

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

(19) World Intellectual Property
Organization

International Bureau

(43) International Publication Date
15 November 2018 (15.11.2018)



(10) International Publication Number
WO 2018/206475 A1

(51) International Patent Classification:

C11D 1/83 (2006.01) *C11D 1/14* (2006.01)
C11D 1/835 (2006.01) *C11D 1/29* (2006.01)
C11D 1/94 (2006.01) *C11D 1/52* (2006.01)
C11D 10/04 (2006.01) *C11D 1/66* (2006.01)
C11D 1/10 (2006.01) *C11D 1/88* (2006.01)
C11D 1/12 (2006.01) *C11D 1/90* (2006.01)

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).

(21) International Application Number:

PCT/EP2018/061640

Published:

— with international search report (Art. 21(3))

(22) International Filing Date:

07 May 2018 (07.05.2018)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

62/504,928 11 May 2017 (11.05.2017) US
17187474.6 23 August 2017 (23.08.2017) EP

(71) Applicant: **BASF SE** [DE/DE]; Carl-Bosch-Strasse 38, 67056 Ludwigshafen am Rhein (DE).

(72) Inventors: **ESPOSITO, James**; 100 Park Avenue, Florham Park, New Jersey 07932 (US). **DUROCHER, David**; 1609 Biddle Avenue, Wyandotte, Michigan 48192 (US). **BANNISTER, Austin**; 1520 Old Stage Road, Mauldin, South Carolina 29662 (US). **BHATT, Jay**; 540 White Plains Road, Tarrytown, New York 10591 (US).

(74) Agent: **BASF IP ASSOCIATION**; BASF SE, G-FLP - C006, 67056 Ludwigshafen (DE).

(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,

(54) Title: CONCENTRATED SURFACTANT AND METHOD OF FORMING

(57) Abstract: A concentrated surfactant is formed using a method that includes providing an alkyl alcohol having the formula: ROH, wherein R is an alkyl group having from 1 to 20 carbon atoms and providing a sugar having the formula: [C₆H₁₂O₆]_{n+1}, wherein n is an average value of zero or greater. The method also includes providing a co-surfactant including water and combining the alkyl alcohol and the sugar to form an alkylpolyglucoside having the formula: [C₆H₁₁O₅][C₆H₁₀O₅]_nOR. The method further includes combining the co-surfactant and the alkylpolyglucoside to form the concentrated surfactant having a total weight percent of the co-surfactant and the alkylpolyglucoside of at least 40 wt % and a total weight percent water of at least 10 wt %. Moreover, the method is free of the step of diluting the alkylpolyglucoside with water prior to the step of combining the co-surfactant and the alkylpolyglucoside to form the concentrated surfactant.



WO 2018/206475 A1

CONCENTRATED SURFACTANT AND METHOD OF FORMING

FIELD OF THE DISCLOSURE

The present disclosure generally relates to concentrated surfactant and a method of forming
5 the concentrated surfactant. More specifically, the method includes combining a co-surfactant
and an alkylpolyglucoside to form the concentrated surfactant but is free of the step of
diluting the alkylpolyglucoside with water prior to the step of combining.

BACKGROUND

10

Alkylpolyglucosides (APGs) are used in numerous industries including personal care, home
care, I&I, agricultural, and oil industries, to name a few. For example, in personal care
products, APGs are chosen for their mildness on human skin, foam production, lather level,
etc. In other industries, APGs are chosen for their surfactant capabilities, etc. However, APGs
15 are known to be extremely difficult to thicken. For that reason, APGs are typically combined
with betaines, which readily thicken in the presence of salts. Thickened combinations of APGs
and betaines can be used in a variety of products. Nevertheless, both the APGs and betaines
are only commercially useable when highly diluted with water. For examples, APGs are
typically only useable when diluted to about 48 wt % active in 52 wt % water. Moreover,
20 betaine is not available anhydrous and is typically only useable when diluted to about 35 to
45 wt % active in about 55 to 65 wt % water. Therefore, it is very expensive and cumbersome
to ship and use such compounds because most of the solution is water. Additionally,
formulators could realize a more efficient supply chain by procuring the APG diluted to the
precise water content used in commercial applications. Accordingly, there remains an
25 opportunity for improvement.

US 5 958 868 A discloses a process for preparing a stable aqueous surfactant concentrate
comprising combining a sugar surfactant comprising an alkyl or alenyl oligoglycoside or a
fatty acid-N-alkyl polyhydroxyalkylamide and a betaine in an aqueous medium, in a weight
30 ratio of 10:90 to 90:10.

EP 0 728 836 A2 discloses a storage-stable, concentrated, aqueous surfactant composition
containing alkylglucosides and betaines in a weight ratio of 9: 1 to 1: 9, wherein the total
surfactant content is at least 25 wt .-% solids content.

35

US 5 925 747 A relates to a process for the production of a pumpable aqueous surfactant
concentrate consisting of water, at least one alkyl or alkenyl oligoglycoside and at least one
amphoteric or zwitterionic surfactant wherein the concentrate has a solid content from about
30 to about 60% by weight.

40

US 5 932 535 A discloses light-colored, low-viscosity surfactant concentrates, made by mixing
a sugar surfactant and a betaine, in a ratio of 90:10 to about 10:90, with the proviso that the
sugar surfactant and betaine are present in the gel phase.

WO 01/37658 A2 relates to a low-foaming wetting aid provided in the form of a highly concentrated flowable and pourable aqueous concentrate containing alkyl(poly) glucoside and low water-soluble alcohols.

5 US 5 258 142 A discloses a concentrate consisting of 35 to 55% by weight water, 10 to 30% by weight of an alkyl glycoside, 10 to 30% by weight of an alkyl sulfate and 1 to 15% by weight of an alkane sulfonate.

10 WO 92/01772 A1 discloses a concentrate consisting of 30-70 % by weight of water, 15-50% by weight of an alkyl glucoside, 3-25 % by weight of an ethoxylated amide and optionally 10-20% by weight of an alkyl sulphate.

15 US 5 883 068 A relates to pumpable water containing surfactant concentrates containing alkyl glycosides, sulfosuccinates and amphoteric surfactants and to their use for the production of surface-active formulations.

20 US 2014/336094 A1 discloses a cleaning composition for dishwashing comprising about 1 to 35 wt. % of an anionic surfactant, about 1 to 35 wt. % of a nonionic surfactant and at least about 1 wt.% of lactic acid.

