

**NON-PROVISIONAL
UTILITY PATENT APPLICATION
TRANSMITTAL - 37 CFR 1.53(b)**

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First Named Inventor: Rocco Burgo
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Applicant Name: Inolex Investment Corporation
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Transmitted herewith for filing is the non-provisional utility patent application entitled:

**NATURAL 1,2-ALKANEDIOLS, COMPOSITIONS HAVING NATURAL 1,2-
ALKANEDIOLS AND PROCESSES FOR MAKING THE SAME**

which is:

an ☐ Original; or
a ☒ Continuation, ☐ Divisional, or ☐ Continuation-in-part (CIP)
of prior U.S. Non-Provisional Patent Application No. 16/262,902, filed January 30, 2019,
which in turn is based on Provisional Patent Application No. 62/623,985, filed January
30, 2018.

Enclosed are:

- ☒ Specification (including Abstract) and claims: 44 pages.
- ☒ 7 sheets of drawings (formal).
- ☒ Application Data Sheet Under 37 C.F.R. 1.76.
- ☒ Unexecuted: ☒ Inventor Declaration; ☐ Inventor Declaration and Power of Attorney; ☐ Inventor Oath; ☐ Substitute Statement.
- ☐ Copy of ☐ Declaration; ☐ Declaration and Power of Attorney from prior application.
- ☐ Copy of separate Power of Attorney (including 37 CFR 3.73(b) statement, if applicable).
- ☐ Microfiche computer program (Appendix).
- ☐ Nucleotide and/or Amino Acid Sequence Submission, including:
 - ☐ Computer readable copy ☐ Paper Copy ☐ Verified Statement.
- ☒ Name of Assignee: Inolex Investment Corporation

- ☐ Certified copy(ies) of ____ Application No(s). ____ filed ____ is/are filed:
☐ herewith or ☐ in prior application ____.
- ☐ Applicant(s), by its/their undersigned attorney, claim(s) Small Entity Status under 37 C.F.R. §1.27 as ☐ an Independent Inventor, or ☐ a Small Business Concern, or ☐ a Non-Profit Organization.
- ☐ **Preliminary Amendment.**
- ☐ Information Disclosure Statement, PTO/SB/08A or B, and cited references.
- ☐ Request for Nonpublication of Application Under 35 U.S.C. §122(b)
- ☐ Other:

The filing fee is calculated as follows:

			MICRO ENTITY			SMALL ENTITY			LARGE ENTITY	
CLAIMS	NO. FILED	NO. EXTRA	BASIC FILING, SEARCH, AND EXAMINATION FEES:			BASIC FILING, SEARCH, AND EXAMINATION FEES:			BASIC FILING, SEARCH, AND EXAMINATION FEES:	
			\$430			\$ 785			\$1,720	
Total	46-20 =	26	X \$ 25	\$	OR	X \$ 50	\$	OR	X \$100	\$2,600
Independent	2 - 3 =	0	X \$115	\$	OR	X \$230	\$	OR	X \$460	\$920
☐ Multiple Dependent Claims			X \$205	\$	OR	X \$410	\$	OR	X \$820	\$0
☐ Application Size Fee (if specification and drawings exceed 100 sheets)										
Total sheets		Add'l sheets	# of sets of 50 (round up to whole number)							
-100	=		/50 =	X \$100 =	\$	OR	X \$200 =	\$	OR	X \$400
Late Fee For Filing Fees, Inventor Oath or Declaration			\$ 40	\$	OR	\$ 80	\$	OR	\$160	\$160
Late Fee For Non-English Specification			\$ 35	\$	OR	\$ 70	\$	OR	\$140	\$0
			TOTAL	\$	OR	TOTAL	\$	OR	TOTAL	\$5400

- ☐ **The Commissioner is not authorized to charge the filing fee at this time as we elect to defer payment of the entire filing fee until receipt of a Notice to File Missing Parts**
- ☒ Applicant herewith charges the above-noted filing fees to the credit card account, Calderone Bullock American Express (Billing No. I0113.0251).
- ☒ The Commissioner is hereby authorized to charge and/or credit Deposit Account No. 60-2682 as noted below.
- ☒ Any overpayments or deficiencies in the above-calculated fee.

- ☒ Any additional fees required under 37 C.F.R. § 1.16 and § 1.17.
- ☒ In the event that a Petition for Extension of Time is required during the prosecution of this application, but not submitted, please charge any extension fee under 37 C.F.R. § 1.136(a) to our Deposit Account noted above.

CORRESPONDENCE ADDRESS



6 November 2019

(Date)

By: _____

KRISTYNE ALISON BULLOCK

Registration No. 42371

CALDERONE BULLOCK LLC

Two Greentree Centre

9000 Lincoln Drive East, Suite 301

Marlton, NJ 08053

Telephone: 856-446-6047

Direct Dial: 856-446-6043

Facsimile: 856-267-5370

E-Mail: kbullock@calderonebullock.com

☒ Customer Number or Bar Code Label: **000159443**

KAB:kab

TITLE OF THE INVENTION

[0001] Natural 1,2-Alkanediols, Compositions Having Natural 1,2-Alkanediols and Processes for Making The Same

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CROSS-REFERENCE TO RELATED APPLICATIONS

[0002] This U.S. Non-Provisional Patent Application is a continuation of co-pending United States Patent Application Serial No. 16/262,902, entitled “Natural 1,2-Alkanediols, Compositions Having Natural 1,2-Alkanediols and Methods of Making Same”, filed January 30, 2019, which in turn claims the benefit under 35 U.S.C. §119(e) of U.S. Provisional Patent Application No. 62/623,985, filed January 30, 2018, entitled “Natural 1,2-Alkanediols, Compositions Having Natural 1,2-Alkanediols and Methods of Making Same,” the entire disclosures of each if which are incorporated herein by reference.

10

BACKGROUND OF THE INVENTION

15 **FIELD OF THE INVENTION**

[0003] The invention herein relates to the field of natural and renewable, *i.e.*, sustainable, antimicrobial components that enable alternative preservation systems for use in compositions applicable to various industries, including personal care, household and institutional or industrial cleaning products, medical or other related uses, and particularly in personal care compositions. More particularly to the preparation of natural and renewable 1,2-alkanediols, methods for making natural and renewable 1,2-alkanediols and compositions including such 1,2-alkanediols prepared from natural and renewable (“sustainable”) feedstocks.

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DESCRIPTION OF RELATED ART

[0004] In most countries, including the United States, cosmetic and/or personal care (“personal care products”) and other consumer products are manufactured and packaged in clean, but not typically sterile conditions, and many are sold in non-sterile forms. As a result, inconsequential (and usually harmless) amounts of bacteria, mold or yeast spores (collectively, “microbes”) may be caught in products. In addition, once a consumer has purchased, opened and begun using such a product, further contamination may occur. For example, in personal

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care products, small amounts of microbes from the air or a consumer's skin may further contaminate the product.

5 [0005] Over time, during transit, storage or use the initial microbe population that was negligible may increase to a level significant enough to result in discoloration or fouling of the product, including the appearance of visible mold, which can impact the usefulness or performance of the product. In the case of personal care products or other consumer products that are applied or ingested (such as vitamins, etc.), it can have a health impact as well, and in some circumstances can lead to adverse skin reactions upon application, including infection.

10 [0006] To address the issue of microbial growth, manufacturers in the personal care industry and in other industries commonly add chemical preservatives, which are typically petrochemically based, to such products and compositions. However, the type and amount of preservative that can be used is subject to restrictions on several fronts: (1) legislative (in some countries, use of particular preservatives are prohibited); (2) technical (the type/amount of preservative must demonstrate its efficacy by meeting certain empirically assessed criteria
15 (“challenge testing”); (3) consumer preference (consumers may perceive certain preservative chemicals as undesirable, such as petroleum-based or non-sustainable products, so products including them are not commercial viable); (4) logistical (*e.g.*, the selected preservative must be effective in the relevant chemical environment (where parameters such as pH, hydrophobicity/hydrophilicity, etc. may vary) and production-cost friendly); and (5)
20 sustainability, *i.e.*, it should be prepared using sustainable processes and feedstock sourcing as described further herein.

