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

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
19 October 2023 (19.10.2023)

WIPO | PCT

(10) International Publication Number
WO 2023/201211 A3

(51) International Patent Classification:
A61K 8/04 (2006.01) *A61K 8/81* (2006.01)
A61K 8/02 (2006.01) *A61K 9/06* (2006.01)

(21) International Application Number:
PCT/US2023/065603

(22) International Filing Date:
10 April 2023 (10.04.2023)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
63/329,616 11 April 2022 (11.04.2022) US
63/331,605 15 April 2022 (15.04.2022) US

(71) Applicant: **GENOMATICA, INC.** [US/US]; 4757 Nexus Center Drive, San Diego, CA 92121 (US).

(72) Inventors: **TADESSE, Fasil, A.**; 4757 Nexus Center Drive, San Diego, CA 92121 (US). **PARIKH, Aakash**; 4757 Nexus Center Drive, San Diego, CA 92121 (US).

(74) Agent: **GAY, David, A.** et al.; Greenberg Traurig, LLP, 77 West Wacker Drive, Suite 3100, Chicago, IL 606101 (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, CV, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IQ, IR, IS, IT, JM, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, MG, MK, MN, MU, 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, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, WS, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, CV, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SC, 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, ME, 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).

(54) Title: NEUTRAL ODOR 1,3-BUTYLENE GLYCOL COMPOSITIONS AND METHODS OF USE THEREOF

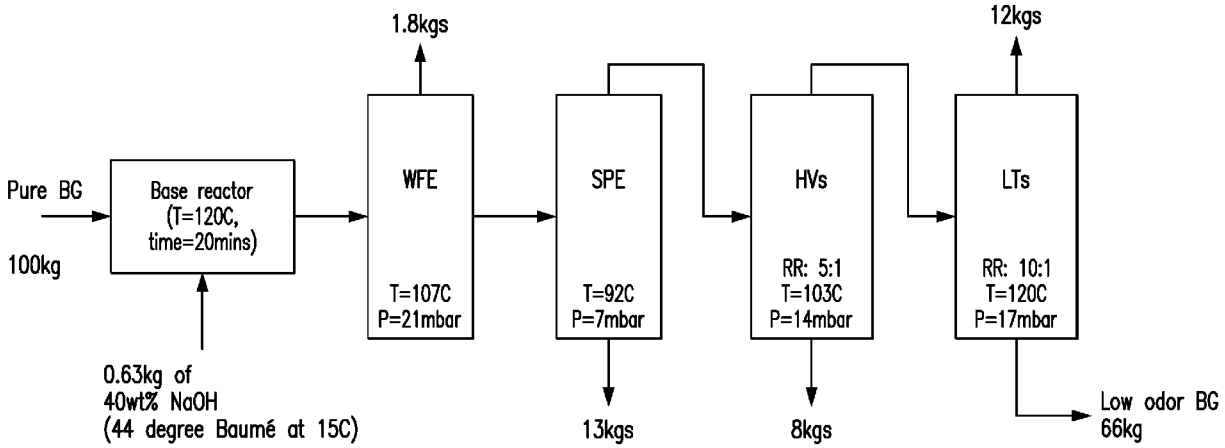

FIG. 1

(57) Abstract: The disclosure provides embodiments directed to a 1,3-butylene glycol (BG) product that has a neutral odor, a composition comprising the BG product described here, and methods of using the BG product and compositions comprising the BG products. BG products described here demonstrate exemplary qualities and characteristics of being natural, sustainable, and having a neutral odor for use in cosmetics, cosmeceuticals, and personal care products. Such BG compositions of the description provide a BG product that does not mask or alter the fragrance notes of the cosmetics, cosmeceuticals, and personal care products. The BG products and compositions comprising such BG products as disclosed here are cost-effective while maintaining a neutral odor.