25 US 5 523 016 relates to a water containing flowable and pumpable surfactant alkyl glycoside preparation consisting of about 20% to 60% by weight of an alkyl polyglucoside, about 0.1% to 3% by weight of an anionic surfactant of the sulfate or sulfonate type and about 37% by weight to about 79.9% by weight water, wherein the ratio by weight of said alkyl polyglucoside to said anionic surfactant is from about 200:1 to about 20:1.

SUMMARY OF THE DISCLOSURE

30 This disclosure provides a method for forming a concentrated surfactant. The method includes the steps of providing an alkyl alcohol having the formula: ROH, wherein R is an alkyl group having from 1 to 20 carbon atoms and providing a sugar having the formula: $[C_6H_{12}O_6]_{n+1}$, wherein n is an average value of zero or greater. The method also includes the steps of providing a co-surfactant including water and combining the alkyl alcohol and the sugar to form an alkylpolyglucoside having the formula: $[C_6H_{11}O_5][C_6H_{10}O_5]_nOR$. The method
35 also includes the step of combining the co-surfactant and the alkylpolyglucoside to form the concentrated surfactant having a total weight percent of the co-surfactant and the alkylpolyglucoside of at least 40 wt % and a total weight percent water of at least 10 wt %. Moreover, the method is free of the step of diluting the alkylpolyglucoside with water prior to the step of combining the co-surfactant and the alkylpolyglucoside to form the concentrated
40 surfactant.

This disclosure also provides a concentrated surfactant. In various embodiments, the concentrated surfactant includes an alkylpolyglucoside having the formula: $[C_6H_{11}O_5][C_6H_{10}O_5]_nOR$, wherein R is an alkyl group having 1 to 20 carbon atoms and n is an
45 average value of zero or greater, betaine, and water. Typically, the total weight percent of the

betaine and the alkylpolyglucoside in these embodiments is from 55 to 75 wt % and the total weight percent water is from 25 to 45 wt %.

5 DETAILED DESCRIPTION OF THE DISCLOSURE

This disclosure provides a concentrated surfactant and a method of forming the concentrated surfactant. The concentrated surfactant is not particularly limited to any particular use or industry and may be used, for example, in personal care, home care, I&I, agricultural, and oil industries. The concentrated surfactant includes an alkylpolyglucoside (APG), a co-surfactant, and water. Each is described in greater detail below.

Method:

The method of forming the concentrated surfactant includes the step of providing an alkyl alcohol having the formula: ROH, wherein R is an alkyl group having from 1 to 20 carbon atoms. The alkyl group may have any number of carbon atoms from 1 to 20 or any value or range of values therebetween. In various embodiments, R is an alkyl group having 8, 9, 10, 11, 12, 13, 14, 15, or 16 carbon atoms. In other embodiments, R is an alkyl group having 8 to 12 carbon atoms. In further embodiments, R is an alkyl group having 8 to 10 carbon atoms. The alkyl group may be linear, branched, or cyclic. In various embodiments, the alkyl group is further defined as an alkenyl group having one or more C=C double bonds. The one or more C=C double bonds may be present at any point in the alkenyl group.

In various embodiments, the step of providing the alkyl alcohol is further defined as providing a first alkyl alcohol having the formula: ROH wherein R is an alkyl group having 1 to 20 carbon atoms and providing a second alkyl alcohol having the formula: R' OH, wherein R' is independently an alkyl group having 1 to 20 carbon atoms. Each of R and R' may be any value described above. In various embodiments, R and/or R' is each independently 8, 10, 12, 14, or 16. In other embodiments, R and/or R' is each independently 9, 11, 13, 15, or 17. Moreover, all values and ranges of values including and between those described above are hereby expressly contemplated for use in non-limiting embodiments.

In a preferred embodiment, the step of providing the alkyl alcohol is further defined as providing a first alkyl alcohol having the formula: ROH, wherein R is an alkyl group having 8 carbon atoms, and providing a second alkyl alcohol having the formula: R' OH, wherein R' is an alkyl group having 10 carbon atoms.

The method also includes the step of providing a sugar having the formula: $[C_6H_{12}O_6]_{n+1}$, wherein n is an average value of zero or greater. In various embodiments, n is an average value of 0, 1, 2, 3, 4, 5, 6, 7, or 8. In various embodiments, n is an average value from 0 to 8, 0.4 to 0.8, 1 to 7, 2 to 6, 3 to 5, or 4 to 5. In various embodiments, n+1 has a value of from 1 to 3, from 1 to 2.5, from 1 to 2, from 1.5 to 3, from 1.5 to 2.5, from 1.5 to 2, from 1.2 to 2.5, from 1.1 to 1.9, from 1.2 to 1.8, from 1.3 to 1.7, from 1.4 to 1.6, from 1.4 to 1.8, or about 1.5. In other embodiments, n+1 is an average value of 1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 1.7, 1.8, 1.9, or 2.

Any sugar having the aforementioned formula or any isomer thereof may be utilized. For example, the sugar may be an aldohexose, or a ketohexose. In various embodiments, the sugar is chosen from allose, altrose, galactose, glucose, gulose, idose, mannose, talose, and combinations thereof. In other embodiments, the sugar is chosen from fructose, psicose,

sorbose, tagatose, and combinations thereof. In even further embodiments, the sugar is chosen from glucose, fructose and galactose. In further embodiments, the sugar is glucose, or fructose, or galactose. The sugar may be any one or more of the aforementioned sugars, each having the formula, $C_6H_{12}O_6$. Moreover, the sugar may be any one or more complexes of the aforementioned sugars when n is greater than zero. These complexes may be

5

alternatively described as carbohydrates. The method also includes the step of combining the alkyl alcohol and the sugar to form an alkylpolyglucoside having the formula: $[C_6H_{11}O_5][C_6H_{10}O_5]_nOR$. The method further includes the step of providing a co-surfactant including water and the step of combining the co-

10

surfactant and the alkylpolyglucoside to form the concentrated surfactant having a total weight percent of the co-surfactant and the alkylpolyglucoside of at least 40 wt % and having a total weight percent water of at least 10 wt %. The method is free of the step of diluting the alkylpolyglucoside with water prior to the step of (E) combining the co-surfactant and the

15

alkylpolyglucoside to form the concentrated surfactant. Relative to the step of combining the alkyl alcohol and the sugar, these may be combined in any order and as a whole or in parts. Similarly, the step of providing the co-surfactant may be any known in the art. The co-surfactant and the alkylpolyglucoside may be combined in any order and as a whole or in parts. After combination, the concentrated surfactant is formed

20

that has a total weight percent of the co-surfactant and the alkylpolyglucoside of at least 40 wt % and alternatively at least 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, or 95, wt %. Also, the total weight percent water of the concentrated surfactant is at least 10 wt % and alternatively, at least 15, 20, 25, 30, 35, 45, 45, 50, 55, or 60, wt %. Moreover, all values and ranges of values including and between those described above are hereby expressly contemplated for use in

25

non-limiting embodiments. In an embodiment, the concentrated surfactant has a total weight percent of the alkylpolyglucoside of from 15 to 50 wt %, a total weight percent of the co-surfactant of from 20 to 40 wt %, and a total weight percent of water of from 25 to 60 wt %.