[0007] There is also a desire to develop alternatives to traditional preservation and to find more user-friendly chemical component combinations that are derived from sustainable and renewable resources (*i.e.*, “feedstocks”). These natural and renewable antimicrobial
25 components and alternatives to traditional preservatives (“alternative preservation”), should provide equal or better protection and performance to the consumer.

[0008] To resolve issues with traditional preservatives, the applicant herein developed a prior art preservative for personal care compositions that does not include parabens, formaldehyde donors or chlorinated compounds, that can be used in all types of personal care
30 formulations (*e.g.*, both “leave-on” and “rinse-off” products). Such paraben-free or other non-petroleum-based alternative preservation products are attractive to consumers. The paraben-free preservative demonstrates efficacy against a broad spectrum of microorganisms at various

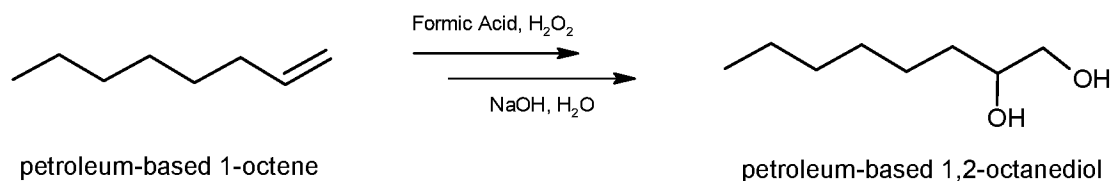
levels of pH, especially around neutral pH levels which are typically in or on the human body. This preservative is described in U.S. Patent Publication No. 2017/0360035 A1, in which one of the components in that preservative system is a 1,2-alkanediol.

[0009] Another attempt in the art to reduce the use of traditional preservatives is in the application of “hurdle technology.” Hurdle technology is the practice of applying several types of restricting or preservative materials or processes so that microbes have a “hurdle(s)” to overcome before they can proliferate to spoilage levels (e.g., adding something to change pH to reduce proliferation and a smaller amount of preservative or other compound that together retard or create “hurdles” to microbial growth). Use of alternative preservation can be one step or “hurdle” in hurdle technology.

[0010] There is a need in the art to further develop “alternative preservation” additives. These alternative preservation systems include consumer-friendly, paraben-free materials that move away from traditional preservation or antimicrobials and towards “natural” and “sustainable” (“renewable”) formulations and feedstocks, as those terms are defined hereinbelow.

[0011] One diol employed in preservation, caprylyl glycol, is believed by the applicant to be the fastest growing alternative preservation component in the world. Other 1,2-alkanediols such as 1,2-hexanediol, 1,2-decanediol, and 1,2-dodecanediol are also growing in popularity and function in alternative preservation formulations.

[0012] An example of one reaction sequence to prepare caprylyl glycol (1,2-octanediol) using an alkene as a key starting material is shown below. The starting material used is a petrochemically-derived 1-octene:



In the above reaction sequence, a petrochemically-derived 1-octene is reacted in the presence of formic acid and peroxide to form an intermediate chemical mixture which, e.g., undergoes a further ring-opening reaction in water with sodium hydroxide to complete formation of the 1,2-octanediol. This provides an excellent alternative preservation additive and is paraben-free, however, the starting material (*i.e.*, 1-octene) is derived from a fossil-based (petrochemical)

resource and importantly, represents a non-renewable feedstock, *i.e.*, a non-sustainable resource.

[0013] Thus, as noted above there is a need for more consumer- and eco-friendly, alternative preservation systems (used alone or as part of hurdle technologies), including those that are paraben-free. There is further a need in the art for a material that is an alternative preservation material or that may be used in an alternative preservation system that is a 100% natural and renewable (“sustainable”) feedstock to create an antimicrobial agent that can be used as or in alternative preservation systems. An example of a “natural” antimicrobial is one that is prepared from a bio-derived feedstock (*e.g.*, from current and sustainable agricultural activities, like non-GMO based-fermentation, algae-, plant- or vegetable-derived, *e.g.*, it comes from vegetable sources, or biomass, and it is not petrochemically-derived (such as being derived from sustainable tree and plant farms active in the 21st century). Such feedstocks are referred to herein as “natural” and “renewable” (*i.e.*, “sustainable”) and are known as a non-petroleum-derived feedstock. Further, such materials are formed by “new” carbon and not from petroleum or other fossil fuel sources (“old” carbon). Such products are referred to herein as “natural” products and are known in the art as non-petrochemically-derived or “bio” products. By “sustainable,” herein, the applicants are referring to materials that come from renewable sources, and not those that deplete a limited natural resource, such as a fossil fuel or other non-renewable resource such as petroleum. Thus a natural or bio product, which is not petrochemically derived, and/or is made from sources that are not petrochemically derived would be sustainable and renewable.

[0014] True natural products (bio-compounds) are formed using biomass (*e.g.*, material stored from carbon cycle processes in living plants and roots, etc. or released through animal respiration or through decomposition). When carbon decomposes and is broken down over millions of years under pressure, it creates fossil fuels (the source of petrochemically-derived carbon). Bio-compounds herein are intended to include materials derived from the carbon of plant sources/biomass, that exist recently and are also sustainable, and are not derived from fossil fuels.

[0015] These bio-based or “natural” feedstocks may be used in the production of alternative preservation formulations. The bio-based or “natural” products from such feedstocks may be tested to determine that they come from a true, natural and sustainable (as those terms are defined herein) feedstock source. Some products are known or advertised as being from natural

sources when, in fact, they may not be prepared from truly natural and/or sustainable feedstock. A natural organic product is typically defined as a compound produced naturally by a living organism. To distinguish a petroleum-based product from a truly natural and/or sustainable product, one must test for the authenticity using established and credible test methods. The most current method employs a detailed analysis of stable isotopes using mass spectroscopy and evaluating carbon-12/carbon-13 and/or hydrogen-1/hydrogen-2 ratios. Such testing is available through several analytical service testing organizations and is much faster, more cost effective, and yields more detailed information compared to radiocarbon testing methods.

[0016] Stable isotope analysis is based on the principle of kinetic isotope effect. The latter effect is well-known to those in the art of chemical kinetics. In the broadest terms, heavy isotopes of a particular element react slower than their lighter equivalent (*e.g.*, carbon-12 as opposed to carbon-13). So, as plants incorporate carbon dioxide into their biomass, the ratio of carbon-12 to carbon-13 will vary depending on the type of chemistry used in the plant to make biomass (*e.g.*, whether the plant undergoes a C₃ or C₄ photosynthesis pathway). This is commonly reported as the $\delta^{13}\text{C}/^{12}\text{C}$ ratio (*i.e.*, $\delta^{13}\text{C}$), and is referenced to a current carbon dioxide standard. In addition, similar isotope kinetic effects are observed when water is incorporated into new biomass, and this is measured as the $\delta^2\text{H}/^1\text{H}$ ratio (*i.e.*, $\delta^2\text{H}$). Using a combination of $\delta^{13}\text{C}$ and $\delta^2\text{H}$ ratios, one familiar with in the relevant art is able to readily distinguish and validate the nature of the feedstock that was used to prepare the product being analyzed (*i.e.*, whether it is petrochemically-derived or derived from recently living or living algae-, plant- or similar bio-sources).

[0017] In Fig. 2, it can be seen in general terms how isotope ratios can be used to determine the source of various detergents that have a strong relation to the feedstocks described herein, like 1-octanol. From the plot in Fig. 2, the $\delta^2\text{H}$ values have a more clearly defined difference between petroleum-based and renewable feedstocks and so in this case prove more valuable and defining than the $\delta^{13}\text{C}$ values. However, the combination using $\delta^2\text{H}$ and $\delta^{13}\text{C}$ values together is a preferred technique employed in the invention herein to prove a feedstock is, in fact, natural and renewable.

