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

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
19 May 2016 (19.05.2016)

WIPO | PCT

(10) International Publication Number
WO 2016/077205 A1

(51) **International Patent Classification**:
A61Q 5/02 (2006.01) *A61Q 19/10* (2006.01)
A61K 8/81 (2006.01) *A61K 8/92* (2006.01)

(21) **International Application Number**:
PCT/US2015/059684

(22) **International Filing Date**:
9 November 2015 (09.11.2015)

(25) **Filing Language**: English

(26) **Publication Language**: English

(30) **Priority Data**:
62/077,585 10 November 2014 (10.11.2014) US

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

(72) **Inventors**: **STELLA, Qing**; One Procter & Gamble Plaza, Cincinnati, Ohio 45202 (US). **WEI, Karl, Shiqing**; One Procter & Gamble Plaza, Cincinnati, Ohio 45202 (US).

(74) **Agent**: **KREBS, Jay A.**; c/o THE PROCTER & GAMBLE COMPANY, Global Patent Services, One Procter & Gamble Plaza, C8-229, Cincinnati, Ohio 45202 (US).

(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, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, 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))*

WO 2016/077205 A1

(54) **Title**: PERSONAL CLEANSING COMPOSITIONS AND METHODS

(57) **Abstract**: A personal care composition includes a surfactant, a liquid hydrophobic benefit agent, and a crystalline hydrophobic ethylene copolymer.

PERSONAL CLEANSING COMPOSITIONS AND METHODS

TECHNICAL FIELD

The present disclosure generally relates to personal cleansing compositions and methods of enhancing deposition of hydrophobic benefit agents.

BACKGROUND OF THE INVENTION

Over time, skin cleansing has become part of a personal hygiene regimen. The cleansing of the skin allows for the removal of dirt, debris, bacteria, and a myriad of other things that can cause harm to the skin or the body. Cleansing is often done with the aid of a surfactant. The surfactant works to help remove deposited materials from the skin. Unfortunately, surfactants can also act to remove good things from the skin as well, like oil. The oil on the skin helps, for example, to protect the skin from losing too much moisture. Removal of too much oil can leave the skin vulnerable to becoming dry. One solution for this problem is to utilize a milder surfactant. Another solution is to replace what is removed by depositing a replacement material on the skin. Historically, however, there has been a struggle to effectively deposit these replacement materials on the skin, especially in rinse off products like cleansers. As such, there is a need for personal care compositions that provide enhanced deposition of materials on the skin.

SUMMARY OF THE INVENTION

The present application includes, for example, a personal cleansing composition, comprising: a) a cleansing phase comprising a surfactant, and b) a benefit phase comprising a liquid hydrophobic benefit agent and a crystalline hydrophobic ethylene copolymer wherein the ethylene copolymer comprises at least 40% ethylene monomer and an acrylate co-monomer.

The present application also includes, for example, a multiphase personal cleansing composition, comprising: a) up to about 95% by weight of the composition of a cleansing phase comprising an anionic surfactant, a co-surfactant, and a water soluble cationic polymer; and b) about 20% or less by weight of the composition of a benefit phase comprising soybean oil and an ethylene propylheptylacrylate copolymer.

These and other combinations will be better understood from the more detailed description below.

DETAILED DESCRIPTION

I. Definitions

As used herein, the following terms shall have the meaning specified thereafter:

"About" as defined herein accounts for +/- 10% of the specified number.

"Anhydrous" refers to those compositions, and components thereof, which are substantially free of water.

"Crystalline hydrophobic ethylene copolymer" refers to a hydrophobic ethylene copolymer with a structure containing more than 40% ethylene monomer that forms crystals 5 μm or larger in liquid oils. The crystals can be observed via a cross polarized optical microscope. The copolymers are random copolymers in hard solid form at 25˚C.

"Multiphase" refers to compositions comprising at least two phases which can be chemically distinct (e.g. a cleansing phase and a benefit phase). Such phases can be in direct physical contact with one another. A personal care composition can be a multiphase personal care composition where phases of the personal care composition can be blended or mixed to a significant degree, but still be physically distinct. In these situations, the physical distinctiveness is undetectable to the naked eye. The personal care composition can also be a multiphase personal care composition where the phases are in physical contact and are visually distinct. Visually distinct phases can take many forms, for example, they can appear as striped, marbled, etc.

"Package" refers to any suitable container for a personal care composition including but not limited to a bottle, tottle, tube, jar, non-aerosol pump, box, wrapper, and combinations thereof.

"Personal care composition" refers to compositions intended for topical application to skin and/or hair. Personal care compositions can be rinse-off formulations, in which the product can be applied topically to the skin and/or hair and then subsequently rinsed within seconds to minutes from the skin or hair with water. The product could also be wiped off using a substrate. The personal care compositions can also be used as shaving aids. The personal care compositions can be extrudable or dispensable from a package. Examples of personal care compositions can include but are not limited to bar soap, shampoo, conditioning shampoo, body wash, moisturizing body wash, shower gels, skin cleansers, cleansing milks, in shower body moisturizer, pet shampoo, shaving preparations, and cleansing compositions used in conjunction with a disposable cleansing cloth.

"SLS" refers to sodium lauryl sulfate.

"STnS" refers to sodium trideceth(n) sulfate, wherein n can define the average number of moles of ethoxylate per molecule.

The phrase "substantially free of" as used herein, unless otherwise specified means that the personal care composition comprises less than about 5%, less than about 3%, less than about 1%, or even less than about 0.1% of the stated ingredient. The term "free of" as used herein means that the personal care composition comprises 0% of the stated ingredient that is the ingredient has not been added to the personal care composition. However, these ingredients may incidentally form as a byproduct or a reaction product of the other components of the personal care composition.

The devices, apparatuses, methods, components, and/or compositions of the present invention can include, consist essentially of, or consist of, the components of the present invention as well as other ingredients described herein. As used herein, "consisting essentially of" means that the devices, apparatuses, methods, components, and/or compositions may include additional ingredients, but only if the additional ingredients do not materially alter the basic and novel characteristics of the claimed devices, apparatuses, methods, components, and/or compositions.

All percentages and ratios used herein are by weight of the total composition and all measurements made are at 25°C, unless otherwise designated.

II. Personal Cleansing Compositions

As discussed above, personal cleansing compositions are often used to remove dirt or debris from the skin or hair. In addition to the dirt and debris, oil (also known as sebum) is also removed through the cleansing process. While too much sebum on the skin or hair is unwanted and there is a need to remove sebum to prevent its build-up on the skin, a certain amount of sebum is good for the skin and hair as it helps protect them. Sebum can act like a barrier holding moisture into the skin and hair so that it doesn't become overly dry.

Not only do we remove sebum through the cleansing process, but sometimes individuals do not produce enough sebum from the start and thus are plagued with dry skin and hair issues. These types of issues also arise with the change in the weather as different seasons have different humidity levels. For example, there is a tendency for the winter months to be more dry and thus for there to be a higher number of people with dry skin and/or hair during that time of year.

While the use of milder surfactants can lessen the impact to the sebum, there is still a desire to deposit hydrophobic benefit agents onto the skin to help further decrease the impact of

sebum removal and to especially help those people who may have already had dry skin or hair to start. Depositing benefit agents onto the skin during a process which is set-up to remove things from the skin has always proved a challenge.

Some benefit agents have proven more difficult to deposit on skin than others. This is especially true for liquid benefit agents with a low viscosity, like soybean oil. Soybean oil has a relatively low particle size (< 3μm) and a low viscosity (less than 100cP). When applied to skin under shear during washing, the soybean oil will spread and contact skin, but is easily wiped away by the rubbing during washing causing low retention on the skin. Previous attempts to enhance deposition of hydrophobic emollient oils focused on hydrophobic, low crystallinity polymers to enhance the viscosity of low viscosity oils by blending the oil and polymer together. The low crystallinity of these polymers was noted as critical due to the belief that a high order of crystallinity in the thickened oil would cause significant antifoaming.