30

In an embodiment, the concentrated surfactant has a total weight percent of the co-surfactant and the alkylpolyglucoside of from 60 to 75 wt % and a total weight percent water of from 25 to 40 wt %.

35

The method may also include the step of heating the surfactant or any one or more of the components. For example, any one or more of the components and/or the surfactant may be heated to reduce viscosity and aid pourability. For example, the step of heating may be further defined as heating up to any temperature up to about 60°C.

Alkylpolyglucoside (APG):

40

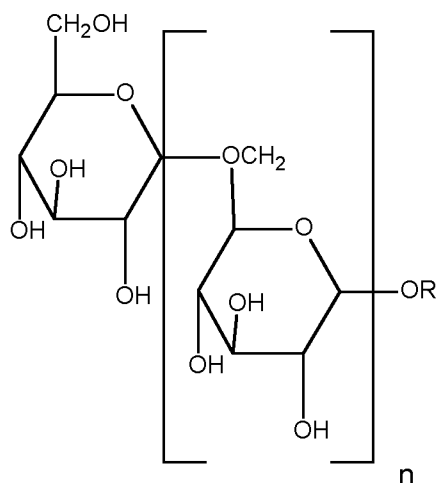
The APG is not particularly limited and typically has the formula $[C_6H_{11}O_5][C_6H_{10}O_5]_nOR$. Each portion of the formula may be any isomer of $C_6H_{12}O_6$. In other words, any structure or form of $C_6H_{12}O_6$ may be used in either portion of the aforementioned formula. The "first" $[C_6H_{12}O_6]$ may be a different isomer than the "second" $[C_6H_{12}O_6]$ of the aforementioned formula. In various additional non-limiting embodiments, all values and ranges of values between and including the aforementioned values are hereby expressly contemplated.

In addition, R may be any alkyl group, linear, branched, cyclic, etc. that has from 1 to 20 carbon atoms. In other words, R may have 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, or 20, carbon atoms. In various embodiments, R has 2 to 19, 3 to 18, 4 to 17, 5 to 16, 6 to 15, 7 to 14, 8 to 13, 9 to 10, 10 to 11, 10 to 12, 8 to 12, 8 to 10, 8 to 14, 10 to 14, 10 to 12, 6 to 14,

5

6, to 12, 6 to 8, 6 to 10, or 6 to 12, carbon atoms. In one embodiment, R is linear and has 10 carbon atoms. In other embodiments, R is C_8-C_{10} , $C_{10}-C_{12}$, $C_{12}-C_{14}$, C_8 , C_{10} , C_{12} , C_{14} , or C_{16} , or any combination thereof. In this formula, n is an average value or number of zero or greater. In various additional non-limiting embodiments, all values and ranges of values between and including the aforementioned values are hereby expressly contemplated.

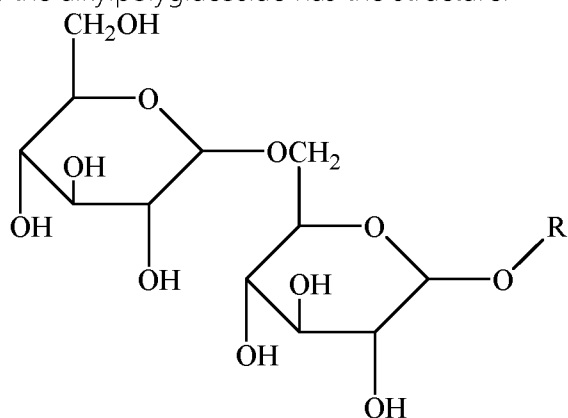
10



wherein n is as described above. In other embodiments, n is 1 or greater. In various embodiments, the average of n+1 is the degree of polymerization of the alkylpolyglucoside and is from 1.2 to 2.5, from 1.3 to 1.7, or from 1.5 to 1.7. In various embodiments, the average of n+1 is 1.2, 1.3, 1.4, 1.5, 1.6, 1.7, 1.8, 1.9, 2, 2.1, 2.2, 2.3, 2.4, or 2.5. In various additional non-limiting embodiments, all values and ranges of values between and including the aforementioned values are hereby expressly contemplated.

15

20 In further embodiments, the alkylpolyglucoside has the structure:



wherein R may be any as described above, e.g. C_8-C_{16} or any therebetween.

Typically, the APG is formed from glucose, i.e., includes glucose as its building block. It is contemplated that any known isomer or anomer of glucose may be used. For example,

glucose has four optic centers, such that glucose can have 15 optical stereoisomers, any of which may be utilized. In various embodiments, galactose, mannose, allose, altrose, gulose, idose, talose, psicose, fructose, sorbose, or tagatose may be used in either the D or L form. Moreover, any cyclic or acrylic version of glucose may be used. Even further, any hydrate of glucose may be used, e.g. fructose monohydrate.

The APG is typically provided neat but may be provided in a solvent, e.g. any described below. Therefore, the amount of the APG utilized may refer to the weight percent of the APG itself or the weight percent of the (APG+solvent). In various embodiments, the APG itself (e.g. measured without the solvent) is utilized in an amount of greater than 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, or 95, weight percent based on a total weight of the surfactant. In other embodiments, the weight percent of the APG itself (measured without solvent) is 14 to 45, 15 to 45, 20 to 40, 25 to 35, or 30 to 35, weight percent based on a total weight of the surfactant. In various additional non-limiting embodiments, all values and ranges of values between and including the aforementioned values are hereby expressly contemplated.

Co-Surfactant:

Referring now to the co-surfactant, the co-surfactant is typically chosen from betaines, amphotacetates, alkanolamides, sarcosinates, sulfosuccinates, carboxylates, sulfates, or combinations thereof. In one embodiment, the co-surfactant is betaine. Betaine may be any neutral chemical compound with a positively charged cationic functional group such as a quaternary ammonium or phosphonium cation (e.g. onium ions) which bears no hydrogen atom and with a negatively charged functional group such as a carboxylate group which may not be adjacent to the cationic site. A betaine thus is a specific type of zwitterion. In one embodiment, the betaine is N,N,N-trimethylglycine. In another embodiment, the betaine is cocamidopropyl betaine.

