts thereof are derived from palm oil,

wherein said LAS and AS are present in said cleaning composition at a LAS-to-AS weight ratio of from 3:1 to 50:1.

2. The cleaning composition of claim 1, further comprising from 0% to 1%, by weight of said cleaning composition, of a linear or branched alkylalkoxy sulphate having a weight average degree of alkoxylation ranging from 0.1 to 10.

3. The cleaning composition of claim 1 or 2, wherein preferably LAS is present at an amount ranging from 8% to 30%, more preferably from 10% to 25%, by weight of said composition, and wherein more preferably AS is present at an amount ranging from 0.2% to 3%, more preferably from 0.3% to 2%, by weight of said composition.

4. The cleaning composition according to any one of the preceding claims, further comprising from 0.3% to 3%, by weight of said composition, of an amphiphilic graft copolymer comprising a polyalkylene oxide backbone grafted with one or more side chains selected from the group consisting of polyvinyl acetate, polyvinyl propionate, polyvinyl butyrate, and combinations thereof, wherein the weight ratio of the polyalkylene oxide backbone over said one or more side chains ranges from 1:0.2 to 1:10; wherein preferably the graph copolymer has a polyethylene oxide backbone grafted with polyvinyl acetate side chains.

5. The cleaning composition according to any one of the preceding claims, wherein said cleaning composition is a granular laundry detergent composition that comprises: (1) from 5% to 50%, preferably from 10% to 40%, more preferably from 15% to 30%, by weight of said granular laundry detergent composition, of a water-soluble alkali metal carbonate and/or bicarbonate, which is preferably sodium carbonate and/or sodium bicarbonate; and/or (2) from 10% to 80%, preferably from 20% to 70%, more preferably from 30% to 60%, by weight of said granular laundry detergent composition, of a water-soluble alkali metal sulphate, which is preferably sodium sulphate.

6. The cleaning composition according to claim 5, wherein said granular laundry detergent composition is characterized by a moisture content of less than 3% by weight of said composition; wherein preferably said granular laundry detergent composition is substantially free of any phosphate builder and comprises from 0% to 15%, preferably from 0% to 10%, more preferably from 0% to 5%, by weight of said granular laundry detergent composition, of a zeolite builder.

7. Use of a cleaning composition according to any one of the preceding claims for hand-washing fabrics.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2017/106819

A. CLASSIFICATION OF SUBJECT MATTER

C11D 10/04(2006.01)i；C11D 17/06(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

C11D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WPI; EPODOC; CNPAT; CNKI; STN; ISI Web of Science; laundry, detergent, wash, clean, granular, particulate, fatty acid, soap, surfactant, palm kernel oil, coconut oil, palm oil, linear alkylbenzene sulphonate, LAS, sulfonate, alkyl sulphate, AS, sulfate, sudsing, suds, foam, rinse

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	CN 106661501 A (THE PROCTER & GAMBLE COMPANY) 10 May 2017 (2017-05-10) the whole document	1-7
A	CN 106574217 A (UNILEVER N.V.) 19 April 2017 (2017-04-19) the whole document	1-7
A	CN 1075507 A (THE PROCTER & GAMBLE COMPANY) 25 August 1993 (1993-08-25) the whole document	1-7
A	US 5443751 A (CHURCH & DWIGHT CO. INC.) 22 August 1995 (1995-08-22) the whole document	1-7
A	WO 9514766 A1 (UNILEVER PLC ET AL.) 01 June 1995 (1995-06-01) the whole document	1-7
A	JP S59221392 A (LION CORP.) 12 December 1984 (1984-12-12) the whole document	1-7

☐ Further documents are listed in the continuation of Box C. ☑ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search **06 July 2018**	Date of mailing of the international search report **25 July 2018**
Name and mailing address of the ISA/CN **STATE INTELLECTUAL PROPERTY OFFICE OF THE P.R.CHINA** **6, Xitucheng Rd., Jimen Bridge, Haidian District, Beijing 100088** **China**	Authorized officer **LING,Hui**
Facsimile No. **(86-10)62019451**	Telephone No. **86-(10)-53962219**

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/CN2017/106819

Patent document cited in search report			Publication date (day/month/year)	Patent family member(s)			Publication date (day/month/year)
CN	106661501	A	10 May 2017	WO	2016015326	A1	04 February 2016
				MX	2017001451	A	11 May 2017
				EP	3174965	A4	28 March 2018
				EP	3174965	A1	07 June 2017
CN	106574217	A	19 April 2017	WO	2016030226	A1	03 March 2016
				EP	3186347	A1	05 July 2017
				CL	2017000324	A1	18 August 2017
				AR	101702	A1	04 January 2017
				EP	3186347	B1	20 December 2017
				EA	201790493	A1	30 June 2017
CN	1075507	A	25 August 1993	CA	2124790	C	30 June 1998
				ES	2142859	T3	01 May 2000
				EP	0615540	B1	15 March 2000
				JP	3357053	B2	16 December 2002
				HU	T67495	A	28 April 1995
				BR	9206856	A	02 May 1995
				NO	942053	D0	02 June 1994
				DE	69230801	T2	02 November 2000
				SK	63994	A3	05 October 1994
				MA	22726	A1	01 July 1993
				CN	1040022	C	30 September 1998
				EP	0615540	A4	28 September 1994
				AU	3234193	A	28 June 1993
				MX	9206959	A	30 June 1993
				EG	20160	A	31 August 1997
				AT	190644	T	15 April 2000
				HU	9401356	D0	29 August 1994
				PH	31575	A	03 November 1998
				EP	0615540	A1	21 September 1994
				FI	942551	A0	31 May 1994
				FI	942551	A	31 May 1994
				CZ	9401232	A3	15 February 1995
				TR	27153	A	09 November 1994
				NO	942053	A	02 June 1994
				WO	9311216	A1	10 June 1993
				JP	H07501575	A	16 February 1995
				CA	2124790	A1	10 June 1993
				DE	69230801	D1	20 April 2000
				EP	0544944	A1	09 June 1993
US	5443751	A	22 August 1995	None			
WO	9514766	A1	01 June 1995	ZA	9408723	B	06 May 1996
				AU	8105894	A	13 June 1995
				BR	9408136	A	05 August 1997
				ZA	9408723	A	06 May 1996
				AU	699010	B2	19 November 1998
				DE	69408160	T2	07 May 1998
				DE	69408160	T3	27 September 2001
				JP	H09505348	A	27 May 1997
				EP	0730637	A1	11 September 1996

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2017/106819

Patent document cited in search report	Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
		US 5723428 A	03 March 1998
		CZ 9601476 A3	11 September 1996
		HU 9601421 D0	28 August 1996
		ES 2112624 T5	16 September 2001
		TR 28740 A	28 February 1997
		ES 2112624 T3	01 April 1998
		HU T77855 A	28 August 1998
		SK 66196 A3	04 June 1997
		DE 69408160 D1	26 February 1998
		PL 314463 A1	16 September 1996
		EP 0730637 B1	21 January 1998
		EP 0730637 B2	23 May 2001
		GB 9324129 D0	12 January 1994
JP S59221392 A	12 December 1984	JP S59221392 A	12 December 1984