[0018] Radiocarbon is an unstable isotope of carbon, known as ^{14}C . ^{14}C is an unstable isotope that emits radiation energy in the form of *beta* particles at a very consistent rate and ultimately decays to the more stable ^{14}N (*i.e.*, a half-life for radiocarbon is 5730 years).

Because petroleum-based (*i.e.*, petrochemically-derived) feedstocks are derived from plants and

5 animals buried millions of years ago, the feedstocks' radiocarbon (*i.e.*, ^{14}C) has been lost to decay. The ASTM International standards provide testing standards to determine the authenticity of a "bio-based compound" using radiocarbon, which may be found in ASTM D6866-16. This standard distinguishes newer carbon from carbon derived from fossil-fuel, or petroleum- and petrochemically-derived sources, *i.e.*, "old carbon." The amount of ^{14}C in
10 recent or current biomass is known, so a percentage of carbon from a renewable source can be estimated from a total organic carbon analysis, which provides the data necessary to determine if a compound is truly derived from a "natural" and/or "sustainable" ("renewable") feedstock source or is derived conversely from a compound of "old" sequestration (*i.e.*, a petrochemically-derived or petroleum-based source). The use of petroleum-based or often
15 labeled fossil-based feedstocks is generally accepted as being non-sustainable, *i.e.*, old carbon is a non-sustainable and not a renewable feedstock, and furthermore, is not considered "natural" and "sustainable" in the art. As defined herein, it would not be considered to be a "natural" product or useful in a "natural" formulation. Hence, use of such feedstocks does not represent a path forward to development of "natural" and "renewable" alternative preservatives.

20 **[0019]** Dehydration of terminal alcohols using traditional methods to form alkene starting materials chemically yields a mixture of 1- alkenes, 2- alkenes, and 3- alkenes due to rearrangements and migrations of the 1-alkene product during the dehydration process. Using such a mixture of alkenes ultimately provides a mixture of diols upon dihydroxylation, providing a low yield of the desired terminal 1,2-diol material and unwanted contaminants.

25 **[0020]** In one known path of forming caprylyl glycol (1,2-octanediol) starting with 1-octanol, made from petrochemically-derived (*i.e.*, petroleum-derived or fossil fuel-derived) feedstocks, the following reaction is known to occur:

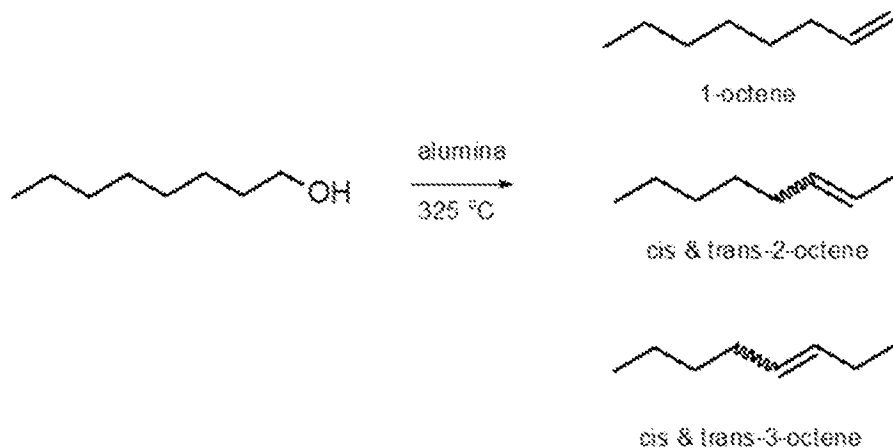
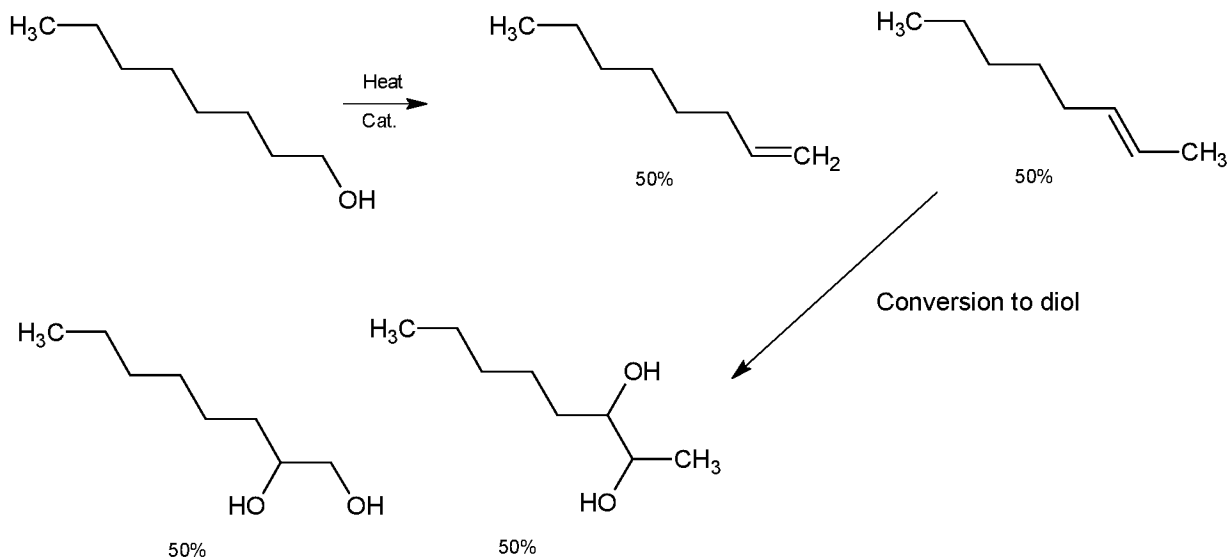


Table A

Catalyst	1-Octene (%)	2-Octene & 3-Octenes (%)	1-Octanol (%)	1-Octene Selectivity (%)
Alumina	87.7	5.3	4.7	94.3

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As can be seen from the above-reaction schemes, the use of heat and a traditional acid catalyst converts 1-octanol to an alkene, *i.e.*, octene. Exposure to the acid sites in the catalyst allows the more thermodynamically stable 2-octene to form along with 1-octene. The 2-octene regioisomers formed (including 3-octene as shown above and 4-octene (not shown)) are very

difficult to separate from the 1-octene and afford a lower net chemical yield of the desired 1-octene. It follows that an increased or higher regioselectivity is a critical factor in the catalytic dehydration of 1-octanol to 1-octene and a desired goal to achieve in the relevant art. When using renewable and natural feedstocks, reaction efficiency (*i.e.*, chemical yield) of the desired product (*i.e.*, 1-alkenes) is critical. There remains a need in the art for a highly regioselective dehydration of 1-octanol that also has high chemical conversion using efficient process equipment and operating in a rapid and energy efficient manner.

[0021] Thus, traditional pathways using an octene mixture of regioisomers as shown above for conversion to a desired terminal 1,2-octanediol is reduced and the yield is also reduced.

This makes the ability to form the desired alternative preservative materials chemically inefficient and not cost effective, creates more waste in process, and makes the overall process less sustainable. There is a strong need in the art for a highly regioselective, and high-chemical conversion rate process for creating a bio-1-octene from a bio-1-octanol.

[0022] International patent Publication No. WO 2004/078336 A2 uses a γ -alumina having no additional promoters but that was instead given a very large pore size and volume to enhance regioselectivity for dehydration of 1-octanol. In this work, the regioselectivity was high (97.7%), but, the chemical conversion was 65% and product selectivity for octenes was only 25%. Thus, the chemical yield of 1-octene from 1-octanol using this catalyst system was only about 15.9%.