The betaine is typically provided in water. Therefore, the amount of the betaine utilized may refer to the weight percent of the betaine itself or the weight percent of the (betaine+water). In various embodiments, the betaine itself (e.g. measured without the water) is utilized in an amount of greater than 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, or 95, weight percent based on a total weight of the surfactant. In other embodiments, the weight percent of the betaine itself (measured without water) is 20 to 40, 25 to 35, 30 to 35, or 35 to 40, weight percent based on a total weight of the surfactant. In various additional non-limiting embodiments, all values and ranges of values between and including the aforementioned values are hereby expressly contemplated.

In one embodiment, the surfactant has a total weight percent of the co-surfactant and the alkylpolyglucoside of from 40 to 75 wt % and a total weight percent water of from 25 to 60 wt %. In another embodiment, the surfactant has a total weight percent of the co-surfactant and the alkylpolyglucoside of from 65 to 75 wt % and a total weight percent water of from 25 to 35 wt %, wherein the concentrated surfactant is free of a co-surfactant that is not an alkylpolyglucoside or betaine, e.g. a butyl-APG, and/or any one of the co-surfactants described herein. In other embodiments, the surfactant has a total weight percent of the alkylpolyglucoside of from 15 to 50 wt %, a total weight percent of the co-surfactant of from 20 to 40 wt %, and a total weight percent of water of from 25 to 60wt %. In various additional non-limiting embodiments, all values and ranges of values between and including the aforementioned values are hereby expressly contemplated.

In an embodiment, the concentrated surfactant includes an alkylpolyglucoside having the formula: $[C_6H_{11}O_5][C_6H_{10}O_5]_nOR$, wherein R is an alkyl group having 1 to 20 carbon atoms and n is an average value of zero or greater, betaine, and water; wherein the total weight percent of said betaine and said alkylpolyglucoside is at least 40 wt % and a total weight percent of water is at least 10 wt %.

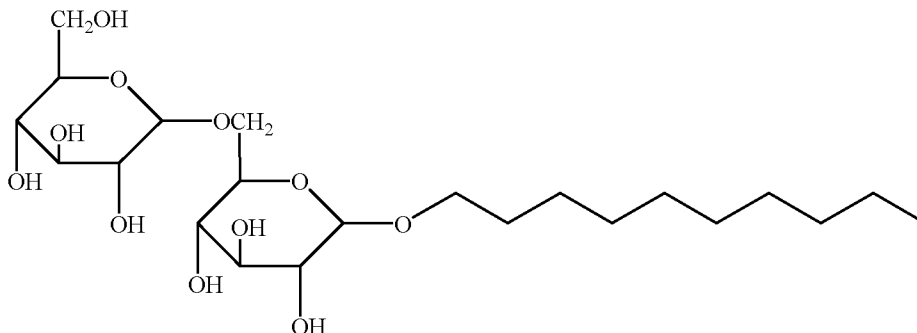
In another embodiment, the co-surfactant is an amphotoacetate. For example, the amphotoacetate may be made by reacting a compound of formula $RCONHCH_2CH_2NHCH_2CH_2OH$, where R is an aliphatic radical, with formaldehyde and a cyanide of formula: R^1CN , wherein R^1 represents a hydrogen atom or an alkali metal, and, when R^1 represents a hydrogen atom, then hydrolyzing the nitrile obtained with an alkali. Alternatively, amphotoacetate may be made by reacting long chain fatty acids, e.g. in the form of the mixture known as "coconut fatty acids", with aminoethylethanolamine (AEEA), and reacting the product with a haloacetic acid or salt thereof in the presence of an alkali. Even further, the amphotoacetate may be defined as a salt of an acetic acid that has a basic substituent, as chosen by one of skill in the art. Any amphotoacetate known in the art may be utilized, e.g. sodium lauroamphoacetate. In other embodiments, the amphotoacetate is disodium cocoamphodiacetate.

In still another, the co-surfactant is an alkanolamide. For example, the alkanolamide may be chosen from coco monoethanolamide, lauramide DEA, and combinations thereof. In a further embodiment, the co-surfactant is a sarcosinate. For example, the sarcosinate may be sodium lauroyl sarcosinate. In another embodiment, the co-surfactant is a sulfosuccinate. For example, the sulfosuccinate may be disodium laureth sulfosuccinate. In a further embodiment, the co-surfactant is a carboxylate. For example, the carboxylate may be sodium laureth-10 carboxylate. In still another embodiment, the co-surfactant is a sulfate. For example, the sulfate may be sodium lauryl sulfate. In another embodiment, the co-surfactant is a taurate. The taurate may be sodium methyl cocoyl taurate.

In still other embodiments, the co-surfactant may include, be, consist essentially of, or consist of, any one or more of the aforementioned co-surfactants. The language "consist essentially of" typically describes embodiments wherein the co-surfactant includes only one type of co-surfactant and is free of other additives or other co-surfactants. For example, if the co-surfactant consists essentially of a betaine, then it may include one or more betaines, may include only one betaine and be free of all other co-surfactants including other betaines, or may include two or more betaines and be free of all other co-surfactants. The co-surfactant, and the concentrated surfactant itself, may be free of, or include less than 5, 4, 3, 2, 1, or 0.5, weight percent of, one or more betaines, amphotoacetates, alkanolamides, sarcosinates, sulfosuccinates, carboxylates, sulfates, or combinations thereof. In various additional non-limiting embodiments, all values and ranges of values between and including the aforementioned values are hereby expressly contemplated. The co-surfactant may be used in any amount so long as the concentrated surfactant has a total weight percent of the co-surfactant and the alkylpolyglucoside of at least 40 wt % and has a total weight percent water of at least 10 wt %. In various embodiments, the APG is utilized with betaine and an additional co-surfactant described above in a weight ratio of 1:1:1, 1:2:1, 2:1:1, 1:1:2, etc. (APG:betaine:additional co-surfactant).

In an embodiment, APG has a structure wherein R has from 8 to 10 carbon atoms, wherein the average of $n+1$ is the degree of polymerization of the alkylpolyglucoside and wherein $n+1$

is an average value of from 1.4 to 1.8, wherein the co-surfactant is betaine, wherein the alkylpolyglucoside has the structure:



5 wherein a total weight percent of the alkylpolyglucoside is of from 15 to 50 wt %, a total weight percent of the co-surfactant is of from 20 to 40 wt %, and a total weight percent of water is of from 25 to 55 wt %, and wherein the concentrated surfactant is free of a co-surfactant that is not an alkylpolyglucoside or betaine.