[Continued on next page]

WO 2023/201211 A3

Published:

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

(88) Date of publication of the international search report:

10 October 2024 (10.10.2024)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 23/65603

A. CLASSIFICATION OF SUBJECT MATTER

IPC - INV. A61K 8/04, A61K 8/02, A61K 8/81 (2023.01)
ADD. A61K 9/06 (2023.01)

CPC - INV. A61K 8/04, A61K 8/02, A61K 8/042, A61K 8/8129
ADD. A61K 9/06

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)
See Search History document

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

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 20210101855 A1 (Genomatica, Inc.) 08 April 2021 (08.04.2021) Para [0006]; [0020]; [0024]; [0077]; [0086]; [0152]	1, 5, and 6-7
Y	US 2012/0214940 A1 (Hsu et al.) 23 August 2012 (23.08.2012) Para [0017]; [0022]; [0024]	1, 5, and 6-7
A	US 2012/0237747 A1 (Tai et al.) 20 September 2012 (20.09.2012) entire document	1, 5, and 6-7
A	US 2013/0131222 A1 (Gross) 23 May 2013 (23.05.2013) entire document	1, 5, and 6-7

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

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"D" document cited by the applicant in the international application
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
25 September 2023	OCT 19 2023
Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-8300	Authorized officer Kari Rodriquez Telephone No. PCT Helpdesk: 571-272-4300

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 23/65603

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.: 17-31
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 extra sheets

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 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.:
1, 5 , and (6-7)/(1,5)

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.

Continuation of Box No. III Observations where unity of invention is lacking

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1. In order for all inventions to be searched, the appropriate additional search fees must be paid.

Group I: Claim 1, 5 and (6-7)/(1 and 5) directed toward a 1,3-butylene glycol (BG) product comprising one or more compounds selected from the group consisting of: 5-norbornene-2-ol; 2-ethyl-l-hexanol; and salts, derivatives, analogs, or solvates thereof, or any combinations thereof, wherein the BG product comprises bioderived BG (bioBG).

Group II: Claim 2 and (6-7)/2 directed toward a 1,3-butylene glycol (BG) product comprising one or more compounds characterized by an odor-active region as measured by gas chromatography/ mass spectrometry/ olfactory (GC/MS/0) having a relative acquisition time selected from a group consisting of: about 0.594 min having a fruity and/or solventy odor; about 0.628 min having a fruity odor; about 0.655 min having a citrus and/or peel odor; about 0.711 min having a solventy odor; about 1.328 mins having a roasty and/or exhaust odor; and combinations thereof, where the BG product comprises bioderived BG (bioBG), and the bioBG has a relative acquisition time of 1 min.

Group III: Claim 3 and (6-7)/3 directed toward a 1,3-butylene glycol (BG) product comprising one or more compounds characterized by an odor-active region as measured by gas chromatography/ quadrupole time-of-flight-mass spectrometry (GC/QTOF-MS), where the odor-active region elutes at an acquisition time of about 12.2 mins at 66.0463 m/z, wherein the BG product comprises bioderived BG (bioBG).

Group IV: Claims 4 and (6-7)/4 directed toward a 1,3-butylene glycol (BG) product comprising one or more compounds comprising a mass spectrum as characterized by quadrupole time-of-flight-mass spectrometry electron ionization (QTOF EI) at 70 eV, wherein the mass spectrum comprises peaks: 39.0229 m/z; 43.0707 m/z; 53.0385 m/z; 57.0169 m/z; 66.0463 m/z; 74.0156 m/z; 81.0333 m/z; 85.0284 m/z; 91.0539 m/z; 95.0489 m/z; and 110.0724 m/z; or the mass spectrum comprises peaks: 39.0229 m/z; 43.0707 m/z; 53.038.5 m/z; 66.0463 m/z; 81.0333 m/z; 91.0539 m/z; 95.0489 m/z; and 110.0724 m/z, wherein the BG product comprises bioderived BG (bioBG).