However, the present inventors have surprisingly discovered the use of crystalline hydrophobic ethylene acrylate copolymers can enhance deposition and provide adequate lather. As for the deposition aspect, a benefit phase containing a soybean oil / glyceryl monooleate / crystalline hydrophobic ethylene acrylate copolymer blend (Exs. 5 and 7) has better deposition than a composition containing a soybean oil / glyceryl monooleate blend (Comparative Ex. C) which can be seen in Table 1, below where deposition was measured using the In-vitro Deposition Protocol:

Table 1

EXAMPLE	DEPOSITION (μg/cm^2)
Comparative Ex. C	30-70
Ex. 5	261
Ex. 7	286

The formulations containing the crystalline hydrophobic ethylene acrylate copolymer showed more than 3 times the soybean oil deposition than Comparative C where there was no copolymer. Without being limited by theory, it is believed that the increase in deposition with the addition of the crystalline hydrophobic ethylene acrylate copolymer is due at least in part to the increase in average particle size based on the combination of the soybean oil with the crystalline hydrophobic ethylene acrylate copolymer. Soy bean oil has a relatively small particle size of about < 3μm, while the particle size of the soy bean oil / crystalline hydrophobic ethylene acrylate copolymer blend has a particle size of about 10-50μm. Larger particles tend to be better

for mass transfer to a surface and positively impact deposition. Benefit phase particle size is measured in neat product under a differential interference contrast optical microscope with a 10x objective lens. The particle size distribution is counted manually. All benefit phase particles are assumed as uniform spheres in this application. For irregular shaped benefit phase particles, the longest axis is used as the diameter for the particle size distribution counting. The number weighted average of all lipid particles is defined as the average lipid particle size. This measurement can also be accomplished with a computer algorithm.

In addition to enhanced deposition, example formulations also had acceptable lather. See Table 2 below, which shows lather properties for several exemplary formulations and a couple of comparative formulations using the Cylinder Lather Method. The data clearly indicates that the crystalline hydrophobic ethylene acrylate copolymers had no antifoaming effect.

Table 2

	Lather (mL)
Ex. 1	240
Ex. 2	240
Ex. 6	215
Ex. 8	225
Comp. A	235
Comp. C	200

Personal cleansing compositions can be multi-phase or single phase. While the components for personal cleansing compositions will be discussed below as being multi-phase for simplicity, the components for each phase could also be used in a single phase. A personal cleansing composition can comprise a cleansing phase and a benefit phase. The cleansing phase and the benefit phase can be blended. The cleansing phase and the benefit phase can also be patterned (e.g. striped and/or marbled).

A. Cleansing Phase

A personal care cleansing composition can comprise from about 50% to about 99.5%, by weight of the composition, of a cleansing phase. A cleansing phase can include a surfactant. The personal care composition can further comprise from about 0.1% to 20%, by weight of the rinse-off personal care composition, of a surfactant. Surfactants can comprise anionic surfactants, nonionic surfactants, amphoteric surfactants, zwitterionic surfactants, cationic surfactants, or mixtures thereof. The personal care composition can include at least one anionic surfactant. A

personal care composition can also comprise, for example, an anionic surfactant, amphoteric surfactant, and a zwitterionic surfactant. Suitable amphoteric or zwitterionic surfactants, for example, can include those described in U.S. Patent No. 5,104,646 and U.S. Patent No. 5,106,609.

Anionic surfactants suitable for use in the cleansing phase of the present compositions include alkyl and alkyl ether sulfates. These materials have the respective formula $ROSO_3M$ and $RO(C_2H_4O)_xSO_3M$, wherein R is alkyl or alkenyl of from about 8 to about 24 carbon atoms, wherein x is about 1 to about 10, and M is a water-soluble cation such as ammonium, sodium, potassium, or triethanolamine. The alkyl ether sulfates are typically made as condensation products of ethylene oxide and monohydric alcohols having from about 8 to about 24 carbon atoms. R may have from about 10 to about 18 carbon atoms in both the alkyl and alkyl ether sulfates. The alcohols can be derived from fats, e.g., coconut oil or tallow, or can be synthetic. Lauryl alcohol and straight chain alcohols derived from coconut oil may be used. Such alcohols may be reacted with about 1 or about 3 to about 10 or about 5 molar proportions of ethylene oxide. The resulting mixture of molecular species may have, for example, an average of 3 moles of ethylene oxide per mole of alcohol, is sulfated and neutralized.

Specific examples of alkyl ether sulfates which may be used in the cleansing phase are sodium and ammonium salts of coconut alkyl triethylene glycol ether sulfate; tallow alkyl triethylene glycol ether sulfate, and tallow alkyl hexaoxyethylene sulfate. Suitable alkyl ether sulfates are those comprising a mixture of individual compounds, said mixture having an average alkyl chain length of from about 10 to about 16 carbon atoms and an average degree of ethoxylation of from about 1 to about 4 moles of ethylene oxide.

Other suitable anionic surfactants include water-soluble salts of the organic, sulfuric acid reaction products of the general formula $[R^1\text{-}SO_3\text{-}M]$, wherein R^1 is chosen from the group consisting of a straight or branched chain, saturated aliphatic hydrocarbon radical having from about 8 to about 24, or about 10 to about 18, carbon atoms; and M is a cation. Suitable examples are the salts of an organic sulfuric acid reaction product of a hydrocarbon of the methane series, including iso-, neo-, ineso-, and n-paraffins, having about 8 to about 24 carbon atoms, preferably about 10 to about 18 carbon atoms and a sulfonating agent, e.g., SO_3, H_2SO_4, oleum, obtained according to known sulfonation methods, including bleaching and hydrolysis. Preferred are alkali metal and ammonium sulfonated $C_{10\text{-}18}$ n-paraffins.

Suitable anionic surfactants for use in the cleansing phase include ammonium lauryl sulfate, ammonium laureth sulfate, triethylamine lauryl sulfate, triethylamine laureth sulfate, triethanolamine lauryl sulfate, triethanolamine laureth sulfate, monoethanolamine lauryl sulfate, monoethanolamine laureth sulfate, diethanolamine lauryl sulfate, diethanolamine laureth sulfate, lauric monoglyceride sodium sulfate, sodium lauryl sulfate, sodium laureth sulfate, potassium laureth sulfate, sodium lauryl sarcosinate, sodium lauroyl sarcosinate, lauryl sarcosine, cocoyl sarcosine, ammonium cocoyl sulfate, ammonium lauroyl sulfate, sodium cocoyl sulfate, sodium lauroyl sulfate, potassium cocoyl sulfate, potassium lauryl sulfate, monoethanolamine cocoyl sulfate, sodium tridecyl benzene sulfonate, sodium dodecyl benzene sulfonate, and combinations thereof.

Anionic surfactants with branched alkyl chains such as sodium trideceth sulfate, for example, may be employed. Mixtures of anionic surfactants can also be used.

Amphoteric surfactants can include those that can be broadly described as derivatives of aliphatic secondary and tertiary amines in which an aliphatic radical can be straight or branched chain and wherein an aliphatic substituent can contain from about 8 to about 18 carbon atoms such that one carbon atom can contain an anionic water solubilizing group, e.g., carboxy, sulfonate, sulfate, phosphate, or phosphonate. Examples of compounds falling within this definition can be sodium 3-dodecyl-aminopropionate, sodium 3-dodecylaminopropane sulfonate, sodium lauryl sarcosinate, N-alkyltaurines such as the one prepared by reacting dodecylamine with sodium isethionate according to the teaching of U.S. Pat. No. 2,658,072, N-higher alkyl aspartic acids such as those produced according to the teaching of U.S. Pat. No. 2,438,091, and products described in U.S. Pat. No. 2,528,378. Other examples of amphoteric surfactants can include sodium lauroamphoacetate, sodium cocoamphoactetate, disodium lauroamphoacetate disodium cocodiamphoacetate, and mixtures thereof. Amphoacetates and diamphoacetates can also be used.