[0023] In another example, U.S. Patent No. 7,576,250 B2, formation of 1-octene by cracking an ether derivative of 1-octanol is described. In this patent, the 1-octanol must first be converted to the methyl ether (*i.e.* methyl octyl ether) and then the ether is subjected to and passed over a γ -alumina catalyst. This involves extra chemical and added cost to make the ether and loss of the methanol in the process leading to a very ineffective and atom inefficient method. Most notably, the catalyst goes from having good conversion and regioselectivity in the first few hours, then, in just a mere 20 h of time-on-stream (“TOS”), all catalysts disclosed in the art show a constant and significant decrease in chemical conversion with a concomitant loss in regioselectivity. This type of short catalyst life time is not acceptable in commercial production efforts.

[0024] A lead-containing alumina catalyst is described in Chinese Patent No. 105312044 B, wherein plumbite pseudoboehmite showed high apparent selectivity and conversion. The catalyst had a carbon deposition rate of ~0.04%/h, which is highly undesirable and would be

unsatisfactory for something like 1000 h of continuous operation. Even more limiting is these catalysts incorporate a toxic heavy metal, namely lead. The use of these catalysts would require costly environmental controls and worker safety precautions if used on the industrial scale for commercial production

5 **[0025]** One path to making a “natural” alkanediol is by fermentation of biomass to form a straight chain, linear alkanediol. For example, U.S. Patent Application Publication No. 2005/0069997 A1 teaches formation of 1,3 propanediol from fermentation broth. However, 1,3-propanediol is not a 1,2-alkanediol. Fermentation processes that form long chain diols are chemically inefficient (*i.e.*, poor life-cycle-analysis numbers) and additionally require use of
10 GMO-bacteria or -yeast, especially if one attempts to make a long carbon 1,2-alkandiol.

[0026] Another example of a natural bio-alcohol that is described in the art is bio-1-butanol, a known substance that has been used in commercial production since the discovery by Pasteur in 1862 of the acetone-butanol-ethanol fermentation process carried out by *clostridium* bacteria (a non-GMO bacteria), although it is used in very limited quantities currently. These bacteria

15 ferment both C₅ and C₆ sugars to form a mixture of acetone, 1-butanol and ethanol (*i.e.*, ABE).

Since the discovery of ABE, advances in fermentation processes can provide optimized production of bio-1-butanol over acetone and ethanol production. While the production is improved, it remains difficult and energy intensive to purify the bio-1-butanol from the fermentation broth and other impurities involved in the fermentation process such as ethanol
20 and acetone. In addition, applicant is unaware of a non-GMO bacteria or yeast process that can form longer chain alcohols (*i.e.*, chains of six or more such as 1-hexanol or 1-octanol).

[0027] Bio-1-butanol is known as a source to make biofuels and provides a pathway for converting straight-chain, linear, primary four-carbon alcohols to bio-1-alkenes at very high yield to improve biofuel production and can also be used, for example in production of eco-
25 friendly tires. In this method, bio-1-alcohols are dehydrated to bio-1-alkenes with high selectivity and chemical yield. The resulting bio-1-alkenes are useful in preparing high flashpoint diesel and jet biofuels useful for civilian and military applications. The bio-1-butanol is dehydrated using a solid phase dehydration catalyst that includes an inorganic

support, such as γ -alumina or zinc aluminate (ZnAl_2O_4), and that has been treated/modified
30 with a basic aqueous solution. The support may be further treated with an organosilane diluted in at least one hydrocarbon solvent. The process can convert bio-1-butanol from a fermentation

process that contains 0.1 to about 90 wt% water and produces a corresponding 1-alkene at a 92-99% regioselectivity, with only a single pass over the solid-phase catalyst, producing a reaction conversion of greater than 95% and a chemical yield of greater than 90% of the bio-1-butene. However, even with such a result for bio-1-butene, it is noted that the conversion of 1-octanol to 1-octene is not simply a homolog of a conversion of 1-butanol to bio-1-butene. In fact, comparative examples described herein below, illustrated that silanization of the catalyst leads to a *loss* of regioselectivity for the dehydration chemistry of 1-octanol.

[0028] Based on the foregoing, while progress has been made, there is a need in the art for continued improvement to consumer products such as personal care products, household products, industrial products and pharmaceutical products to provide additives, especially for antimicrobial use or for boosting the effects of known preservatives or alternative preservation systems, so as to keep products safe from contamination and fresh in storage and in use, while avoiding traditional preservatives and finding and relying on components for consumer product compositions from natural bio-sources. There is more particularly a need for a natural, and preferably renewable/sustainable feedstock source to create a natural, bio-caprylyl glycol (*i.e.*, a natural or bio-1,2-octanediol) and the associated bio-1-alkene intermediate.

BRIEF SUMMARY OF THE INVENTION

[0029] The invention provides efficient pathways to achieve a 100% “natural” or “bio-compound” that is an authentic “natural” material, and preferably includes bio-1,2-alkanediols of carbon lengths from about 5 to about 20, and preferably from 5 to about 14, that can be used alone, in combinations of different types of bio-1,2-alkanediols, or in blends with other natural or traditional antimicrobials and other cosmetic additives.

[0030] The invention includes a process for the synthesis of bio-1,2-alkanediols, comprising: providing a bio-alkene having a carbon chain of about 5 to about 20 carbon atoms and a bio-1-alkene regioselectivity of at least about 80%; and converting the bio-alkene to a bio-1,2-alkanediol having a carbon chain length of about 5 to about 20 carbon atoms.

[0031] In one embodiment of the process, the bio-alkene and the bio-1,2-alkanediol each have a carbon chain of about 6 to about 14 carbon atoms. The bio-alkene and the bio-1,2-alkanediol each may have a carbon chain length of about 6 to about 10 carbon atoms. The bio-alkene and the bio-1,2-alkanediol each may have a carbon chain length of about 6 to about 8

carbon atoms. For example, the bio-alkene may be bio-octene and the bio-1,2-alkane diol may be bio-1,2-octanediol.

5 **[0032]** In a further embodiment of the process, the bio-alkene preferably results from a process wherein a bio-1-alcohol is dehydrated by heating the bio-1-alcohol in a reactor with a catalyst. The reactor may be a fixed bed reactor. The fixed bed reactor may also be, *e.g.*, a fluidized fixed bed reactor. In such an embodiment, the catalyst may be selected from ZnAl_2O_4 and a γ -alumina catalyst.

10 **[0033]** The bio-alkene in a preferred embodiment has a bio-1-alkene regioselectivity of about 92% to about 99%, and preferably about 95% to about 99%. The process also preferably yields at least about 92% to about 99% of the bio-1,2-alkanediol.

15 **[0034]** As noted above in one embodiment a catalyst treatment may be used. The catalyst may be a γ -alumina catalyst treated with a base to form a modified γ -alumina catalyst. The base may comprise a Group I or a Group II metal. The γ -alumina catalyst may be treated, *e.g.*, with a calcium promoter to provide a modified γ -alumina catalyst. The modified γ -alumina catalyst may then be calcined to provide a calcined γ -alumina catalyst. In one embodiment, wherein a calcium promoter is used, the calcium promoter may be used in an amount of about 0.01 weight percent to about 4 weight percent based on the weight of CaO determined after calcination, and preferably about 1 weight percent to about 2 weight percent based on the weight of CaO determined after calcination.

20 **[0035]** A preferred temperature during calcination is about 400°C to about 500°C, more preferably about 420°C to about 480°C, and most preferably about 440°C to about 460°C. Calcination may be carried out in an oven. The calcination may be performed in air or under an atmosphere of nitrogen or other inert gas(es).

25 **[0036]** The bio-alkene preferably undergoes a distillation step to refine the bio-alkene prior to converting the bio-alkene to the bio-1,2-alkanediol. The bio-1,2-alkanediol formed from the bio-alkene may also undergo a final distillation step to refine the bio-1,2-alkanediol.