10 In various embodiments, the APG and the co-surfactant are utilized in a weight ratio of from 1:2 to 2:1 or about 1:1. These weight ratios may describe the weight of the APG and the co-surfactant neat or diluted in water or solvent. For example, if the ratios refer to a "neat" weight, this means that the weight is based on the compounds themselves not taking into account the total weight after dilution, e.g. if they are dispersed in water. In various additional non-limiting embodiments, all values and ranges of values between and including the

15 aforementioned values are hereby expressly contemplated.

In an embodiment, the betaine and alkylpolyglucoside are present in a weight ratio of 1:2 to 2:1, based on the weight of said betaine and said alkylpolyglucoside.

20 In additional embodiments, the concentrated surfactant has a viscosity of less than or equal to 1500, 1,000, 750, or 500, cps measured at 25 °C using a Brookfield RV or LV viscometer with a spindle and RPM chosen to give a 20-80% torque range, e.g. using a Brookfield RV4 viscometer at 20 rpm, all measurements made at 25°C. In various additional non-limiting embodiments, all values and ranges of values between and including the aforementioned values are hereby expressly contemplated.

25 In other embodiments, the concentrated surfactant has a visual clarity evaluated at 25°C in a 1cm test tube. For example, the concentrated surfactant may be visually evaluated to be clear with no haze or non-homogeneity noted. In further embodiments, the concentrated surfactants have a percent solids of from 55 to 75, 60 to 70, 60 to 65, or 65 to 70, %. In various additional non-limiting embodiments, all values and ranges of values between and including the aforementioned values are hereby expressly contemplated. Moreover, the

30 concentrated surfactant may be homogeneous after standing for 21 days at room temperature, as evaluated visually by one of skill in the art.

The concentrated surfactant may also include one or more co-solvents in addition to the water. Such co-solvents may include glycerine, propylene glycol, ethylene glycol, polyethylene glycol (PEG 600 or less), dipropylene glycol, diethyleneglycol, and combinations thereof. The

35 co-solvent may be utilized in an amount of from 0 to 10 wt% based on a total weight of the concentrated surfactant.

This disclosure also provides a personal care composition that includes the concentrated surfactant. The personal care composition may be further defined as a body wash, face wash, or shampoo. The concentrated surfactant may be utilized in any amount in the personal care composition, e.g. in amount of from 0.1 to 10, 1 to 10, 1 to 5, or 5 to 10, parts by weight per 100 parts by weight of the personal care composition. In still other embodiments, the disclosure provides a manual dishwashing composition that includes the concentrated surfactant. The concentrated surfactant may be utilized in any amount therein, e.g. in any of the amounts described above. In various additional non-limiting embodiments, all values and ranges of values between and including the aforementioned values are hereby expressly contemplated. Any one of the aforementioned personal care and/or manual dishwashing compositions may be formed by a method that includes combining any one or more of the aforementioned compounds together to form the concentrated surfactant and combining any one or more additives therewith in proportions determined by one of skill in the art.

15 EXAMPLES

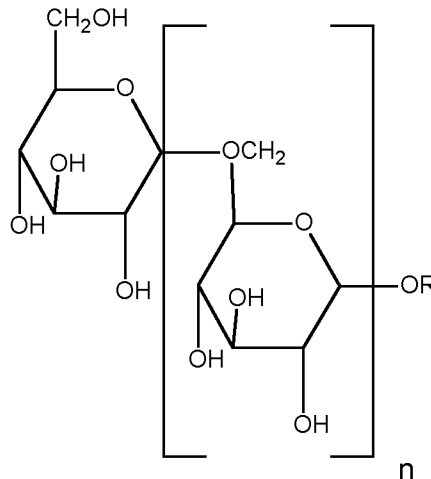
The examples are created and evaluated to determine clarity and viscosity. Clarity is determined visually, by an experienced laboratory technician, and rated as clear or not-clear. Viscosity is determined by an experienced laboratory technician and designated as viscous, too thick, or pourable.

	Surf. 1	Surf. 2	Surf. 3	Surf. 4	Surf. 5	Surf. 6
Weight Ratio of APG:Betaine	1:1	2:1	1:2	1:1	2:1	1:2
APG Type	APG 1	APG 1	APG 1	APG 1	APG 1	APG 1
Betaine Type	B1	B1	B1	B2	B2	B2
g APG Solution	70	140	35	90	180	45
APG Active (Wt %)	100	100	100	100	100	100
APG Active (g)	70	140	35	90	180	45
Active Wt % APG in Final Surfactant	25.90	41.20	14.90	31.00	47.30	18.40
g Betaine Solution	200	200	200	200	200	200
Betaine Active (Wt %)	35	35	35	45	45	45
Betaine Active (g)	70	70	70	90	90	90
Active Wt % Betaine in Final Surfactant	26.00	20.60	29.80	31.10	23.80	36.70
Total Active Wt % (APG + Betaine) in Final Surfactant	51.90	61.80	44.70	62.10	71.10	55.10
Total Wt % Water in Final Surfactant	48.10	38.20	55.30	37.90	28.90	44.90
Total Wt % of (APG + Betaine + Water) in Final Surfactant	100.00	100.00	100.00	100.00	100.00	100.00
Visual Evaluation Results	Clear/ Viscous	Clear/ Too Thick	Clear/ Pourable	Clear/ Too Thick	Clear/ Too Thick	Clear/ Pourable

	Surf. 1	Surf. 2	Surf. 3	Surf. 4	Surf. 5	Surf. 6
Approximate Viscosity of Final Surfactant at 25 °C	~ 1000 cps	>1000 cps	~ 500 cps	>1000 cps	> 1000 cps	~ 500 cps

Typically, any surfactant that has an approximate viscosity of 1000 cps or more at 25°C is deemed to be slowly pourable or not pourable at all, depending on the viscosity.

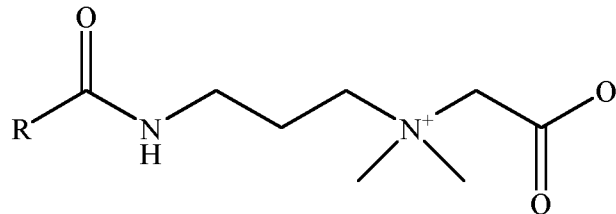
APG 1 has the following chemical structure wherein R is a mixture of C₈-C₁₀ groups, as is appreciated in the art and n is approximately 0.5.



5

The betaines B1 and B2 have the chemical structure as shown below wherein R is a mixture of C₁₂-C₁₄ groups, as appreciated in the art. Betaine B1 is a mixture of the betaine below and 65 wt% water. Betaine B2 is a mixture of the betaine below and 55 wt% water.