Group V: Claims 8 directed toward a 1,3-butylene glycol (BG) product, wherein the BG product comprises a bioderived BG (bioBG), wherein the BG product further comprises one or more compounds, wherein 3-hydroxybutanal is in an amount of less than 25 ppm; 4-hydroxy-2-butanone is in an amount less than 25 ppm; 4-(3-hydroxybutoxy)butan-2-one is in an amount less than 25 ppm; 4-((4-hydroxybutan-2- yl)oxy)- butan-2-one is in an amount less than 25 ppm; 1,2-propanediol is in an amount less than 1 ppm; 1,3 -propanediol is in an amount less than 10 ppm; 2,3-butanediol is in an amount less than 1 ppm; 2,4- dimethy1-6-((1-(4-methy1-1,3-dioxan -2-yl)propan-2-yl)oxy)-1,3-dioxane is in an amount less than 2 ppm; 4-(sec-butoxy)-2,6-dimethyl-1,3-dioxane is in an amount less than 4 ppm; 2,4-dimethyl-1,3- dioxane is in an amount less than 8 ppm; (E)-4-methy1-2-(prop-1-en-1-y1)-1,3-dioxane is in an amount less than 8 ppm; 3-hydroxybutyl acetate is in an amount less than 8 ppm; 1-(2-methy1-1,3-dioxan-4- yl)propan-2-ol is in an amount less than 8 ppm; 2-methyl-4-propyl-1,3-dioxane is in an amount less than 8 ppm; tri-substituted 1,3-dioxane is in an amount less than 8 ppm and/or 3- hydroxybutyl carbono-substituted in an amount less than 8 ppm, wherein R1 to R4 are the same or different; a hydrogen atom, a Cl - C4 alkyl group optionally substituted by an OH group, or a C2-C4 alkenyl group optionally substituted by OH group; 2,4-dimethyl-2-vinyl-1,3- dioxane; 2-(2,4-dim ethyl-1,3 -di oxan-2-yl)ethan-1 -ol; 2,2,4-trimethy1-1,3-dioxane; 4-methyl-1,3- dioxane, wherein the total of 2,4-dimethy1-2-vinyl-1,3-dioxane; 2-(2,4-dimethy1-1,3-dioxan-2- ypethan- 1 -ol; 2,2,4-trimethyl-1,3-dioxane; 4-methyl-1,3-dioxane is in a total amount of less than 34 ppm; (E)-4-methyl-2-(prop-1-en-1 -y1)-1,3 -dioxane ; 1-(4 -methyl-1,3 -dioxan-2-yl)propan-2-ol ; 2,4 -dimethy1-1,3 -dioxanc ; 3 -hydroxybutyl (E)-but-2 -enoate; 3 -hydroxybutyl acetate; 3 -hydroxybutyl 3 - hydroxybutanoate , wherein the total of (E)-4-methyl-2-(prop-1-en- 1-y1)-1,3 -dioxane ; 1 -(4-methy1-1,3- dioxan-2-yl)propan-2-ol; 2,4-dimethy1-1,3 -dioxane ; 3 -hy droxyb utyl (E)-b ut-2-eno ate ; 3 -hy droxyb utyl acetate; 3-hydroxybutyl 3-hydroxybutanoate is in a total amount of less than 63 ppm or wherein the total of 2,4-dimethy1-2-viny1-1,3-dioxane; 2-(2,4-dimethy1-1,3-dioxan-2-yl)ethan-l-ol; 2,2,4-trimethyl1,3 -dioxane ; 4-methyl-1,3-dioxane; (E)-4-methyl-2-(prop-1-en-1 -y1)-1,3 -dioxane ; 1 -(4-methy1-1,3- dioxan-2-yl)propan-2-ol; 2,4-dimethy1-1,3-dioxane ; 3 -hydroxybutyl (E)-but-2-eno ate ; 3 -hydroxybutyl acetate; 3-hydroxybutyl 3-hydroxybutanoate is in a total amount of less than 97 ppm; methyl vinyl ketone is in an amount less than 8 ppm; 1-hydroxy-3-butanone is in an amount less than 1 ppm; acetone is in an amount less than 6 ppm; formaldehyde is in an amount less than 2 ppm; crotonaldehyde is in an amount less than 1 ppm; acetaldol is in an amount less than 1 ppm; acetaldehyde is in an amount less than 5 ppm; butyraldehyde is in an amount less than 4 ppm; 2-butanol, wherein the total of 2,4-dimethyl2-vinyl -1,3 -di oxan e ; 2-(2,4-dim ethyl -1,3-di oxan -2-y1)eth an -1 -ol ; 2,2,4-tri m ethyl -1,3 -di oxan e ; 4- methyl-1,3 -dioxane ; (E)-4-methyl-2-(prop-l-en-1-y1)-1,3-dioxane; 1 -(4-methy1-1,3-dioxan-2- yl)propan-2-ol; 2,4-dimethy1-1,3-dioxane; 3 -hydroxybutyl (E)-but-2-enoate; 3 -hydroxybutyl acetate; 3 - hydroxybutyl 3-hydroxybutanoate; and 2-butanol is in a total amount of less than 65 ppm; butyl acetate; butyl acrylatc ; 4-hydroxy-2-butanonc; 2-methoxymethy1-2,4,5-trimethyl-1,3-dioxolane (solvcnty); 3 - heptanone ; 1 -octen-3 -one ; N-pentyl-2-butylamine; 3 -buten-2-one ; 2-butenal; 2,4 -dimethyl-1,3 - dioxane ; 2-e thy1-5 - methyl-1,3 -dio xane ; butyl acrylate; 2-hepty1-1,3-dioxepane; 1 -hydroxy-2- propanone; 1,2 propanediol (12PDO); 1,2,3-butanetriol; 1,2,3-propanetriol; 1,3 propanediol (13PD0); 1,4-butanediol (B D 0); 2,3 -butanediol (23BD 0) ; 2,5 -hexanedione ; 3 -buten-2-ol ; cis-cryotyl alcohol; isopropyl alcohol (IPA); methyl vinyl ketone (MVK); n-butane (n-but); dimethylethanolamine (DMAE); toluene; and any combinations thereof.