30 **[0037]** In another embodiment of the process, the bio-alkene may result from a process wherein the bio-1-alcohol in water is dehydrated by heating the bio-1-alcohol with a catalyst using no purge gas or under a purge gas. The purge gas may preferably be nitrogen but other inert gases may be used within the scope of the invention.

[0038] The bio-alkene in the process may also be converted to the bio-1,2-alkanediol by reacting the bio-alkene in the presence of at least one of peracid, *e.g.*, formic acid or acetic acid,

and hydrogen peroxide to form a mixture of bio-1,2-epoxyalkane having an epoxy ring and bio-1,2-alkanediol, and contacting this mixture with water and sodium hydroxide to complete formation to the bio-1,2-alkanediol.

5 **[0039]** The overall process preferably process yields at least about 60% to about 99% of the bio-1,2-alkanediol, and more preferably yields at least about 72% to about 99% of the bio-1,2-alkanediol.

10 **[0040]** The invention further includes a process for making bio-1,2-alkanediols, comprising: providing a bio-1-alcohol and a catalyst treated with a base; dehydrating the bio-1-alcohol in the presence of the catalyst to form a bioalkene having a carbon chain of about 5 to about 20 carbon atoms and a bio-1-alkene regioselectivity of at least about 80%; and converting the bio-alkene to a bio-1,2-alkanediol having a carbon chain length of about 5 to about 20 carbon atoms. Preferably, the catalyst is treated with a promoter and then calcined.

15 **[0041]** The catalyst in this process may also be a γ -alumina catalyst and the base may comprise calcium. The γ -alumina catalyst is preferably treated with a calcium promotor and after treatment is calcined at a temperature of about 400°C to about 500°C. The process preferably yields about 92% to about 99% of the bio-1,2-alkanediol.

20 **[0042]** The invention further includes a method for treating a catalyst for use in dehydration of alcohols, comprising providing a γ -alumina catalyst; treating the γ -alumina catalyst with a base, preferably a promoter as described herein, comprising a Group I or a Group II metal; and heating the γ -alumina catalyst to a temperature of about 400°C to about 500°C, which is preferably done in a very controlled and deliberate manner. The base may comprise calcium, and preferably the base may be a calcium promoter and the heating occur during calcination. The calcium promoter may be used in an amount of about 0.01 weight percent to about 4 weight percent based on the weight of CaO determined after calcination, and more preferably in
25 an amount of about 1 weight percent to about 2 weight percent based on the weight of CaO determined after calcination, preferably after careful calcination. The temperature during calcination in a preferred embodiment may be about 420°C to about 480°C, and more preferably may be about 440°C to about 460°C. Beneficial results are achieved based on the applicant's process including the preferred ranges noted. Applicant's determined that high
30 calcination temperatures decrease catalyst regioselectivity and thus chemical yield of bio-1-alkene.

[0043] The invention further includes a composition, comprising at least one first bio-1,2-alkanediol having a carbon chain length of about 5 to about 20 carbon atoms which is synthesized by conversion of a first bio-alkene having a carbon chain of about 5 to about 20 carbon atoms and a bio-1-alkene regioselectivity of at least about 80%.

5 **[0044]** The composition may be a personal care composition, such as a hair care composition, an oral care composition, a skin care composition or a cosmetic composition.

[0045] The composition may also be a composition for a household product, such as a fabric care product or a cleaning product.

10 **[0046]** The composition may also be an industrial composition, or a pharmaceutical composition, a vitamin composition, or a health care composition.

[0047] In one embodiment of the composition herein, the composition may comprise a second bio-1,2-alkanediol, different than the first bio-1,2-alkanediol, the second bio-1,2-alkanediol having a carbon chain length of about 5 to about 20 carbon atoms which is synthesized by conversion of a second bio-alkene, preferably regioselectively, such that the
15 resulting bio-alkene of about 5 to about 20 carbon atoms has a terminal bio-alkene content of at least about 80% and a bio-1-alkene regioselectivity of at least about 80%. The composition may comprise at least one other bio-compound different from the first and the second bio-1,2-alkanediols. In another embodiment, the composition may comprise an antimicrobial compound different from the first and the second bio-1,2-alkanediol and different from the
20 other bio-compound. The composition may also further comprise at least one other bio-compound different from the at least one bio-1,2-alkanediol, and in another embodiment, such a composition may also further comprise at least one antimicrobial compound different from the at least one bio-1,2-alkanediol and different from the other bio-compound. The first bio-1-alkene in such composition preferably has a regioselectivity of about 92% to about 99% and
25 more preferably about 95% to about 99%. The first bio-alkene may be a bio-octene and the at least one first bio-1,2-alkane diol may be a bio-1,2-octanediol.

[0048] Also included in the invention is a method for providing an antimicrobial effect to a composition, including incorporating an antimicrobial system to the composition, wherein the antimicrobial system comprises at least one first bio-1,2-alkanediol having a carbon chain
30 length of about 5 to about 20 carbon atoms which is synthesized by conversion of at least one first bio-alkene having a carbon chain of about 5 to about 20 carbon atoms and a bio-1-alkene regioselectivity of at least about 80%. The antimicrobial system may further comprise a

second bio-1,2-alkanediol different than the first bio-1,2-alkanediol, wherein the first bio-1,2-alkanediol has a carbon chain length of about 5 to about 20 carbon atoms and is formed by regioselectively converting a second bio-alkene, different than the first bio-alkene, having a carbon chain length of about 5 to about 20 carbon atoms and a bio-1-alkene regioselectivity of at least about 80%. The composition may further comprise at least one other bio-compound different from the first and the second bio-1,2-alkanediols, and in another embodiment may comprise at least one other preservative compound different from the first and the second bio-1,2-alkanediol and different from the other bio-compound. Such a composition may also further comprise at least one other bio-compound different from the at least one first bio-1,2-alkanediol. The antimicrobial may also further comprise at least one other antimicrobial compound and/or preservative compound different from the at least one first bio-1,2-alkanediol and different from the other bio-compound. The antimicrobial system may be made so as to demonstrate antimicrobial efficacy. The first bio-1-alkene preferably has a regioselectivity of about 92% to about 99%, and preferably about 95% to about 99%. The first bio-alkene may be bio-octene and the at least one first 1,2-alkane diol may be a bio-1,2-octanediol.

[0049] The invention further includes in one embodiment a method for boosting the antimicrobial efficiency of an antimicrobial and/or a preservative in a composition, comprising incorporating an antimicrobial system into the composition, wherein the second antimicrobial system comprises at least one first bio-1,2-alkanediol having a carbon chain length of about 5 to about 20 carbon atoms which is synthesized by regioselective conversion of a first bio-alkene having a carbon chain of about 5 to about 20 carbon atoms and a bio-1-alkene regioselectivity of at least about 80%. In the method, the antimicrobial system may further comprise a second bio-1,2-alkanediol different than the first bio-1,2-alkanediol, wherein the second bio-1,2-alkanediol has a carbon chain length of about 5 to about 20 carbon atoms and is formed by conversion of a second bio-alkene, different than the first bio-alkene, having a carbon chain length of about 5 to about 20 carbon atoms and a bio-1-alkene regioselectivity of at least about 80%. In the composition, it may further comprise at least one other bio-compound different from the antimicrobial and/or preservative and different from the first and the second bio-1,2-alkanediols. The composition may also further comprise at least one other bio-compound different from the at least one first bio-1,2-alkanediol. The first bio-1-alkene preferably has a regioselectivity of about 92% to about 99%, and more preferably about 95% to about 99%. In one embodiment, the antimicrobial system demonstrates antimicrobial efficacy. The first bio-

alkene may be a bio-octene and the at least one first bio-1,2-alkane diol may be a bio-1,2-octanediol.