Zwitterionic surfactants suitable for use as cleansing surfactant in the structured aqueous cleansing phase include those that are broadly described as derivatives of aliphatic quaternary ammonium, phosphonium, and sulfonium compounds, in which the aliphatic radicals can be straight or branched chain, and wherein one of the aliphatic substituents contains from about 8 to about 18 carbon atoms and one contains an anionic group, e.g., carboxy, sulfonate, sulfate, phosphate, or phosphonate.

Other zwitterionic surfactants suitable for use in the cleansing phase include betaines, including high alkyl betaines such as coco dimethyl carboxymethyl betaine, cocoamidopropyl

betaine, cocobetaine, lauryl amidopropyl betaine, oleyl betaine, lauryl dimethyl carboxymethyl betaine, lauryl dimethyl alphacarboxyethyl betaine, cetyl dimethyl carboxymethyl betaine, lauryl bis-(2-hydroxyethyl) carboxymethyl betaine, stearyl bis-(2-hydroxypropyl) carboxymethyl betaine, oleyl dimethyl gammacarboxypropyl betaine, and lauryl bis-(2-hydroxypropyl)alpha-carboxyethyl betaine. The sulfobetaines may be represented by coco dimethyl sulfopropyl betaine, stearyl dimethyl sulfopropyl betaine, lauryl dimethyl sulfoethyl betaine, lauryl bis-(2-hydroxyethyl) sulfopropyl betaine and the like; amidobetaines and amidosulfobetaines, wherein the $RCONH(CH_2)_3$ radical is attached to the nitrogen atom of the betaine are also useful in the present compositions.

Amphoacetates and diamphoacetates can also be used. Non-limiting examples of suitable amphoacetates and diamphoacetates include sodium lauroamphoacetate, sodium cocoamphoactetate, disodium lauroamphoacetate, and disodium cocodiamphoacetate.

Cationic surfactants can also be used in the cleansing phase and may represent less than about 5%, by weight of the cleansing phase.

Suitable nonionic surfactants for use in structured aqueous cleansing phase include condensation products of alkylene oxide groups (hydrophilic in nature) with an organic hydrophobic compound, which may be aliphatic or alkyl aromatic in nature.

Other suitable surfactants or cosurfactants that can generally be used in a cleansing phase for a rinse-off personal care composition are described in McCutcheon's: Detergents and Emulsifiers North American Edition (Allured Publishing Corporation 1947) (1986), McCutcheon's, Functional Materials North American Edition (Allured Publishing Corporation 1973) (1992) and U.S. Patent No. 3,929,678 (filed Aug. 1, 1974).

The cleansing phase can include a structuring surfactant. Such a structuring surfactant can be included from about 1% to about 20%, by weight of the personal care composition; from about 2% to about 15%, by weight of the personal care composition; or from about 5% to about 10%, by weight of the personal care composition. Such a structuring surfactant can include sodium trideceth(n) sulfate, hereinafter STnS, wherein n defines the average moles of ethoxylation. n can range, for example, from about 0 to about 3; n can range from about 0.5 to about 2.7; from about 1.1 to about 2.5; from about 1.8 to about 2.2; or n can be about 2. When n is less than 3, STnS can provide improved stability, improved compatibility of benefit agents within the rinse-off personal care compositions, and/or increased mildness of the rinse-off personal care compositions, such described benefits of STnS are disclosed in U.S. Patent Application Pub. No. 2012/0009285.

The personal care composition can further comprise from about 0.1% to 20%, by weight of the personal care composition, of a cosurfactant. Cosurfactants can comprise amphoteric surfactants, zwitterionic surfactants, or mixtures thereof. Examples of these types of surfactant are discussed above.

The personal care composition can also comprise a water soluble cationic polymer. The water soluble cationic polymer can be present from about 0.001 to about 3 percent by weight of the personal care composition. The water soluble cationic polymer can also be present from about 0.05 to about 2 percent by weight of the personal care composition. The water soluble cationic polymer can also be present from about 0.1 to about 1 by weight of the personal care composition. The polymer may be in one or more phases as a deposition aid for the benefit agents described herein. Suitable cationic deposition polymers for use in the compositions of the present invention contain, for example, cationic nitrogen-containing moieties such as quaternary ammonium or cationic protonated amino moieties. The cationic protonated amines can be primary, secondary, or tertiary amines depending upon the particular species and the selected pH of the personal care composition.

Nonlimiting examples of cationic deposition polymers for use in compositions include polysaccharide polymers, such as cationic cellulose derivatives. The cationic cellulose polymers can be, for example, the salts of hydroxyethyl cellulose reacted with trimethyl ammonium substituted epoxide, referred to in the industry (CTFA) as Polyquaternium 10 which are available from Amerchol Corp. (Edison, N.J., USA) in their Polymer KG, JR and LR series of polymers. The water soluble cationic polymer comprises, for example, KG-30M. Other suitable cationic deposition polymers include cationic guar gum derivatives, such as guar hydroxypropyltrimonium chloride, specific examples of which include the Jaguar series (preferably Jaguar C-17) commercially available from Rhodia Inc., and N-Hance polymer series commercially available from Ashland.

The water soluble cationic polymer can comprise, for example, a cationic guar. In one example, the cationic guar comprises guar hydroxypropyltrimonium chloride. The guar hydroxypropyltrimonium chloride can comprise, for example, N-hance™ CG-17 Cationic Guar. The cationic guar can be, for example, selected from a group consisting of N-hance™ 3196, Jaguar C-500, Jaguar C-17, and a combination thereof. Deposition polymers can have a cationic charge density from about 0.8 meq/g to about 2.0 meq/g or from about 1.0 meq/g to about 1.5 meq/g, or about 0.96 meq/g.

The water soluble cationic polymer can also comprise synthetic polyacrylamides. Examples of suitable synthetic polyacrylamides include polyquaternium 76 and Polymethylene-*bis*-acrylamide methacrylamido propyltrimethyl ammonium chloride (PAMMAPTAC, AM:MAPTAC ratio 88:12. In one example, the water soluble cationic polymer comprises PAM/MAPTAC.

A cleansing phase of a personal care composition can also include an associative polymer. Such associative polymer can be a crosslinked, alkali swellable, associative polymer comprising acidic monomers and associative monomers with hydrophobic end groups, whereby the associative polymer comprises a percentage hydrophobic modification and a hydrophobic side chain comprising alkyl functional groups. Without intending to be limited by theory, it is believed the acidic monomers can contribute to an ability of the associative polymer to swell in water upon neutralization of acidic groups; and associative monomers anchor the associative polymer into structured surfactant hydrophobic domains, e.g., lamellae, to confer structure to the surfactant phase and keep the associative polymer from collapsing and losing effectiveness in a presence of an electrolyte.

The crosslinked, associative polymer can comprise a percentage hydrophobic modification, which is a mole percentage of monomers expressed as a percentage of a total number of all monomers in a polymer backbone, including both acidic and other non-acidic monomers. Percentage hydrophobic modification of the associative polymer, hereafter %HM, can be determined by the ratio of monomers added during synthesis, or by analytical techniques such as proton nuclear magnetic resonance (NMR). Associative alkyl side chains can comprise, for example, butyl, propyl, stearyl, steareth, cetyl, lauryl, laureth, octyl, behenyl, beheneth, steareth, or other linear, branched, saturated, or unsaturated alkyl or alketh hydrocarbon side chains. The acidic monomer can comprise any acid functional group, for example sulfate, sulfonate, carboxylate, phosphonate, or phosphate or mixtures of acid groups. The acidic monomer can comprise, for example, a carboxylate, alternatively the acidic monomer is an acrylate, including acrylic acid and/or methacrylic acid. The acidic monomer comprises a polymerizable structure, e.g., vinyl functionality. Mixtures of acidic monomers, for example acrylic acid and methacrylic acid monomer mixtures, are useful.

The associative monomer can comprise a hydrophobic end group and a polymerizable component, e.g., vinyl, which can be attached. The hydrophobic end group can be attached to the polymerizable component, hence to the polymer chain, by different means but can be attached by an ether or ester or amide functionality, such as an alkyl acrylate or a vinyl alkanoate monomer.