*********CONTINUED ON SUPPLEMENTAL PAGE********

Continuation of Box No. III Observations where unity of invention is lacking

Group VI: Claim 9 directed toward A 1,3-butylene glycol (BG) product, wherein the BG product comprises a bioderived BG (bioBG), wherein the BG product does not comprise a compound selected from the group consisting of: 3 -hydroxy-butanal ; 4-hydroxy-2-butanone; 4-(3-hydroxybutoxy)butan-2-one ; 4-((4-hydroxybutan2-yl)oxy)-butan-2 -one ; 1,2-propanediol; 1,3 -propanediol; 2,3 -butanediol ; 2,4-dimethy1-6-al -(4- methyl-1,3 -dioxan-2-yl)propan-2-yl)oxy)-1,3 -dioxane ; 4-(sec-butoxy)-2,6-dimethy1-1,3-dioxane; 2,4-dime thy1-1,3-dioxane; (E)-4-methyl-2-(prop-1 -en-l-y1)-1,3 -dioxane ; 3 -hydroxybutyl acetate; 1 -(2- methyl-1,3 -dioxan-4-yl)propan-2-ol ; 2-methyl-4-propy1-1,3-dioxane; tri-substituted 1,3 -dioxane and/or 3-hydroxybutyl carbono-substituted wherein RI to R4 are the same or different; a hydrogen atom, a CI-C4 alkyl group optionally substituted by an OH group, or a C2-C4 alkenyl group optionally substituted by OH group; 2,4-dimethy1-2-vinyl-1,3-dioxane; dimethy1-1,3 -dioxan-2-ypethan-1 -ol; 2,2,4-trimethy1-1,3-dioxanc; 4-methyl-1,3-dioxanc; (E)-4- methy1-2-(prop-1-en-1-y1)-1,3-dioxane; 1-(4-methyl-1,3-dioxan-2-yl)propan-2-ol; 2,4-dimethy1-1,3- dioxane; 3-hydroxybutyl (E)-but-2-enoate; 3-hydroxybutyl acetate; 3-hydroxybutyl 3- hydroxybutanoate; methyl vinyl ketone; 1-hydroxy-3-butanone; acetone; formaldehyde; crotonaldehyde; acetaldol; acetaldehyde; butyraldehyde; 2-butanol; butyl acrylate; butyl acetate; 4- hydroxy-2 -butanone ; 2 -methoxymethy1-2,4,5 -trimethyl-1,3 -dioxo lane (solventy); 3 -heptanone ; 1- octen-3 -one ; N-pentyl-2-butylamine; 3 -buten-2-one ; 2-butenal; 2,4-dimethy1-1,3-dioxane; 2-ethy1-5 - methyl-1,3 -dioxane ; butyl acrylate; 2-hepty1-1,3-dioxepane; 1-hydroxy-2-propanone; 1,2 propanediol (12PD0); 1,2,3-butanetriol; 1,2,3-propanetriol; 1,3 propanediol (13PD0); 1,4-butanediol (BDO); 2,3-butanediol (23BDO); 2,5-hexanedione; 3-buten-2-ol; cis-cryotyl alcohol; isopropyl alcohol (IPA); nbutane (n-but); dimethylethanolamine (DMAE); toluene; and or any combinations thereof, wherein the BG product comprises bioderived BG (bioBG).