[0050] In yet a further embodiment, the invention includes an antimicrobial product, comprising at least one first bio-1,2-alkanediol having a carbon chain length of about 5 to about 20 carbon atoms which is synthesized by conversion of a first bio-alkene having a carbon chain of about 5 to about 20 carbon atoms and a bio-1-alkene regioselectivity of at least about 80%. The product may further comprise a second bio-1,2-alkanediol, different than the at least one first bio-1,2-alkanediol, the second bio-1,2-alkanediol having a carbon chain length of about 5 to about 20 carbon atoms and formed by conversion of a second bio-alkene, different than the first bio-alkene, having a carbon chain length of about 5 to about 20 carbon atoms and a bio-1-alkene regioselectivity of at least about 80%.

[0051] The antimicrobial product may further comprise at least one other bio-compound different from the at least one first and the second bio-1,2-alkanediols. In one embodiment, the product may further comprise a second antimicrobial and/or a preservative different from the antimicrobial product. The product may also further comprise at least one other bio-compound different from the at least one first bio-1,2-alkanediol, and may also further comprise a second antimicrobial and/or a preservative different from the antimicrobial product. The first bio-1-alkene preferably has a regioselectivity of about 92% to about 99%.

[0052] The antimicrobial product preferably also demonstrates antimicrobial efficacy. The first bio-alkene may be bio-octene and the at least one first 1,2-alkane diol may be a bio-1,2-octanediol.

[0053] The invention also includes a product for boosting the efficacy of an antimicrobial and/or a preservative in a composition, the product comprising at least one first bio-1,2-alkanediol having a carbon chain length of about 5 to about 20 carbon atoms which is synthesized by conversion of a first bio-alkene having a carbon chain of about 5 to about 20 carbon atoms and a bio-1-alkene regioselectivity of at least about 80%. Such product may further comprise a second bio-1,2-alkanediol, different than the at least one first bio-1,2-alkanediol, the second bio-1,2-alkanediol having a carbon chain length of about 5 to about 20 carbon atoms and formed by conversion of a second bio-alkene, different than the first bio-alkene, having a carbon chain length of about 5 to about 20 carbon atoms and a bio-1-alkene regioselectivity of at least about 80%. The composition of the product may also further comprise at least one other bio-compound different from the at least one first and the second

bio-1,2-alkanediols, and also may further comprise at least one other bio-compound different from the at least one first bio-1,2-alkanediol. The first bio-1-alkene preferably has a regioselectivity of about 92% to about 99%. The first bio-alkene may be bio-octene and the at least one first bio-1,2-alkane diol may be bio-1,2-octanediol. The product preferably
5 demonstrates antimicrobial efficacy.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

[0054] The foregoing summary, as well as the following detailed description of preferred embodiments of the invention, will be better understood when read in conjunction with the appended drawings. For the purpose of illustrating the invention, there is shown in the
10 drawings embodiments which are presently preferred. It should be understood, however, that the invention is not limited to the precise arrangements and instrumentalities shown. In the drawings:

[0055] Fig. 1 is a process flow chart of steps in a preferred embodiment of a process described herein;

15 **[0056]** Fig. 2 is graphical representation of $\delta^2\text{H}$ and $\delta^{13}\text{C}$ values for petroleum-based alcohols, alkenes and acids and the corresponding natural and renewable analogs;

[0057] Fig. 3 is the Gas Chromatograph (GC) chromatogram of the reactor output from the dehydration of bio-1-octanol using the catalyst prepared in Example 4 at 0.2ml of bio-1-octanol feed and heated to 315°C;

20 **[0058]** Fig. 4 is the GC chromatogram of the bio-1-octene obtained from the reactor after distillation;

[0059] Fig. 5 is the GC chromatogram of the bio-1,2-octanediol obtained from dehydration of bio-1-octene, conversion to the 1,2-octanediol and then fractional distillation of the 1,2-octanediol;

25 **[0060]** Fig. 6 is the GC chromatogram of the petro-1,2-octanediol currently approved for use in cosmetic formulation; and

[0061] Fig. 7 is a photo comparing catalyst with 1400 h TOS (left) and new catalyst (on right).

DETAILED DESCRIPTION OF THE INVENTION

[0062] The invention includes a process for the synthesis of bio-1,2-alkanediols. As used herein, "bio" when used with "alkanediol," or any specific alkanediol compounds noted within this class of compounds is intended to mean as described above that the compound, and preferably all of the carbons in the compound within this class of compounds, as described further below are "natural" compounds that are also authentic natural compounds derived from plant sources (algae-, plant-, animal- or biomass-derived) and are non-petrochemically derived (*i.e.*, not derived from a non-renewable resource such as fossil fuel, petroleum or other "old" carbon source). In this sense, as they are derived from renewable materials, they are also sustainable compounds. It also means that such materials are formed from bio-alkenes. When used in the terms, "bio-alcohol," or "bio-alkene," and similar compounds herein, "bio" is intended also to have the same connotation as noted above for describing "bio-1,2-alkanediol." Such materials should preferably satisfy the requirements of having and being derived from an authentic or "new" carbon material (non-petrochemically derived) feedstock as confirmable through testing such a compound using mass spectroscopy as described above and/or gas chromatography, the current ASTM D6866-16 standard or prior methods such as specific stable isotope analysis (CSIA). The invention further includes the bio-1-alkenes and bio-1,2-alkanediols resulting from the synthesis process, as well as various products incorporating them. The invention further includes a method for treating a catalyst, which may be used in embodiments herein for dehydrating a bio-1-alcohol to form a bio-alkenes used in the processes herein for forming bio-1,2-alkanediols.

[0063] The invention provides efficient pathways to 100% "natural" or "bio" compounds that are from new carbon or authentic carbon materials that are not petrochemically derived and are preferably used in compositions and products that can be made for a wide variety of end uses and compositions, including as components of antimicrobial compositions and as cosmetic additives, among other uses described herein.

[0064] Also disclosed herein are methods of using bio-1,2-alkanediols for use as antimicrobials in a composition such as in or with an alternative preservation system and/or as hurdle technology. Also disclosed are various compositions comprising bio-1,2-alkanediols, including when used as an antimicrobial. Also described are methods of boosting the antimicrobial efficacy of a composition already including a preservative or alternative

preservation system, and the resulting boosted antimicrobial efficacy composition. Each of such methods includes incorporating into the composition a bio-1,2-alkanediol, combination(s) of at least two different bio-1,2-alkanediols, or combination(s) of at least one bio-1,2-alkanediol with at least one other bio-compound different from the at least one bio-1,2-alkanediol, wherein the bio-1,2-alkanediol(s) either act as a antimicrobial or boost the efficacy of another antimicrobial, preservative or other alternative preservation system already present in a composition. The bio-1,2-alkanediols may themselves be an antimicrobial product and/or a antimicrobial efficacy boosting product whether used alone, in combinations of one or more different bio-1,2-alkanediols, or in combination(s) of one or more different bio-1,2-alkanediols with at least one other bio-compound different from the bio-1,2-alkanediols and/or an optional, different antimicrobial, preservative or alternative preservation system. The bio-1,2-alkanediols when used in compositions herein exhibit antimicrobial efficacy.

[0065] In one embodiment herein, a process is described herein for synthesis of bio-1,2-alkanediols. As noted above, materials referred to herein as “natural” are intended to include materials that are non-petrochemically derived and are sustainable, whether synthesized from non-petrochemically derived, natural materials or formed from a natural, and preferably an authentic natural or bio-based source.

[0066] The method includes providing a bio-alkene having a carbon chain of about 5 to about 20 carbon atoms, preferably about 6 to about 14 carbon atoms, and more preferably about 6 to about 10 carbon atoms, with a bio-1-octene being preferred. The bio-alkene is preferably a bio-1-alkene with a traditional α -olefinic structure. It also preferably has a regioselectivity when prepared of at least about 80%, more preferably at least about 92% and most preferably at least about 95% up to as much as 99%.