10



The data set forth above demonstrate that useable surfactants can be formed with increased concentrations of actives. This allows for final products to be formed with higher concentrations of additives and decreases shipping costs associated with shipping water.

15

All combinations of the aforementioned embodiments throughout the entire disclosure are hereby expressly contemplated in one or more non-limiting embodiments even if such a disclosure is not described verbatim in a single paragraph or section above. In other words, an expressly contemplated embodiment may include any one or more elements described above selected and combined from any portion of the disclosure.

20

One or more of the values described above may vary by ± 5%, ± 10%, ± 15%, ± 20%, ± 25%, etc. Unexpected results may be obtained from each member of a Markush group independent from all other members. Each member may be relied upon individually and or in combination and provides adequate support for specific embodiments within the scope of the appended claims. The subject matter of all combinations of independent and dependent

25

claims, both singly and multiply dependent, is herein expressly contemplated. The disclosure is illustrative including words of description rather than of limitation. Many modifications and variations of the present disclosure are possible in light of the above teachings, and the disclosure may be practiced otherwise than as specifically described herein.

5 It is also to be understood that any ranges and subranges relied upon in describing various embodiments of the present disclosure independently and collectively fall within the scope of the appended claims, and are understood to describe and contemplate all ranges including whole and/or fractional values therein, even if such values are not expressly written herein. One of skill in the art readily recognizes that the enumerated ranges and subranges
10 sufficiently describe and enable various embodiments of the present disclosure, and such ranges and subranges may be further delineated into relevant halves, thirds, quarters, fifths, and so on. As just one example, a range "of from 0.1 to 0.9" may be further delineated into a lower third, i.e. from 0.1 to 0.3, a middle third, i.e. from 0.4 to 0.6, and an upper third, i.e. from 0.7 to 0.9, which individually and collectively are within the scope of the appended
15 claims, and may be relied upon individually and/or collectively and provide adequate support for specific embodiments within the scope of the appended claims. In addition, with respect to the language which defines or modifies a range, such as "at least," "greater than," "less than," "no more than," and the like, it is to be understood that such language includes subranges and/or an upper or lower limit. As another example, a range of "at least
20 10" inherently includes a subrange of from at least 10 to 35, a subrange of from at least 10 to 25, a subrange of from 25 to 35, and so on, and each subrange may be relied upon individually and/or collectively and provides adequate support for specific embodiments within the scope of the appended claims. Finally, an individual number within a disclosed range may be relied upon and provides adequate support for specific embodiments within
25 the scope of the appended claims. For example, a range "of from 1 to 9" includes various individual integers, such as 3, as well as individual numbers including a decimal point (or fraction), such as 4.1, which may be relied upon and provide adequate support for specific embodiments within the scope of the appended claims.

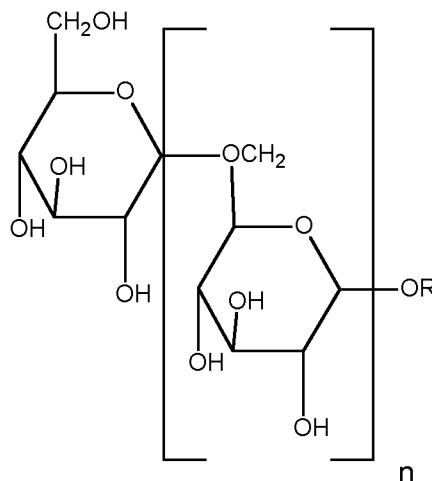
CLAIMS

What is claimed is:

1. A method for forming a concentrated surfactant, said method comprising the steps of:
- 5 A. providing an alkyl alcohol having the formula: ROH, wherein R is an alkyl group having from 1 to 20 carbon atoms;
- B. providing a sugar having the formula: $[C_6H_{12}O_6]_{n+1}$, wherein n is an average value of zero or greater;
- 10 C. combining the alkyl alcohol and the sugar to form an alkylpolyglucoside having the formula: $[C_6H_{11}O_5][C_6H_{10}O_5]_nOR$;
- D. providing a co-surfactant comprising water; and
- E. combining the co-surfactant and the alkylpolyglucoside to form the concentrated surfactant having a total weight percent of the co-surfactant and the alkylpolyglucoside of at least 40 wt % and having a total weight percent water of at least 10 wt %,
- 15 wherein said method is free of the step of diluting the alkylpolyglucoside with water prior to the step of (E) combining the co-surfactant and the alkylpolyglucoside to form the concentrated surfactant.

- 20 2. The method of claim 1 wherein the R has from 8 to 16 carbon atoms.

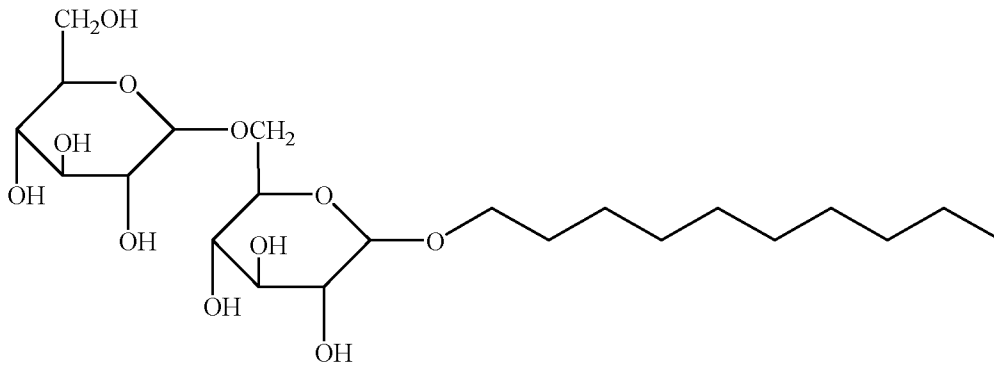
3. The method of claim 1 or 2 wherein the alkylpolyglucoside has the structure:



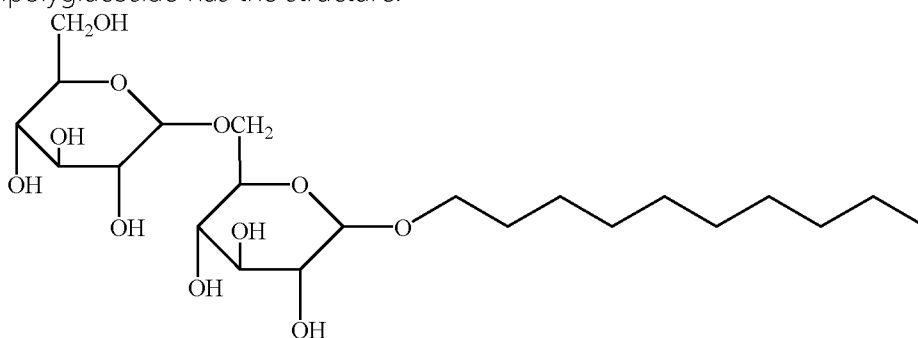
wherein n is an average value of 0.4 to 0.8.