Group VII: Claim 10 directed toward a 1,3-butylene glycol (BG) product, wherein the BG product does not comprise one or more compounds having an odor-active region as measured by gas chromatography/ quadrupole time-of-flight-mass spectrometry (GC/QTOF -MS), wherein the odor-active region elutes at an acquisition time selected from a group consisting of: about 12 mins at 59.0489 m/z, about 13 mins at 57.0698 m/z, about 15.5 mins at 70.0411 m/z, about 28.5 mins at 114.0675 m/z, and combinations thereof, wherein the BG product comprises bioderived BG (bioBG).

Group VIII: Claim 11 directed toward a 1,3-butylene glycol (BG) product, wherein the BG product does not comprise one or more compounds comprising a mass spectrum as characterized by quadrupole time-of-flight-mass spectrometry electron ionization (QTOF EI) at 70 eV, wherein the mass spectrum comprises an odoractive region, wherein the mass spectrum is selected from the group consisting of: (a) 43.017 m/z, 55.0541 m/z, 73.0283 m/z, 86.0723 m/z, 97.0642 m/z, and 115.0752; (b) 41.0385 m/z, 57.0698 m/z, 68.0259 m/z, 72.0569 m/z, 85.0646 m/z, 99.0801 m/z, and 114.1033 m/z; and (c) 43.0179 m/z, 57.0336 m/z, 72.0206 m/z, 86.0362 m/z, 114.0675 m/z, 128.0830 m/z, 138.0670 m/z, and 155.1060 m/z, wherein the BG product comprises bioderived BG (bioBG).

Group IX: Claims 12-13 directed toward a 1,3-butylene glycol (BG) product, wherein the BG product comprising bioderived BG (bioBG) does not comprise one or more compounds comprising: an odor-active region as measured by GC/MS that elutes at an acquisition time selected from a group consisting of: about 9.3 mins (toluene); about 9.6 mins (butyl acetate); about 10.5 mins (butyl acrylate); about 16 mins (4-hydroxy-2-butanone); and any combinations thereof, where bioBG elutes at an acquisition time of about 18 mins; or an odor-active region as measured by GC/MS that elutes at an acquisition time selected from a group consisting of: about 9.3 mins (toluene); about 9.6 mins (butyl acetate); about 10.5 mins (butyl acrylate); about 11 mins; about 11.7 mins; about 14.2 mins; about 16 mins (4-hydroxy-2-butanone); about 17.7 mins; and any combinations thereof, where bioBG elutes at an acquisition time of about 18 mins.

Group X: Claim 14 directed toward a 1,3-butylene glycol (BG) product, wherein the BG product does not comprise one or more compounds comprising an odor-active region as measured by GC/MS/0 that elutes at an acquisition time selected from the group consisting of: -2.5 mins (rubber and/or plastic and/or green; 3-buten-2- one); -2.7 mins (plastic); -2.9 mins (solventy; 2-butenal); -4.6 mins (plastic: 2,4-dimethyl-1,3- dioxane); -6.2 mins (fruity and/or plastic; 2-ethyl-5-methyl-1,3-dioxane); -6.6 mins (plastic and/or pungent and/or mushroom and/or metallic; butyl acrylate); -8.2 mins (fruity and/or plastic and/or metal and/or mushroom; 2-hepty1-1,3-dioxepane); about 11.8 mins (waxy and/or fatty) ; and any combinations thereof, where the BG product comprises bioderived BG (bioBG).