The hydrophobic end group can also be separated from the chain, for example, by an alkoxy ligand such as an alkyl ether. The associative monomer can be, for example, an alkyl ester, an alkyl (meth)acrylate, where (meth)acrylate is understood to mean either methyl acrylate or acrylate, or mixtures of the two.

The hydrophobic end group of the associative polymer can be incompatible with the aqueous phase of the composition and can associate with lathering surfactant hydrophobe components. Without intending to be limited by theory, it is believed that longer alkyl chains of structuring polymer hydrophobe end groups can increase incompatibility with the aqueous phase to enhance structure, whereas somewhat shorter alkyl chains having carbon numbers closely resembling lathering surfactant hydrophobes (e.g., 12 to 14 carbons) or multiples thereof (for bilayers, e.g.) can also be effective. An ideal range of hydrophobic end group carbon numbers combined with an optimal percentage of hydrophobic monomers expressed as a percentage of the polymer backbone can provide increased structure to the lathering, structured surfactant composition at low levels of polymer structurant.

The associative polymer can be Aqupec SER-300 made by Sumitomo Seika of Japan, which is Acrylates/C10-30 alkyl acrylate crosspolymer and comprises stearyl side chains with less than about 1% HM. Other preferred associative polymers can comprise stearyl, octyl, decyl and lauryl side chains. Preferred associative polymers are Aqupec SER-150 (acrylates/C10-30 alkyl acrylates crosspolymer) comprising about C18 (stearyl) side chains and about 0.4% HM, and Aqupec HV-701EDR which comprises about C8 (octyl) side chains and about 3.5% HM. In another example, the associative polymer can be Stabylen 30 manufactured by 3V Sigma S.p.A., which has branched isodecanoate hydrophobic associative side chains.

Other optional additives can be included in the cleansing phase, including for example an emulsifier (e.g., non-ionic emulsifier) and electrolytes. Suitable emulsifiers and electrolytes are described in U.S. Patent Application Serial No. 13/157,665.

B. Benefit Phase

As noted herein, personal care compositions can include a benefit phase. The composition may comprise from about 0.1 % to about 50%, by weight of the composition, of a benefit phase. The benefit phase can be hydrophobic and/or anhydrous. The benefit phase can also be substantially free of or free of surfactant. In particular, the benefit phase can comprise from about 0.1% to about 50%, by weight of the rinse-off personal care composition, of a benefit agent. The benefit phase can include, for example, from about 0.5% to about 20%, by weight of the rinse-off personal care composition, of a benefit agent.

A benefit phase can have a particle size of about 4 to about 500 μm, from about 5 to about 300μm, from about 6 to about 100 μm, or from about 10 to about 50 μm. The particle size is measured in neat product under a differential interference contrast optical microscope with a 10x objective lens. The particle size distribution is counted manually. All benefit phase particles are assumed as uniform spheres in this application. For irregular shaped benefit phase particles, the longest axis is used as the diameter for the particle size distribution counting. The number weighted average of all lipid particles is defined as the average lipid particle size. This measurement can also be accomplished with a computer algorithm.

A benefit phase can have a viscosity as measured by a standard rheometer, such as a Brookfield R/S plus. A sample of 2.5 mL is measured with a spindle C75-1 at a shear rate of 2 s^{-1} at 25°C. A benefit phase can generally have a viscosity of about 200 cP to about 15,000cP. However, it has been discovered that lower viscosity benefit phases (i.e. less than about 2000 cP) can be advantageous for manufacturing as it is easier to blend the benefit phase and the surfactant phase. Thus, for example, the benefit phase has a viscosity of 200 cP to about 1800 cP or from about 300 cP to about 1500cP.

A benefit agent can include a liquid benefit agent. A liquid benefit agent is considered liquid if that is its natural state at room temperature (i.e. 23°C). A liquid benefit agent can have a viscosity of less than about 1000 cP, less than about 800 cP, or less than about 600 cP, and can be measured with a standard rheometer.

The liquid benefit agent can have a hydrophobic component. The hydrophobic component can be, for example, a water-dispersible, non-volatile liquid. The water-dispersible, non-volatile liquid benefit agents can have a Vaughn Solubility Parameter (VSP) ranging from about 5 to about 14. Non-limiting examples of hydrophobic benefit materials having VSP values ranging from about 5 to about 14 include the following: Cyclomethicone (5.9), Squalene (6.0), Isopropyl Palmitate (7.8), Isopropyl Myristate (8.0), Castor Oil (8.9), Cholesterol (9.6), Butylene Glycol (13.2), soy bean oil, olive oil (7.87), mineral oil (7.1), and combinations thereof.

Non-limiting examples of glycerides suitable for use as liquid benefit agents herein can include castor oil, safflower oil, corn oil, walnut oil, peanut oil, olive oil, cod liver oil, almond oil, avocado oil, palm oil, sesame oil, soybean oil, vegetable oils, sunflower seed oil, coconut oil, cottonseed oil, jojoba oil, and combinations thereof.

Non-limiting examples of glyceride derivatives suitable for use as liquid benefit agents herein can include cationic derivatives, amino acid derivatives, alkanolamide derivatives, esterified derivatives, ether derivatives, hydrogenated derivatives, and combinations thereof.

Non-limiting examples of metathesized oligomers suitable for use as liquid benefit agents herein can include oligomers derived from metathesis of unsaturated polyol esters, for example. Exemplary metathesized unsaturated polyol esters and their starting materials are set forth in U.S. Patent Application U.S. 2009/0220443 A1, which is incorporated herein by reference. The unsaturated polyol ester is an unsaturated ester of glycerol. Sources of unsaturated polyol esters of glycerol include synthesized oil, plant oils, algae oils, bacterial derived oils, and animal oils, combinations of theses, and the like. Representative examples of plant oils include argan oil, canola oil, rapeseed oil, coconut oil, corn oil, cottonseed oil, olive oil, palm oil, peanut oil, safflower oil, sesame oil, soy-bean oil, sunflower oil, high oleoyl soy-bean oil, high oleoyl sunflower oil, linseed oil, palm kernel oil, tung oil, castor oil, high erucic rape oils, Jatropha oil, combinations of theses, and the like. Representative examples of animal oils include fish oil and the like. A representative example of a synthesized oil includes tall oil, which is a byproduct of wood pulp manufacture.

Other examples of unsaturated polyol esters include diesters such as those derived from ethylene glycol or propylene glycol, esters such as those derived from pentaerythritol or dipentaerythritol, or sugar esters such as SEFOSE®. Non-limiting examples of sucrose polyesters suitable for use include SEFOSE® 1618S, SEFOSE® 1618U, SEFOSE® 1618S B6, SEFOSE® 1618U B6, Sefa Cottonate, Sefa C895, Sefa C1095, SEFOSE® 1618S B4.5, all available from The Procter and Gamble Co. of Cincinnati, Ohio. Other examples of suitable natural polyol esters may include but not be limited to sorbitol esters, maltitol esters, sorbitan esters, maltodextrin derived esters, xylitol esters, and other sugar derived esters. The poloyl ester oligomers may also be modified further by partial hydroformylation of the unsaturated functionality to provide one or more OH groups and an increase in the oligomer hydrophilicity.

Non-limiting examples of hydrocarbons suitable for use as liquid benefit agents herein can include carbon chain length of about C6 or higher including alkanes, polyalkanes, olefins, polyolefins and combinations thereof. Non-limiting examples include mineral oil.

Non-limiting examples of glyceride derivatives for use as liquid benefit agents here in can include cationic derivatives, amino acid derivatives, alkanolamide derivatives, esterified derivatives, ether derivatives, hydrogenated or partially hydrogenated oils and their derivatives, and combination thereof.

Non-limiting examples of alkyl esters suitable for use as liquid benefit agents herein can include isopropyl esters of fatty acids and long chain esters of long chain (i.e. C10-C16) fatty

acids, non-limiting examples of which can include isopropyl palmitate, isohexyl palmitate and isopropyl myristate.