25

4. The method of claim 1 or 2 wherein the alkylpolyglucoside has the structure:



5. The method of any one of claims 1-4 wherein the concentrated surfactant has a total weight percent of the co-surfactant and the alkylpolyglucoside of from 60 to 75 wt % and a total weight percent water of from 25 to 40 wt %.
- 5
6. The method of any one of claims 1-4 wherein the concentrated surfactant has a total weight percent of the alkylpolyglucoside of from 15 to 50 wt %, a total weight percent of the co-surfactant of from 20 to 40 wt %, and a total weight percent of water of from 25 to 60 wt %.
- 10
7. The method of any one of claims 1-3 wherein the average of $n+1$ is the degree of polymerization of the alkylpolyglucoside and wherein $n+1$ is an average value of from 1.4 to 1.8.
- 15
8. The method of any one of claims 1-7 wherein the co-surfactant is a betaine.
9. The method of any one of claims 1-7 wherein the co-surfactant comprises an amphoacetate, an alkanolamide, a sarcosinate, a sulfosuccinate, a carboxylate, a sulfate, or combinations thereof.
- 20
10. The method of any one of claims 1-9 wherein the co-surfactant and the alkylpolyglucoside are utilized in a weight ratio of 1:2 to 2:1, based on the weight of the co-surfactant and the alkylpolyglucoside.
- 25
11. The method of claim 1 wherein R has from 8 to 10 carbon atoms, wherein the average of $n+1$ is the degree of polymerization of the alkylpolyglucoside and wherein $n+1$ is an average value of from 1.4 to 1.8, wherein the co-surfactant is betaine, wherein the alkylpolyglucoside has the structure:



wherein a total weight percent of the alkylpolyglucoside is of from 15 to 50 wt %, a total weight percent of the co-surfactant is of from 20 to 40 wt %, and a total weight percent of water is of from 25 to 55 wt %, and wherein the concentrated surfactant is free of a co-surfactant that is not an alkylpolyglucoside or betaine.

5

12. The method of claim 1 wherein the step of providing the alkyl alcohol is further defined as providing a first alkyl alcohol having the formula: ROH, wherein R is an alkyl group having 8 carbon atoms, and providing a second alkyl alcohol having the formula: R' OH, wherein R' is an alkyl group having 10 carbon atoms.

10

13. A concentrated surfactant comprising:
an alkylpolyglucoside having the formula: $[C_6H_{11}O_5][C_6H_{10}O_5]_nOR$, wherein R is an alkyl group having 1 to 20 carbon atoms and n is an average value of zero or greater;
a betaine; and

15

water;
wherein a total weight percent of said betaine and said alkylpolyglucoside is at least 40 wt % and a total weight percent water is at least 10 wt %.

14. The concentrated surfactant of claim 13 wherein R has from 8 to 16 carbon atoms

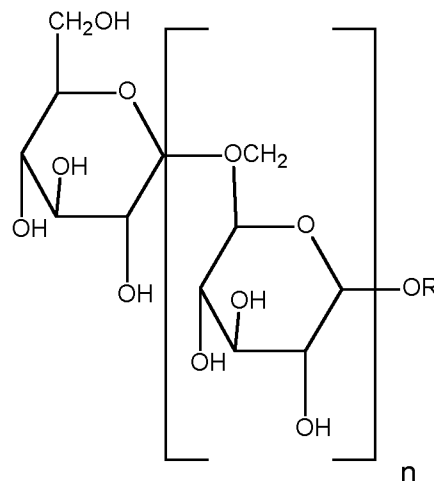
20

15. The concentrated surfactant of claim 13 wherein R has from 8 to 12 carbon atoms.

16. The concentrated surfactant of claim 13 wherein R has from 8 to 10 carbon atoms.

25

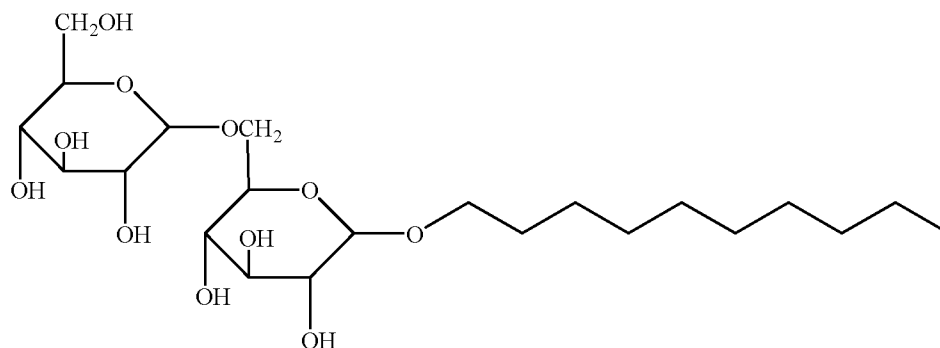
17. The concentrated surfactant of any one of claims 13-16 wherein said alkylpolyglucoside has the structure:



wherein n is an average value of 0.4 to 0.8.

30

18. The concentrated surfactant of any one of claims 13-16 wherein said alkylpolyglucoside has the structure:



19. The concentrated surfactant of any one of claims 13-18 wherein having a total weight percent of said betaine and said alkylpolyglucoside of from 40 to 75 wt % and a total weight percent water of from 25 to 60 wt %.
- 5
20. The concentrated surfactant of any one of claims 13-18 having a total weight percent of said alkylpolyglucoside of from 15 to 50 wt %, a total weight percent of said betaine of from 20 to 40 wt %, and a total weight percent of said water of from 25 to 55 wt %.
- 10
21. The concentrated surfactant of any one of claims 13-18 wherein said betaine and said alkylpolyglucoside are present in a weight ratio of 1:2 to 2:1, based on the weight of said betaine and said alkylpolyglucoside.
- 15
22. The concentrated surfactant of any one of claims 13-21 that is free of a co-surfactant that is not an alkylpolyglucoside or betaine.
23. The concentrated surfactant of any one of claims 13-22 that has a viscosity of less than or equal to 1000 cps measured at 25 °C using Brookfield RV4 viscometer at 20 rpm.