Group XI: Claim 15 directed toward a 1,3-butylene glycol (BG) product, wherein the BG product does not comprise one or more compounds comprising an odor-active region as measured by GC/MS/0 that elutes at an acquisition time selected from the group consisting of: -9 mins - -9.2 mins (relative acquisition times -0.5 min, -0.506 min, -0.511 min, respectively) having a fusel and/or sulfur and/or oil odor; -9.3 mins (relative acquisition time 0.517 min; toluene); -10.2 mins - -10.4 mins (relative acquisition times 0.567 min, 0.572 min, 0.578 min, respectively) having a fruity and/or plastic odor; -10.5 mins - -10.7 mins (relative acquisition times 0.583 min 0.589 min, 0.594 min, respectively) having a fruity and/or floral and/or plastic odor; and -13.3 mins - 13.5 mins (relative acquisition times 0.739 min, 0.744min, -0.75 min, respectively) having a plastic and/or roasty odor; and any combinations thereof, where the BG product comprises bioderived BG (bioBG).

Group XII: Claim 16 directed toward a 1,3-butylene glycol (BG) product, wherein the BG product does not comprise one or more compounds comprising an odor-active region as measured by GC/MS/0 having a relative acquisition time selected from a group consisting of: about 0.417 min (rubber and/or plastic and/or green), about 0.450 min (plastic), about 0.483 min (solventy), about 0.783 min (plastic), about 1.033 min (fruity and/or plastic), about 1.1 mins (plastic and/or pungent and/or mushroom and/or metallic), about 1.367 mins (fruity and/or plastic and/or metal and/or mushroom), about 1.967 mins (waxy and/or fatty), and combinations thereof, where the BG product comprises bioderived BG (bioBG), and the bioBG has a relative acquisition time of 1 min.

The inventions listed as Groups I-XII do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons:

Special Technical Features:

Group I requires one or more compounds selected from the group consisting of: 5-norbornene-2-ol; 2-ethyl-l-hexanol; and salts, derivatives, analogs, or solvates thereof, not required by Groups II-XIV.

******CONTINUED ON SUPPLEMENTAL PAGE********

Continuation of Box No. III Observations where unity of invention is lacking

Group II requires one or more compounds characterized by an odor-active region as measured by gas chromatography/mass spectrometry/olfactory (GC/MS/0) having a relative acquisition time selected from a group consisting of: about 0.594 min having a fruity and/or solventy odor; about 0.628 min having a fruity odor; about 0.655 min having a citrus and/or peel odor; about 0.711 min having a solventy odor; about 1.328 mins having a roasty and/or exhaust odor; and combinations thereof, not required by Groups I and III-XIV.

Group III requires one or more compounds characterized by an odor-active region as measured by gas chromatography/quadrupole time-of-flight-mass spectrometry (GC/QTOF-MS), where the odor-active region elutes at an acquisition time of about 12.2 mins at 66.0463 m/z, not required by Groups I-II and IV-XIV.

Group IV requires one or more compounds comprising a mass spectrum as characterized by quadrupole time-of-flight-mass spectrometry electron ionization (QTOF EI) at 70 eV, wherein the mass spectrum comprises peaks: 39.0229 m/z; 43.0707 m/z; 53.0385 m/z; 57.0169 m/z; 66.0463 m/z; 74.0156 m/z; 81.0333 m/z; 85.0284 m/z; 91.0539 m/z; 95.0489 m/z; and 110.0724 m/z; or the mass spectrum comprises peaks: 39.0229 m/z; 43.0707 m/z; 53.038.5 m/z; 66.0463 m/z; 81.0333 m/z; 91.0539 m/z; 95.0489 m/z; and 110.0724 m/z, not required by Groups I-III and V-XIV.