Non-limiting examples of silicone oils suitable for use as hydrophobic liquid skin benefit agents herein can include dimethicone copolyol, dimethylpolysiloxane, diethylpolysiloxane, mixed C1-C30 alkyl polysiloxanes, phenyl dimethicone, dimethiconol, and combinations thereof. Nonlimiting examples of silicone oils useful herein are described in U.S. Patent No. 5,011,681. Still other suitable hydrophobic skin benefit agents can include milk triglycerides (e.g., hydroxylated milk glyceride) and polyol fatty acid polyesters.

The benefit agent may also be non-liquid. Some examples of non-liquid benefit agents include hydrocarbons. Non-limiting examples of hydrocarbons suitable for use as non-liquid benefit agents herein can include petrolatum, microcrystalline wax, polyalkanes, polyolefins, and combinations thereof.

Non-limiting examples of glycerides suitable for use as non-liquid benefit agents herein can include plant waxes, animal fats, hydrogenated or partially hydrogenated plant oils, e.g. shea butter, hydrogenated soybean oil, hydrogenated palm, lanolin, lard, and combinations thereof.

Non-limiting examples of metathesized glycerides suitable for use as non-liquid benefit agents herein can include metathesized palm oil, hydrogenated or partially hydrogenated metathesized soybean oil and canola oil, and combinations thereof.

Non-limiting examples of alkyl esters suitable for use as non-liquid benefit agents herein can include isopropyl esters of fatty acids and long chain esters of long chain (i.e. C10-C24) fatty acids, e.g., cetyl ricinoleate, non-limiting examples of which can include cetyl riconoleate and stearyl riconoleate. Other examples can include hexyl laurate, isohexyl laurate, myristyl myristate, decyl oleate, isodecyl oleate, hexadecyl stearate, decyl stearate, isopropyl isostearate, diisopropyl adipate, diisohexyl adipate, dihexyldecyl adipate, diisopropyl sebacate, acyl isononanoate lauryl lactate, myristyl lactate, cetyl lactate, and combinations thereof.

Non-limiting examples of alkenyl esters suitable for use as non-liquid benefit agents can include oleyl myristate, oleyl stearate, oleyl oleate, and combinations thereof.

Non-limiting examples of polyglycerin fatty acid esters suitable for use as non-liquid benefit agents herein can include decaglyceryl distearate, decaglyceryl diisostearate, decaglyceryl monomyriate, decaglyceryl monolaurate, hexaglyceryl monooleate, and combinations thereof.

Non-limiting examples of lanolin and lanolin derivatives suitable for use as non-liquid benefit agents herein can include lanolin, lanolin wax, lanolin alcohols, lanolin fatty acids,

isopropyl lanolate, acetylated lanolin, acetylated lanolin alcohols, lanolin alcohol linoleate, lanolin alcohol riconoleate, and combinations thereof.

Non-limiting examples of silicones suitable for use herein can include silicone elastomers. Other suitable benefit agents are described in U.S. Patent Application Publication No. 2012/0009285.

The benefit phase may also comprise a crystalline hydrophobic ethylene copolymer. The ethylene copolymers are random copolymers and may be present from about 0.01 % to about 5 % by weight of the personal care composition. The crystalline hydrophobic ethylene copolymer may be present from about 0.05 % to about 2 % by weight of the personal care composition. As another example, the crystalline hydrophobic ethylene copolymer may be present from about 0.1 % to about 1.5 % by weight of the personal care composition.

The crystalline hydrophobic ethylene copolymer contains at least 40% ethylene monomer by weight of the crystalline hydrophobic ethylene acrylate copolymer. The crystalline hydrophobic ethylene copolymer can contain from about 40%, 50%, 60%, 70%, 80%, 90%, 95%, 96%, 97%, to about 99%, 98%, 97%, 96%, 95%, 90%, 80%, 70%, 60%, 50%, or any combination thereof to form a range, of ethylene monomer.

In addition, the crystalline hydrophobic ethylene copolymer can comprise an acrylate monomer. The polymer may contain about 1 % to about 60%, by weight of the polymer, of an acrylate monomer. The acrylate monomer may be defined by the following formula: $(R^1)(R^2)C=C(R^3)(COOR^4)$, wherein, each R^1, R^2, and R^3 is independently H or C_1- C_4-alkyl, in one example H or methyl, in another example two of R^1, R^2, and R^3 are H and the other is H or methyl, in another example R^1, R^2, and R^3 are all H; and R^4 is C_1- C_{20}-alkyl, or is selected from straight-chain and branched alkyl groups having from 4 to 20, from 6 to 20, from 8 to 20, or from 9 to 20 carbon atoms.

Some examples of suitable crystalline hydrophobic ethylene acrylate copolymers include ethylene:propylheptylacrylate, ethylene:propylheptylacrylate:vinyl acetate, and combinations thereof. A suitable crystalline hydrophobic ethylene acrylate copolymer can include 86.2% ethylene : 13.8% propylheptylacrylate; 90.4% ethylene : 9.6% propylheptylacrylate; 96% ethylene : 4% propylheptylacrylate; or 81.8% ethylene : 9.6% propylheptylacrylate : 8.6% vinyl acetate.

The crystalline hydrophobic ethylene copolymer can comprise a vinyl actetate monomer. The vinyl acetate monomer may be defined by the following formula: $(R^{10})(R^{11})C=C(R^9)(COR^{12})$, wherein R^9 is independently H or C_1-C_4-alkyl, one of R^{10} and R^{11} is -

$C(O)R^{13}$ and the other is H or C_1-C_4-alkyl; and R^{12} and R^{13} are each independently -OH or C_1-C_{20}-alkoxy; or R^{12} and R^{13} together from an -O- group.

In addition, a crystalline hydrophobic ethylene acrylate copolymer can include a combination of ethylene, propylheptylacrylate, and an additional monomer. This additional monomer can be up to 10 %, by weight of the copolymer. This additional monomer can be represented as $(R^5)(R^6)C=C(R^7)(OCOR^8)$ wherein, each R^5, R^6, and R^7 is independently H or C_1-C_4-alkyl, preferably H or methyl, more preferable two of R^5, R^6, and R^7 are H and the other is H or methyl, in particular R^5, R^6, and R^7 are all H; and R^8 is C_1- C_{20}-alkyl, preferably C_1- C_9-alkyl, more preferably C_1- C_3-alkyl, specifically either or methyl, and especially methyl. A suitable example of this additional monomer is vinyl acetate.

C. Additional Ingredients

Additional ingredients can also be added to the personal care composition for treatment of the skin and/or hair, or to modify the aesthetics of the personal care composition as is the case with perfumes, colorants, dyes or the like. Materials useful in products herein can be categorized or described by their cosmetic and/or therapeutic benefit or their postulated mode of action or function. However, it can be understood that actives and other materials useful herein can, in some instances, provide more than one cosmetic and/or therapeutic benefit or function or operate via more than one mode of action. Therefore, classifications herein can be made for convenience and cannot be intended to limit an ingredient to particularly stated application or applications listed. A precise nature of these additional materials, and levels of incorporation thereof, will depend on the physical form of the composition and the nature of the cleansing operation for which it is to be used. The additional materials can usually be formulated at about 6% or less, about 5% or less, about 4% or less, about 3% or less, about 2% or less, about 1% or less, about 0.5% or less, about 0.25% or less, about 0.1% or less, about 0.01% or less, or about 0.005% or less of the rinse-off personal care composition.

To further improve stability under stressful conditions such as high temperature and vibration, densities of separate phases can be adjusted such that they can be substantially equal. To achieve this, low density microspheres can be added to one or more phases of the rinse-off personal care composition. Examples of rinse-off personal care compositions that comprise low density microspheres are described in a patent application published on May 13, 2004 under U.S. Patent Publication No. 2004/0092415A1 entitled "Striped Liquid Personal Cleansing Compositions Containing A Cleansing Phase and A Separate Phase with Improved Stability," filed on Oct. 31, 2003 by Focht, et al.