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2018/061640

A. CLASSIFICATION OF SUBJECT MATTER					
INV.	C11D1/83	C11D1/835	C11D1/94	C11D10/04	
ADD.	C11D1/10	C11D1/12	C11D1/14	C11D1/29	C11D1/52
	C11D1/66	C11D1/88	C11D1/90		
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)
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 A	US 5 958 868 A (PI SUBIRANA RAFAEL [ES] ET AL) 28 September 1999 (1999-09-28) column 1, line 43 - column 3, line 4; claims; examples	13-23 1-12
X A	EP 0 728 836 A2 (GOLDSCHMIDT AG TH [DE]) 28 August 1996 (1996-08-28) page 3, line 42 - page 4, line 2; claims; examples	13-23 1-12
X A	US 5 925 747 A (UPHUES GUENTER [DE] ET AL) 20 July 1999 (1999-07-20) column 1, lines 8-12 column 2, lines 14-42 claims; examples	13-23 1-12
	----- -/--	

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	"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
"E" earlier application or patent but published on or after the international filing date	"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
"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)	"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
"O" document referring to an oral disclosure, use, exhibition or other means	"&" document member of the same patent family
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search 1 June 2018	Date of mailing of the international search report 11/06/2018
--	--

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

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2018/061640

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 932 535 A (NEUSS MICHAEL [DE] ET AL) 3 August 1999 (1999-08-03)	13-23
A	column 2, line 36 - column 4, line 3; claims; examples	1-12
A	----- WO 01/37658 A2 (COGNIS DEUTSCHLAND GMBH [DE]) 31 May 2001 (2001-05-31) examples	1-23
A	----- US 5 258 142 A (GIESEN BRIGITTE [DE] ET AL) 2 November 1993 (1993-11-02) examples	1-23
A	----- WO 92/01772 A1 (HENKEL KGAA [DE]) 6 February 1992 (1992-02-06) examples	1-23
A	----- US 5 883 068 A (HENSEN HERMANN [DE] ET AL) 16 March 1999 (1999-03-16) examples	1-23
A	----- US 2014/336094 A1 (GROSS STEPHEN F [US]) 13 November 2014 (2014-11-13) examples	1-23
A	----- US 5 523 016 A (GIESEN BRIGITTE [DE] ET AL) 4 June 1996 (1996-06-04) examples	1-23
A	----- US 2017/044471 A1 (COOPE-EPSTEIN JANET [US] ET AL) 16 February 2017 (2017-02-16) claim 19	1-23

INTERNATIONAL SEARCH REPORT

International application No.
PCT/EP2018/061640

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.
3. As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-23

Method for forming a concentrated surfactant comprising the step of combining a co-surfactant comprising water and an undiluted alkylpolyglucoside, wherein the amount of co-surfactant and alkylpolyglucoside in the concentrated surfactant is at least 40 wt%, and the amount of water in the concentrated surfactant is at least 10 wt%.

Concentrated surfactant comprising an alkylpolyglucoside, a betaine, and water, wherein the amount of betaine and alkylpolyglucoside in the concentrated surfactant is at least 40 wt%, and the amount of water in the concentrated surfactant is at least 10 wt%.

1.1. claims: 9(completely); 1-7, 10, 12(partially)

Method for forming a concentrated surfactant comprising the step of combining a co-surfactant comprising water and an undiluted alkylpolyglucoside, the co-surfactant being not a betaine, wherein the amount of co-surfactant and alkylpolyglucoside in the concentrated surfactant is at least 40 wt%, and the amount of water in the concentrated surfactant is at least 10 wt%.

1.2. claims: 8, 11, 13-23(completely); 1-7, 10, 12(partially)

Method for forming a concentrated surfactant comprising the step of combining a betaine comprising water and an undiluted alkylpolyglucoside, wherein the amount of betaine and alkylpolyglucoside in the concentrated surfactant is at least 40 wt%, and the amount of water in the concentrated surfactant is at least 10 wt%.

Concentrated surfactant comprising an alkylpolyglucoside, a betaine, and water, wherein the amount of betaine and alkylpolyglucoside in the concentrated surfactant is at least 40 wt%, and the amount of water in the concentrated surfactant is at least 10 wt%.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2018/061640

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5958868	A	28-09-1999	DE 19511670 A1 02-10-1996 EP 0817827 A1 14-01-1998 ES 2144734 T3 16-06-2000 US 5958868 A 28-09-1999 WO 9630477 A1 03-10-1996
EP 0728836	A2	28-08-1996	DE 19506207 A1 29-08-1996 EP 0728836 A2 28-08-1996
US 5925747	A	20-07-1999	CN 1159798 A 17-09-1997 DE 4435495 A1 11-04-1996 EP 0784609 A1 23-07-1997 ES 2135772 T3 01-11-1999 US 5925747 A 20-07-1999 WO 9610558 A1 11-04-1996
US 5932535	A	03-08-1999	NONE
WO 0137658	A2	31-05-2001	AR 026569 A1 19-02-2003 AU 2836101 A 04-06-2001 DE 19956236 A1 31-05-2001 GT 200000214 A 07-06-2002 WO 0137658 A2 31-05-2001
US 5258142	A	02-11-1993	CA 2084655 A1 06-12-1991 CN 1057013 A 18-12-1991 DE 4017922 A1 12-12-1991 EP 0532549 A1 24-03-1993 JP H05509111 A 16-12-1993 US 5258142 A 02-11-1993 WO 9118963 A1 12-12-1991
WO 9201772	A1	06-02-1992	BR 9106664 A 08-06-1993 CA 2088067 A1 24-01-1992 CN 1058424 A 05-02-1992 DE 4023334 A1 30-01-1992 EP 0540568 A1 12-05-1993 JP H05509117 A 16-12-1993 WO 9201772 A1 06-02-1992
US 5883068	A	16-03-1999	DE 4435387 A1 11-04-1996 EP 0785980 A1 30-07-1997 ES 2130653 T3 01-07-1999 US 5883068 A 16-03-1999 WO 9610622 A1 11-04-1996
US 2014336094	A1	13-11-2014	NONE
US 5523016	A	04-06-1996	AT 134703 T 15-03-1996 DE 4117689 A1 03-12-1992 DE 59205509 D1 04-04-1996 EP 0586429 A1 16-03-1994 ES 2083743 T3 16-04-1996 JP H06507655 A 01-09-1994 US 5523016 A 04-06-1996 WO 9221742 A1 10-12-1992
US 2017044471	A1	16-02-2017	EP 3334813 A1 20-06-2018

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2018/061640

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
		KR 20180034661 A	04-04-2018
		US 2017044471 A1	16-02-2017
		WO 2017030996 A1	23-02-2017