Group V requires one or more compounds, wherein 3-hydroxybutanal is in an amount of less than 25 ppm; 4-hydroxy-2-butanone is in an amount less than 25 ppm; 4-(3-hydroxybutoxy)butan-2-one is in an amount less than 25 ppm; 4-((4-hydroxybutan-2- yl)oxy)- butan-2-one is in an amount less than 25 ppm; 1,2-propanediol is in an amount less than 1 ppm; 1,3 - propanediol is in an amount less than 10 ppm; 2,3-butanediol is in an amount less than 1 ppm; 2,4- dimethy1-6-((1-(4-methy1-1,3-dioxan-2-yl)propan-2-yl)oxy)-1,3-dioxane is in an amount less than 2 ppm; 4-(sec-butoxy)-2,6-dimethyl-1,3-dioxane is in an amount less than 4 ppm; 2,4-dimethyl-1,3- dioxane is in an amount less than 8 ppm; (E)-4-methy1-2-(prop-1-en-1-y1)-1,3-dioxane is in an amount less than 8 ppm; 3-hydroxybutyl acetate is in an amount less than 8 ppm; 1-(2-methy1-1,3-dioxan-4- yl)propan-2-ol is in an amount less than 8 ppm; 2-methyl-4-propyl-1,3-dioxane is in an amount less than 8 ppm; tri-substituted 1,3-dioxane is in an amount less than 8 ppm and/or 3- hydroxybutyl carbono-substituted in an amount less than 8 ppm, not required by Groups I-IV and VI-XIV.

Group VI requires a product that does not comprise a compound selected from the group consisting of: 3 -hydroxy-butanal ; 4-hydroxy-2 -butanone; 4-(3-hydroxybutoxy)butan-2-one ; 4-((4-hydroxybutan 2-yl)oxy)-butan-2 -one ; 1,2-propanediol; 1,3 -pro panediol; 2,3 - butanediol ; 2,4-dimethy1-6-al -(4- methyl-1,3 -dioxan-2-yl)propan-2-yl)oxy)-1,3 -dioxane ; 4-(sec-butoxy)-2,6-dimethy1-1,3-dioxane; 2,4-dime thy1-1,3-dioxane; (E)-4-methyl-2-(prop-1 -en-l-y1)-1,3 -dioxane ; 3 -hydroxybutyl acetate; 1 -(2- methyl-1,3 -dioxan-4-yl)propan-2-ol ; 2-methyl-4-propy1-1,3-dioxane; tri-substituted 1,3 -dioxane, not required by Groups I-V and VII-XIV.

Group VII requires a product that does not comprise one or more compounds having an odor-active region as measured by gas chromatography/ quadrupole time-of flight-mass spectrometry (GC/QTOF-MS), wherein the odor-active region elutes at an acquisition time selected from a group consisting of: about 12 mins at 59.0489 m/z, about 13 mins at 57.0698 m/z, about 15.5 mins at 70.0411 m/z, about 28.5 mins at 114.0675 m/z, and combinations thereof, not required by Groups I-VI and VIII-XIV.

Group VIII requires a product that does not comprise one or more compounds comprising a mass spectrum as characterized by quadrupole time-of-flight-mass spectrometry electron ionization (QTOF EI) at 70 eV, wherein the mass spectrum comprises an odor active region, wherein the mass spectrum is selected from the group consisting of: (a) 43.017 m/z, 55.0541 m/z, 73.0283 m/z, 86.0723 m/z, 97.0642 m/z, and 115.0752; (b) 41.0385 m/z, 57.0698 m/z, 68.0259 m/z, 72.0569 m/z, 85.0646 m/z, 99.0801 m/z, and 114.1033 m/z; and (c) 43.0179 m/z, 57.0336 m/z, 72.0206 m/z, 86.0362 m/z, 114.0675 m/z, 128.0830 m/z, 138.0670 m/z, and 155.1060 m/z, not required by Groups I-VII and IX-XIV.