Other non-limiting ingredients that can be used in the personal care composition of the present invention can comprise an optional benefit component that can be selected from the group consisting of thickening agents; preservatives; antimicrobials; fragrances; chelators (e.g. such as those described in U.S. Pat. No. 5,487,884 issued to Bisset, et al.); sequestrants; vitamins (e.g. Retinol); vitamin derivatives (e.g. tocophenyl actetate, niacinamide, panthenol); sunscreens; desquamation actives (e.g. such as those described in U.S. Pat. No. 5,681,852 and 5,652,228 issued to Bisset); anti-wrinkle/ anti-atrophy actives (e.g. N-acetyl derivatives, thiols, hydroxyl acids, phenol); anti-oxidants (e.g. ascorbic acid derivatives, tocophenol) skin soothing agents/skin healing agents (e.g. panthenoic acid derivatives, aloe vera, allantoin); skin lightening agents (e.g. kojic acid, arbutin, ascorbic acid derivatives) skin tanning agents (e.g. dihydroxyacteone); anti-acne medicaments; essential oils; sensates; pigments; colorants; pearlescent agents; interference pigments (e.g such as those disclosed in U.S. Pat. No. 6,395,691 issued to Liang Sheng Tsaur, U.S. Pat. No. 6,645,511 issued to Aronson, et al., U.S. Pat. No. 6,759,376 issued to Zhang, et al, U.S. Pat. No. 6,780,826 issued to Zhang, et al.) particles (e.g. talc, kolin, mica, smectite clay, cellulose powder, polysiloxane, silicas, carbonates, titanium dioxide, polyethylene beads) hydrophobically modified non-platelet particles (e.g. hydrophobically modified titanium dioxide and other materials described in a commonly owned, patent application published on Aug. 17, 2006 under Publication No. 2006/0182699A, entitled "Personal Care Compositions Containing Hydrophobically Modified Non-platelet particle filed on Feb. 15, 2005 by Taylor, et al.) and mixtures thereof. The multiphase personal care composition can comprise from about 0.1% to about 4%, by weight of the rinse-off personal care composition, of hydrophobically modified titanium dioxide. Other such suitable examples of such skin actives are described in U.S. Patent Application Serial No. 13/157,665.

D. Exemplary Combinations

As one example, a personal care composition comprises a cleansing phase comprising a surfactant; and a benefit phase comprising a liquid hydrophobic benefit agent and a crystalline hydrophobic ethylene acrylate copolymer.

As another example, a personal care composition comprises a cleansing phase comprising an anionic surfactant; and a benefit phase comprising a liquid hydrophobic benefit agent selected from the group consisting of oils, metathesized oils, cationic oil derivatives, amino acid derivatized oils, esterified oils, alkanolamide derivatized oils, ether derivatized oils, mineral oil, sucrose esters, cholesterol, fatty esters, fatty alcohols, polyolefins, and combinations thereof, and a crystalline hydrophobic ethylene acrylate copolymer.

In an additional example, a personal care composition comprises a cleansing phase comprising an anionic surfactant, a cosurfactant, an associative polymer, and an electrolyte; and a benefit phase comprising soy bean oil and a crystalline hydrophobic ethylene acrylate copolymer.

E. Methods

In addition to the compositions above, inventive methods are also present. For example, a method for increasing benefit agent deposition to skin and/or hair in a personal cleansing composition includes combining a surfactant, a liquid benefit agent, and a crystalline hydrophobic ethylene acrylate copolymer to form a personal care composition. As an example, the surfactant is in a cleansing phase while the liquid benefit agent and crystalline hydrophobic ethylene acrylate copolymer are in a benefit phase. In a further example, the personal cleansing composition is applied to skin of a user and rinsed off. As an example, the crystalline hydrophobic ethylene acrylate copolymer comprises ethylene propylheptylacrylate.

For simplicity, only a minimal amount of compositional ingredients and variants are discussed here. The above disclosure relating to the compositions and ingredients are equally applicable here as well.

F. EXAMPLES

Rinse off composition	Comp. A	Ex.1	Ex.2	Comp. B	Ex.3	Ex.4	Comp. C	Ex.5	Ex.6	Ex.7	Ex. 8
Cleansing phase, %											
Distilled water	Q.S.	Q.S.	Q.S.	Q.S.	Q.S.	Q.S.	Q.S.	Q.S.	Q.S.	Q.S.	Q.S.
Sodium Tridecyl Ether Sulfate - 2 mol	12.95	12.95	12.95	12.48	12.48	12.48	11.86	11.86	11.86	11.86	11.86
Cocamidopropyl Betaine	8.39	8.39	8.39	8.08	8.08	8.08	7.68	7.68	7.68	7.68	7.68
TDA 3-Ethoxylated Tridecyl Alcohol	1.34	1.34	1.34	1.29	1.29	1.29	1.23	1.23	1.23	1.23	1.23
Sodium Chloride	4.58	4.58	4.58	4.44	4.44	4.44	4.22	4.22	4.22	4.22	4.22
Guar Hydroxypropyltrimonium Chloride (median charge density of about 0.96 meq/g)	0.44	0.44	0.44	0.42	0.42	0.42	0.40	0.40	0.40	0.40	0.40
Xanthan Gum	0.20	0.20	0.20	0.19	0.19	0.19	0.18	0.18	0.18	0.18	0.18
Acrylates/C10-30 Alkyl Acrylate Crosspolymer	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Citric Acid Anhydrous (Global)	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Preservative 1	0.14	0.14	0.14	0.13	0.13	0.13	0.12	0.12	0.12	0.12	0.12
Preservative 2	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Preservative 3	0.28	0.28	0.28	0.27	0.27	0.27	0.26	0.26	0.26	0.26	0.26
Perfume	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25
Benefit phase, %											
A			2.0			5.0			10.0		
B		2.0			5.0			10.0			
D	2.0			5.0			10.0				
C										10.0	2.0

Benefit Phases

Benefit phase, %	A	B	C	D
Soybean oil	87.3	87.3	87.3	97
Glyceryl monooleate	0.9	0.9	0.9	1.0
Preservative	1.8	1.8	1.8	2.0
ethylene (86.2%):propylheptylacrylate (13.8%)	10.0	--	--	--
ethylene (90.4%):propylheptylacrylate (9.6%)	--	10%	--	--
ethylene (96%):propylheptylacrylate (4%)	--	--	10%	--
Viscosity (cP)	385	2029	12003	63

The cleansing phases of both the inventive and comparative formulations are prepared by adding water in a mixing vessel. Then the following ingredients are added with continuously mixing: sodium chloride, water soluble cationic polymer if applicable (e.g. N-hance CG-17 cationic guar), laurylamidopropyl betaine, sodium tridecyl sulfate, ethoxylated tridecyl alcohol, sequestering agent, and associative polymer. The pH is then adjusted by adding oxidizer (50% solution) as needed to attain a pH = 5.7 ± 0.2. Then the preservatives are added and the phase mixed until homogeneous.

The benefit phase, if only soy bean oil-glyceryl monooleate-preservative mixture, is added to the cleansing phase, and mixed at 2000 rpm for 1 minute on a SpeedMixer™ (Model DAC, 400FV available from FleckTeck, Inc USA). If the benefit phase comprises a hydrophobic ethylene copolymer in addition to the soybean oil-glyceryl monooleate-preservative mixture, then the polymers are heated to a few degrees (3-5°C) above their melt temperature in the soy bean oil-glyceryl monooleate-preservative mixture. The copolymers generally have a melting temperature of about 50°C to about 100°C. The two components are mixed with any standard mixing techniques until the polymer is fully dissolved into the soybean oil-glyceryl monooleate-preservative mixture, followed by cooling to room temperature. The benefit phase is then added to the cleansing phase, and mixed at 2000 rpm for 1 minute on a SpeedMixer™. If a smaller particle size benefit phase is desired, then both the benefit phase and the cleansing phase may be warmed to a similar temperature before mixing.

Shampoo Composition	Comp. D	Ex.9	Ex.10
Distilled Water	Q.S.	Q.S.	Q.S.