[0067] Such bio-alkenes may be bio-1-pentene, bio-1-iso-pentene, bio-1-hexene, bio-1-heptene, bio-1-octene, bio-1-nonene, bio-1-decene, bio-1-dodecene, and related bio-1-alkenes up to chain length of 20 carbons. Larger or smaller bio-alkenes may also be made, however, the preferred bio-alkenes for use herein are those with sufficient chain length to serve as effective antimicrobials when converted to bio-1,2-alkanediols without losing the desired properties. Such bio-alkenes may be straight or branched chain molecules, although straight chain molecules are preferred and may include one or more functional or substituted groups for desired end effects in the end use application, for example, sulfonate groups, hydroxyl groups, ether groups, amide groups, carbonyl groups, carboxylic acid groups, amine groups, fluorinated

groups, aryl or arene groups, and similar functional groups without intending to be limiting. Preferably any such functional or substituted groups do not interfere with conversion to an alkanediol or with the antimicrobial end application desired for the particular alkanediol.

[0068] Such bio-alkenes, such as bio-1-hexene and bio-1-octene, as are generated according to the invention, may be used to make bio-1,2-alkanediols as described herein, and may also be used to make other bio-based compounds and polymers, including, *e.g.*, for synthesis of bio-based olefin copolymers. Bio-1-alkenes herein may be used, for example, in free radical or catalytic polymerization processes as are known in the art, to yield a variety of bio-polyalphaolefins homopolymers and copolymers, which are useful as lubricants and cosmetic ingredients. A further example, includes bio-linear low-density polyethylene (bio-LLDPE) can be prepared via copolymerization of bio-ethylene (derived via dehydration of sugarcane derived bio-ethanol to bio-ethylene) with bio-1-alkene copolymers yielding 100% renewable bio-LLDPE, a thermoplastic resin useful in film applications such as food and non-food packaging and shrink/stretch films.

[0069] The process of the invention includes an embodiment wherein the process makes bio-1,2-alkanediols, including providing a bio-1-alcohol and a catalyst treated with a base, preferably with a promoter and then calcined; dehydrating the bio-1-alcohol in the presence of the catalyst to form a bioalkene having a carbon chain length of about 5 to about 20 carbon atoms and a bio-1-alkene regioselectivity of at least about 80%; and converting the bio-alkene to a bio-1,2-alkanediol having a carbon chain length of about 5 to about 20 carbon atoms.

[0070] An overall flow diagram of a preferred process of making bio-1,2-alkanediols, that incorporates a preferred method of treating a catalyst as described further below is provided as embodiment 100 as shown in Fig. 1.

[0071] In the process generally referred to herein as process 100, in Fig. 1, prior to

introducing the bio-1-alcohol, a catalyst is prepared. A suitable γ -alumina catalyst, *e.g.*, Al_2O_3 , 110 is introduced into a reactor 101 into which a calcium promotor or other base treatment material 102 as described further below is introduced. After a suitable treatment described in detail below, a modified catalyst 103 leaves reactor 101 and enters a heated chamber 104 such as an oven for heat treatment. If a catalyst promoter is used, for example, a calcination step occurs at preferred and controlled temperature ranges to increase a level of regioselectivity in a resulting bio-alkene in the next step. After, *e.g.*, calcination in chamber 104, the calcined or otherwise heat-treated catalyst 105 is introduced along with a bio-1-alcohol 106 such as bio-1-

hexanol or bio-1-octanol into a reactor 107 to promote intimate contact between the alcohol and the catalyst. Suitable reactors included fixed bed reactors, fluidized bed reactors, tubular reactors, and other suitable reactors. After sufficient time for dehydration of the bio-1-alcohol to a bio-alkene 109, which highly regioselects to a bio-1-alkene, a further, optional distillation or other purification or refining step in a column(s) or other equipment 110, may occur. The refined or otherwise purified and highly regioselective bio-alkene, which should be of a high quantity of bio-1-alkene, is then introduced to a reactor 112 in order to convert the bio-1-alkene into a bio-1,2-alkane diol 113. Such bio-1,2-alkane diol 113 may be further and optionally refined such as by distillation in a column(s) or through other steps in equipment 114. After purification or distillation, a final high yield of up to 99% is removed as the final bio-1,2-alkane diol 115.

[0072] The bio-1-alkene may be made using a catalytic process, and preferably using a catalyst that has been treated according to the method described herein. In one embodiment, the bio-alkene, which is preferably made herein to be of a high regioselectivity bio-1-alkene is formed using a bio-1-alcohol that is dehydrated by heating the bio-1-alcohol in the presence of a catalyst. This may be done, for example, by passing the bio-1-alcohol through a fixed bed reactor, or a fluidized bed reactor. The fixed bed may be packed with a catalyst, preferable a treated catalyst having been treated using techniques as described below.

[0073] For example, a bio-1-alcohol derived from a plant source, including biomass that can produce a related acid (*e.g.*, 1-octanol may be derived from coconut, palm or other plant source or biomass that can produce octanoic acid, which is subsequently reduced via catalytic dehydrogenation to 1-octanol). The bio-1-alcohol is then dehydrated regioselectively by feeding the material at an elevated temperature into, *e.g.*, a fixed bed reactor or other suitable reactor providing intimate contact between the bio-1-alcohol and the catalyst. The fixed bed may be packed with or otherwise arranged to provide sufficient contact with a catalyst. Other suitable reactors may be provided for this purpose provided they can achieve suitable contact for assisting in dehydration. Examples include tubular reactors, fixed and fluidized bed reactors, and the like.

[0074] The reactor can be designed as a simple heated reaction tube packed with catalyst and a flow of the gaseous bio-1-alcohol over the catalyst, preferably in a single pass affording greater than about 95% conversion, with greater than about 98% a preferred embodiment, and in all cases with no recycle stream used whatsoever in the overall process flow. In one

embodiment, the reaction tube is heated isothermally, the tube having from 1 to 10 reaction zone temperatures along the length of the tube, each heated in the range of about 240°C to about 360°C in order to optimize catalyst performance. In a preferred embodiment, the reaction tube has 1 to 4 reaction zone temperatures in the range of about 260°C to about 340°C.

5 [0075] In one embodiment the process is carried out in a fluidized bed reactor operated in the temperature range of about 240°C to about 360°C. Other continuous flow reactor designs can be used in accordance with procedures and practices used by those familiar with the art of chemical engineering.

[0076] The catalyst used may be prepared by treating γ -alumina (*e.g.*, Porocel®
10 CatGuard®) with at least one base, preferably a promoter, such as with sodium hydroxide, potassium hydroxide, calcium acetate and the like to create a second catalyst. This second catalyst is then calcined to create a third catalyst. The calcination temperature has been found to be most unexpected and critical to creating the most effective catalyst. As seen below when
15 calcined at about 500°C, a significant drop occurs in regioselectivity compared to catalysts calcined at lower temperatures. In one embodiment, as demonstrated in Table 1 below, preferred calcination temperature is about 400°C to about 480°C, and a more preferred calcination temperature is about 440°C to 460°C.

Table 1

20

Catalyst	Calcination Temperature (°C)	1-Octene (%)	2-Octene & 3-Octenes (%)	1-Octanol (%)	1-Octene Selectivity (%)
EXAMPLE 1	440	94.0	3.2	1.6	97.4
EXAMPLE 2	500	88.9	6.6	3.5	93.1

[0077] Varying catalysts may be used for assisting the bio-1-alcohol in the dehydration step. However, it is preferred that a suitable catalyst that can achieve high levels as
25 regioselectivity as described herein is used. Suitable catalysts include γ -alumina-based catalysts and ZnAl_2O_4 . Preferably, the catalyst is treated with a base, such as with sodium hydroxide, potassium hydroxide, calcium acetate and the like. In one preferred example, the catalyst is a γ -alumina catalyst treated with a base including a Group I or Group II metal. In

one more preferred embodiment, calcium may be included in the base, and a calcium promoter used. After being treated with the calcium promoter to form a modified γ -alumina catalyst, in a further preferred embodiment, the modified γ -alumina catalyst is then calcined using varying calcination techniques but at temperatures which are preferably much lower than used in standard calcination methods to provide a calcined γ -alumina catalyst. The initial treatment provides a modified γ -alumina catalyst that is then calcined to be ready for use for varying processes including in the dehydration step of the processes herein for making bio-1-alkenes and their subsequent conversion to bio-1,2-alkandriols.