Group IX requires a product that does not comprise one or more compounds comprising an odor-active region as measured by GC/MS that elutes at an acquisition time selected from a group consisting of: about 9.3 mins (toluene); about 9.6 mins (butyl acetate); about 10.5 mins (butyl acrylate); about 16 mins (4-hydroxy-2-butanone); and any combinations thereof, where bioBG elutes at an acquisition time of about 18 mins; or an odor-active region as measured by GC/MS that elutes at an acquisition time selected from a group consisting of: about 9.3 mins (toluene); about 9.6 mins (butyl acetate); about 10.5 mins (butyl acrylate); about 11 mins; about 11.7 mins; about 14.2 mins; about 16 mins (4-hydroxy-2-butanone); about 17.7 mins; and any combinations thereof, not required by Groups I-VIII and X-XIV.

Group X requires a product that does not comprise e one or more compounds comprising an odor-active region as measured by GC/MS/0 that elutes at an acquisition time selected from the group consisting of: -2.5 mins (rubber and/or plastic and/or green; 3-buten-2- one); -2.7 mins (plastic); -2.9 mins (solventy; 2-butenal); -4.6 mins (plastic: 2,4-dimethyl-1,3- dioxane); -6.2 mins (fruity and/or plastic; 2-ethyl-5-methyl-1,3-dioxane); -6.6 mins (plastic and/or pungent and/or mushroom and/or metallic; butyl acrylate); -8.2 mins (fruity and/or plastic and/or metal and/or mushroom; 2-hepty1-1,3-dioxepane); about 11.8 mins (waxy and/or fatty) ; and any combinations thereof, not required by Groups I-IX and XI-XIV.

Group XI requires a product that does not comprise one or more compounds comprising an odor-active region as measured by GC/MS/0 that elutes at an acquisition time selected from the group consisting of: -9 mins - -9.2 mins (relative acquisition times -0.5 min, -0.506 min, -0.511 min, respectively) having a fusel and/or sulfur and/or oil odor; -9.3 mins (relative acquisition time 0.517 min; toluene); -10.2 mins - -10.4 mins (relative acquisition times 0.567 min, 0.572 min, 0.578 min, respectively) having a fruity and/or plastic odor; -10.5 mins - -10.7 mins (relative acquisition times 0.583 min 0.589 min, 0.594 min, respectively) having a fruity and/or floral and/or plastic odor; and -13.3 mins - 13.5 mins (relative acquisition times 0.739 min, 0.744 min, —0.75 min, respectively) having a plastic and/or roasty odor; and any combinations thereof, where the BG product comprises bioderived BG (bioBG), not required by Groups I-X and XII.

Group XII requires a product that does not comprise one or more compounds comprising an odor-active region as measured by GC/MS/0 having a relative acquisition time selected from a group consisting of: about 0.417 min (rubber and/or plastic and/or green), about 0.450 min (plastic), about 0.483 min (solventy), about 0.783 min (plastic), about 1.033 min (fruity and/or plastic), about 1.1 mins (plastic and/or pungent and/or mushroom and/or metallic), about 1.367 mins (fruity and/or plastic and/or metal and/or mushroom), about 1.967 mins (waxy and/or fatty), and combinations thereof, not required by Groups I-XI.

*******CONTINUED ON SUPPLEMENTAL PAGE********

International application No.

PCT/US 23/65603

Continuation of Box No. III Observations where unity of invention is lacking

Common Technical Features:

Groups I-XII share the share the common technical feature of a 1,3-butylene glycol (BG) product, wherein the BG product comprises bioderived BG (bioBG).

However, these shared technical features do not represent a contribution over prior art, because the shared technical feature is anticipated by US 2021/0101855 A1 to Genomatica, Inc. (hereinafter Genomatica). Genomatica discloses a 1,3-butylene glycol (BG) product (Para [0076] Provided herein are purified bio-BG products as well as processes and systems for producing such purified bio-BG products; Para [0006] whereby the bioderived 1,3-BG includes detectable levels of one or more compounds selected from 3-hydroxy-butanal, 4-hydroxy-2-butanone) wherein the BG product comprises bioderived BG (bioBG) (Para [0010] In some embodiments, the bioderived 1,3 - BG has a chemical purity of 99.0 % or more).

As the shared technical features were known in the art at the time of the invention, they cannot be considered common technical features that would otherwise unify the groups. Therefore, Groups I-XII lack unity under PCT Rule 13.

Item 4 Cont.: Claims 17-31 are unsearchable claims because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).