Sodium Laureth-1 Sulfate	13.0%	13.0%	13.0%
Cocamidopropyl Betaine	1.7%	1.7%	1.7%
Guar Hydroxypropyltrimonium Chloride	0.25%	0.25%	0.25%
Thixcin	0.03%	0.03%	0.03%
Tetrasodium EDTA Tetrahydrate	0.16%	0.16%	0.16%
Citric Acid Anhydrous	0.26%	0.26%	0.26%
Sodium Benzoate	0.25%	0.25%	0.25%
Kathon	0.03%	0.03%	0.03%
Perfume	0.8%	0.8%	0.8%
Sodium Chloride	Up to 1%	Up to 1%	Up to 1%
Soybean Oil Emulsion	10%	-	-
Ethylene Copolymer/Soybean Oil Emulsion	-	10%	10%

Emulsion Composition	Comp. Emulsion 1	Emulsion for Ex. 9	Emulsion for Ex. 10
Soybean Oil	9.0%	9.0%	9.0%
Ethylene (94.8%)/Propylheptylacrylate (5.2%) Copolymer	-	1.0%	-
Ethylene (91.3%)/ Propylheptylacrylate (8.7%) Copolymer	-	-	1.0%
Glycerin	7.5%	7.5%	7.5%
Glycerylmonooleate	1.75%	1.75%	1.75%
Tween 20	3.5%	3.5%	3.5%
Distilled Water	Q.S.	Q.S.	Q.S.

G. Test Protocol

In-vitro Deposition Evaluation Method: The *In-vitro* Deposition Evaluation Method measures the deposition of benefit agents on a skin mimic. The method compares the quantity of benefit agent of the skin mimic surface before and after cleansing in an automated cleansing unit, such as the automated cleansing unit described in co-pending and co-assigned Multiphase Personal Care Composition With Enhanced Deposition, U.S. Application No. 12/510,880 (filed July 28, 2009) and In-Vitro Deposition Evaluation Method for Identifying Personal Care Compositions Which Provide Improved Deposition of Benefit Agents, U.S. Application No. 12/511,034 (filed July 28, 2009).

The *In-vitro* Deposition Evaluation Method uses two 12-well plates (hereinafter referred to as "plates"). Suitable 12-well plates are commercially available from Greiner bio-one. For example, the Cellstar® 12 well suspension culture plate has 3 rows and 4 columns with a well

volume of about 6.2 mL. The Cellstar® 12 well suspension culture plate comprises the approximate dimensions of 19 mm in height, 127 mm in length and 85 mm in width. The Cellstar® 12 well suspension culture plate has a well diameter of 23 mm, a well depth of 15 and a well to well spacing of 2 mm. A Cellstar® 12 well suspension culture plate is provided for containing the samples comprising the personal care composition in the Examples above.

The *In-vitro* Deposition Evaluation Method uses approximately 120g of bodies for two plates. Five grams of bodies carefully loaded into each of the 12 wells of the two plates to ensure the same quantity is loaded into each well. Each body is a spherical stainless steel bearing that is approximately 2 mm in circumference. Each body comprises ferrometallic material. Suitable bodies are those available from WLB Antriebeselemente Gmbh, Scarrastrasse 12, D-68307 Mannheim, Germany.

The personal care compositions are prepared according to the description in the Example Section above. After the examples of the personal care compositions are prepared, control and test samples are prepared by determining the dilution ratio and dispensing both the personal care composition and distilled water into the wells of the microplate and allow the samples to mix while being exposed to the automated washing process. The dilution ratio used in this application is one part of composition and twenty nine parts of water (1:29). A pre-calibrated positive displacement pipette is used to dispense 66.7 µL of composition on to the bodies in each well, followed by dispensing 1933.3 µL of distilled water into each well. The control samples and test samples are dispensed in the specified wells of the plate, all within a 20 minute time frame. Each composition is placed in 6 different well, 3 of which are in plate 1 and the other 3 well are in plate 2. A test control composition containing the benefit agent should be used in every test to ensure consistency among tests.

The skin mimic used in the *In-vitro* Deposition Evaluation Method is comprised of a molded bicomponent polyurethane substrate. The skin mimic is textured on one side with a pattern that resembles the texture of human skin. The textured side of the skin mimic is coated with 1, 1, 1-trimethyl-1-pentene that is plasma deposited. The skin mimic surface has a total surface energy of 32 ±1.0 (mJ/m^2) and a contact angle in water of 100°±2.0. Suitable skin mimic surface materials are described in co-pending and co-assigned Coated Substrate with Properties of Keratinous Tissue, U.S Patent Pub. No. 20070128255A1 (filed Aug. 11, 2006) (published June 7, 2007) and Methods of Use of Substrate Having Properties of Keratinous Tissue, U.S Patent Pub. No. 20070288186A1 (filed Feb. 5, 2007) (published Dec. 13, 2007).

After all of the wells of the plate are filled with the samples and the pieces of skin are made and coated, the skin mimic is prepared for the *In-vitro* Deposition Evaluation Method. Two pieces of skin mimic are prepared by cutting the skin mimic to fit on top of all 12 openings of the wells of the plate while wearing gloves. The two pieces of skin mimic pieces are numbered "1" and "2".

Next, the pieces of skin mimics are arranged over the openings of the wells of the microplates. The pieces of skin mimic surface material are transferred to cover the openings of the wells of the each of the plates to ensure that the textured and treated region of the skin mimic is facing the openings of the wells of the plate. A lid is placed over each piece of the skin mimic and the associated plate to form a lidded plate.

The lidded plates are placed into plate holders of an automated cleansing unit, or, a device used in the *in-vitro* Deposition Evaluation Method of the present invention. The automated cleansing unit comprises a horizontal base comprising four microplate holders. The horizontal base is made of rectangle of aluminum comprising the following approximate dimensions of 3/8 inch in height, fourteen inches in width and twenty seven inches in length. The automated cleansing unit further comprises two vertical supports comprised of aluminum with the approximate dimensions of one inch by two inches by ten and 3/4 of an inch in height. The vertical supports are attached to a horizontal support comprising a rodless air slide. The horizontal support comprising a rodless air slide comprises the approximately dimension of a ½ inch by two inches by twenty six and ½ inches in height. Suitable rodless air slides comprise a one inch bore and eleven inch stroke and have associated end lugs and mount brackets, which are commercially available from McMaster-Carr. The rodless air slide can be double acting and comprises a carriage that is connected to an internal piston and two compressed air ports.

The automated cleansing unit comprises two magnetic arms. The horizontal support comprising a rodless air slide is the structure upon which the two magnetic arms are mounted. The magnetic arms are mounted to the rodless air slide such that the magnetic arms move back and forth along the length of the double acting rodless air slide by the force of compressed air. Each of the magnetic arms are comprised of aluminum and have the approximate dimensions of one inch by two inches by fourteen inches in length and have a "T" shape channel that houses seven neodymium iron boron magnets (not shown). Each of the neodymium iron boron magnets has the approximate dimensions of two inches in length, one inch in width and half or an inch in height. Each of the neodymium iron boron magnets comprises a magnetic strength of 12200 Gauss, available from Edmund Scientifics. The magnetic arms are configured at a height of

about 2.75 cm above the microplate holder with the caveat that the magnets maintain their function to attract and move the bodies comprised within the wells of the microplate. The magnetic arms move back and forth along the length of the rodless air slide by the force of compressed air at a speed of approximately 6 back and forth sweeps over the length of the rodless air slide over a 10 second time period.

The magnetic arms can be configured with four microplate holders. Each of the microplate holders comprise a clamping plate and four pistons attached to a pneumatic control unit. When actuated, the pistons for the pneumatic control unit hold the plates in the four plate holders at a pressure of about 90 psi. Prior to placing the lidded plates into the plate holders of automated cleansing unit, the pneumatic control unit is turned on.

The automated cleansing unit can comprise a pneumatic control unit. The top view shows components of the pneumatic control unit which can be connected to the rodless air slide, the piston and clamping plates. The pneumatic control unit can be used to apply compressed air to the automated cleansing unit, which imparts a force by converting the potential energy of compressed air into kinetic energy. The pneumatic control unit comprises a solenoid air control valve, a distribution manifold outlet, a compressed air control valve, a compressed air flow regulator, an alternating output binary valve, a two-hand safety pneumatic control valve, a compressed air control valve and various connectors that provide pressurized air to the automated cleansing unit from an external air source. The air control valve, air flow regulators, alternating a binary valves, a two-hand safety pneumatic control valve are positioned upstream of a solenoid air control valve. A suitable solenoid air control valve can be described as a double air style valve with a 10 psi to 120 operating pressure. Suitable compressed air flow regulators can operate, for example, in the pressure range of 14 psi to 116 psi. Suitable air control valve alternating output binary valves 40 can operate, for example, in a 35 psi to 100 psi range. All of the components of the pneumatic control unit are available from McMaster-Carr®.

The lidded plates are placed into the plate holders and pneumatic control unit is actuated such that the lidded plates are held under 90 psi of pressure. The magnetic arms are actuated on and arms moves over the lidded microplates at a height of 2.65cm above the plate holders. The magnetic arms of the automated cleansing unit, sweep back and forth over the plate holders for 5 minutes, at a speed of 6 sweeps per every 10 seconds. After 5 minutes of the automated cleansing process, the lidded plates are removed from the plate holders and are disassembled.

After the automated washing process, two large 4000ml beakers of 20°C to 25°C water are filled. The first piece of skin mimic is removed from the first plate and submerged in the tap

water within the first beaker five times. The second piece of skin mimic is removed from the second microplate and submerged within the second beaker five times. The completeness of rinsing step is judged visually by the lack of foam on the skin mimic and presence of defined circles of deposited material on the skin mimic. Both piece of skin mimic are blotted gently with paper towels and fumed in a drying hood for at least 3 hours each.

The cut-out pieces of treated skin mimic are then extracted with a solvent and the extract is analyzed and quantified by gas chromatography.

Cylinder Lather

Lather volume is measured using a graduated cylinder and a rotating mechanical apparatus. A 1,000 ml graduated cylinder is used which is marked in 10 ml increments, has a height of 14.5 inches at the 1,000 ml mark from the inside of its base, and has a neck at its top fitted for a plastic insert cap (for example, Pyrex No. 2982). Moderately hard water is prepared with 1.5:1 ion ratio Ca/Mg by dissolving 1.14 grams calcium chloride dihydrate and 1.73 grams magnesium chloride hexahydrate into one U.S. gallon distilled water. The water is maintained at between 105 – 110 °F. The graduated cylinder is heated to about the same temperature by flushing with excess tap water at the same temperature for about 15 seconds, then drying it inside and out. 100.0 grams of the moderately hard water at the indicated temperature is weighed directly into the graduated cylinder. The cylinder is clamped in a mechanical rotating device, which clamps the cylinder vertically with an axis of rotation that transects the center of the graduated cylinder. Using a 3- or 4-place metric balance, invert the plastic cap for the graduated cylinder onto the balance pan and weigh 0.500 grams of composition to within 4 milligrams accuracy, using a holder to keep the cap level. Insert the cap into the graduated cylinder neck while being careful that all composition is now in the space in the cylinder interior. For compositions with very low viscosity which will not remain on the cap surface, 500 mg composition can be added directly to the graduated cylinder. Rotate the cylinder for 25 complete revolutions at a rate of about 10 revolutions per 18 seconds to create lather, and stop in a level, vertical position. A timer is set to allow 15 seconds for drainage. After 15 seconds, the lather volume is measured by recording the lather height to the nearest 10 ml mark (including any water that has drained to the bottom on top of which the lather is floating). The entire process should take less than 3 minutes in order to maintain desired temperature.

If the top surface of the lather is uneven, the lowest height at which it is possible to see halfway across the graduated cylinder is the lather volume (ml). If the lather is so coarse that a single or only a few foam cells (“bubbles”) reach across the entire cylinder, the height at which at

least about 10 foam cells are required to fill the space is the lather volume, also in ml up from the base. The maximum foam height is 1,000 ml (even if the total foam height exceeds the 1,000 ml mark on the graduated cylinder). The measurement is repeated and at least three results averaged to obtain the lather volume.

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 personal cleansing composition, comprising:
   a) a cleansing phase comprising a surfactant, and
   b) a benefit phase comprising a liquid hydrophobic benefit agent and a crystalline hydrophobic ethylene copolymer wherein the ethylene copolymer comprises at least 40% ethylene monomer and an acrylate co-monomer.

2. The personal cleansing composition of claim 1, wherein the acrylate co-monomer comprises $(R^1)(R^2)C=C(R^3)(COOR^4)$, wherein R^1, R^2, and R^3 is independently H or C_1- C_4-alkyl, and R^4 is a C_1- C_{20}-alkyl.

3. The personal cleansing composition of claim 2, wherein R^1, R^2, and R^3 is independently H or methyl; or wherein two of R^1, R^2, and R^3 are H and the remaining is H or methyl.

4. The personal cleansing composition of claims 2-3, wherein R^4 is a straight or branched alkyl group having from 4-20 Carbon atoms, preferably from 6-20 Carbon atoms, more preferably from 8-20 Carbon atoms, even more preferably from 9-20 Carbon atoms.

5. The personal cleansing composition of any preceding claim, wherein the acrylate co-monomer is a branched acrylate.

6. The personal cleansing composition of any preceding claim, wherein the liquid hydrophobic benefit agent is selected from the group consisting of oils, metathesized oils, cationic oil derivatives, amino acid derivatized oils, esterified oils, alkanolamide derivatized oils, ether derivatized oils, mineral oil, sucrose esters, cholesterol, fatty esters, fatty alcohols, polyolefins, and combinations thereof.

7. The personal cleansing composition of any preceding claim, wherein the crystalline hydrophobic ethylene copolymer comprises from 40% to 97%, by weight of the polymer, of ethylene.

8. The personal cleansing composition of any preceding claim, wherein the crystalline hydrophobic ethylene copolymer comprises ethylene propylheptacrylate.

9. The personal cleansing composition of claim 8, wherein the ethylene propylheptacrylate comprises from 40% to 97% of ethylene and from 3% to 60% of propylheptacrylate.

10. The personal cleansing composition of any preceding claim, wherein the copolymer comprises a third monomer.

11. The personal cleansing composition of claim 10, wherein the third monomer comprises $(R^5)(R^6)C=C(R^7)(OCOR^8)$ wherein each R^5, R^6, and R^7 is independently H or C_1- C_4-alkyl, and R^8 is C_1- C_{20}-alkyl.

12. The personal cleansing composition of any preceding claim, wherein the copolymer further comprises a vinyl actetate monomer.

13. The personal cleansing composition of any preceding claim, wherein the hydrophobic benefit agent comprises soy bean oil.

14. The personal cleansing composition of any preceding claim, wherein the cleansing phase further comprises a cationic deposition polymer.

15. The personal cleansing composition of claim 14, wherein the cationic deposition polymer comprises cationic guar with a median charge density of 0.5 meq/g to 1.5 meq/g; or a median charge density of 0.96 meq/g.

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2015/059684

A. CLASSIFICATION OF SUBJECT MATTER
INV. A61Q5/02 A61K8/81 A61Q19/10 A61K8/92
ADD.

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)
A61Q A61K

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)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DATABASE GNPD [Online] MINTEL; September 2014 (2014-09), "Extra Mild Moisturising Bar", XP002752390, Database accession no. 2527423 the whole document -----	1-15
X	DATABASE GNPD [Online] MINTEL; November 2013 (2013-11), "Shampoo", XP002752391, Database accession no. 2242340 the whole document -----	1-15

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[X] Further documents are listed in the continuation of Box C.

[X] 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

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"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

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Date of the actual completion of the international search	Date of mailing of the international search report
18 December 2015	11/01/2016

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Szarek, Sophie

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Form PCT/ISA/210 (second sheet) (April 2005)

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2015/059684

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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X	DATABASE GNPD [Online] MINTEL; June 2009 (2009-06), "Tahitian Escape Exfoliating Body Wash", XP002752393, Database accession no. 1124626 the whole document	1-15
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X,P	WO 2015/054348 A1 (PROCTER & GAMBLE [US]) 16 April 2015 (2015-04-16) page 2, line 18; example 1	1-15
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International application No
PCT/US2015/059684

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