[0078] When employing a calcium promoter, it may be used in the treatment noted above in amounts of about 0.01 weight percent to about 4 weight percent, based on the amount of CaO determined after calcination. In preferred embodiments, about 1 weight percent to about 2 weight percent of the calcium promoter is used based on the amount of CaO determined after calcination.

[0079] In another embodiment, if desired, the alumina-based treated catalyst may be further organosilanized with an organosilane by treatment with, for example, diethoxydiphenylsilane to form an organosilanized base-treated γ -alumina catalyst. The organosilanized base may be, for example, diethoxydiphenylsilane, dichlorodiphenylsilane and similar materials.

[0080] In one embodiment a catalyst support may comprise ZnAl_2O_4 and may also be modified by a base, e.g., by reaction with a promoter and similar catalysts and modified catalyst materials known or to be developed that are capable of carrying out the process as noted herein in a manner similar to the catalysts noted herein that can create a high level of regioselectivity could also be used.

[0081] The catalysts as noted above in addition to being suitable if treated with a base, may alternatively or also be treated with an organosilane or organosilane-modified material to create a promoter-modified catalyst. This promoted catalyst may be further organosilanized with an organosilane by treatment with diethoxydiphenylsilane to create a third, organosilanized and promoter-modified γ -alumina catalyst. The organosilane used to modify the catalyst may be, for example, diethoxydiphenylsilane, dichlorodiphenylsilane and similar materials. As seen in EXAMPLE 10 herein, silanization of the catalyst leads to a decrease in bio-1-octene selectivity, once again showing a difference from previous art and the direct and proven differences in the dehydration catalyst makeup necessary for a highly regioselective dehydration of 1-butanol or 1-octanol.

[0082] In other treatment techniques herein, the γ -alumina catalyst may be modified by the technique of incipient wetting impregnation. A solution of the base is used to modify a solid support in a manner so as to avoid excess moisture that can result in support damage and chemical change. In one embodiment, the incipient wetting impregnation solution (IWS) is about 40% to about 100% the weight of the solid support, which may be, for example an untreated γ -alumina catalyst. In one embodiment, the untreated γ -alumina catalyst is selected from the commercially available, Porocel® CatGuard®. Preferably, the IWS is about 50% to about 60% of the catalyst support weight.

[0083] The γ -alumina may also be provided in a powder form having a surface area of about 50 to about 400 m²/g. The γ -alumina in one embodiment is shaped by a suitable extrusion process, as are known to those skilled in this art of solid phase catalysts. In one example, the γ -alumina is in the form of 1/16" to 1/8" cylindrical rods with a length to diameter ratio of about 20:1, preferably about a ratio of about 5:1. The extrudate can be in the shape of spheres, star-shaped, hollow cylinders or any three-dimensional shape that can ultimately deliver a γ -alumina with sufficient surface area pore volume, mechanical strength, and physical size to be used in a continuous flow reactor system.

[0084] Once prepared, *e.g.*, a base-treated, preferably a promoter treated, γ -alumina catalyst, as noted above is preferably calcined with care taken in regulating the temperature. This is done at an elevated temperature, preferably in a suitable chamber such as an oven, and the temperature range, while elevated to heat the materials, is not as high as calcination treatments typically used in prior catalyst processes. Instead, the temperature for calcination is kept at about 400°C to about 500°C, and preferably about 420°C to about 480°C, and most preferably about 440°C to about 460°C. Typically, prior standard calcination treatments occur at temperatures 500°C or higher with no limits established or specified for effectiveness. However, applicants discovered that by controlling this temperature and in the specific catalyst treatment process noted herein, the regioselectivity can be unexpectedly controlled to disproportionately favor formation of the bio-1-alkene when the bio-1-alcohol is dehydrated using the resulting calcined catalyst derived from a combination of catalyst treatment and a carefully controlled calcination process.

[0085] In the dehydration step herein, the bio-1-alcohol may be fed to a reactor undiluted or in water through the reactor. Optional an inert gas (*e.g.*, nitrogen) may be used as a purge gas to retain consistency and avoid contaminants in the process. The bio-1-alcohol is preferably

fed, such as by a pump (such as an HPLC pump) or pressurized gas source at a temperature of about 200°C to about 400°C, although temperatures may be adjusted for different bio-1-alcohols depending on the reaction time and flow rate, the catalyst selected and the desired outcome. As the product is removed from the reactor, it is preferably monitored to determine content, identification of product and the ratio of bio-1-alkene conversion as well as the regioselectivity. In a preferred embodiment, the bio-1-alkene has a regioselectivity of at least about 80%, and more preferably about 92% to about 99% and even more preferably about 95% to about 99%.

[0086] In one embodiment, the dehydration process as described in Fig. 1 using the invention catalyst, i.e., the catalyst resulting from the preferred treatment and calcination process noted above, can be stopped and the catalyst maintained under inert gas flow for extended periods of time. This shutdown period can be hours, days or weeks, with heating or no heating applied during this period. The invention catalyst can be re-heated and dehydration process resumed without any detrimental effect on catalyst activity or regioselectivity. Thus, the invention catalysts are not only robust in continuous operation, but they can withstand periods of rest (inactivity) without negative effect on catalyst performance when brought back on line.

[0087] The bio-1-alkene may also be formed using a process in which the bio-1-alcohol in water is dehydrated by heating the bio-1-alcohol with a catalyst under a purge gas as noted above in a bulk process or other continuous reactor. Base and optional organosilane treatments may also be used as well as catalysts and reaction conditions such as those noted above, and most preferably, through use of a calcined γ -alumina catalyst formed by the process described above.

[0088] The bio-1-alcohol may also be formed using a process in which the bio-1-alcohol in water is dehydrated by heating the bio-1-alcohol with a catalyst under a purge, but as noted above, in bulk process or some other continuous reactor. Base and optional organosilane treatments may also be used as well as catalysts and reaction conditions as noted above.

[0089] Once the bio-1-alcohol is dehydrated to form the highly regioselective terminal, bio-1-alkene, that material is then converted to a bio-1,2-alkandiol having a carbon chain length of about 5 to about 20 carbon atoms. Prior to conversion, the bio-1-alkene may optionally be further refined such as by a distillation, vacuum distillation, fractionation or similar refining step to further purify the bio-alkenes to remove trace impurities and minor undesired fractions.

For example, in forming a bio-1-octene, a C8 olefin content of about 90 weight percent to about 99 weight percent can be achieved, and at least about 95 weight percent and preferably about 97 weight percent or greater C8 olefin in the form of the *n*- α -olefin (*i.e.*, 1-octene) can be achieved. In addition, in forming a bio-1-hexene, a C6 content of about 95 weight percent to about 99.8 weight percent can be achieved, with at least about 96 weight percent to about 99 weight percent thereof having a 1-hexene structure.

[0090] Various chemical reactions may be used for this conversion as are known for use in standard alkene to alkanediol conversions using petrochemically derived starting materials and/or that are used for smaller chain bio-alkanes. For example, the bio-1-alkene is reacted in the presence of at least one of formic acid or acetic acid, and a peroxide such as hydrogen peroxide to form an intermediate solution including a bio-1,2-epoxyalkane, bio-1,2-alkanediol, and other components. This is then further contacted with a base solution, such as a sodium hydroxide or another suitable base solution, to complete formation of the bio-1,2-alkanediol. The process noted above preferably yields about 60% to about 99%, and more preferably about 70% to about 99% or about 75% to about 99% of bio-1,2-alkanediol.

[0091] A bio-1-alkanol may also be converted to bio-1-alkene for use in this process by dehydrating the bio-1-alkanol using heat and an acid catalyst in accordance with other previous techniques.

[0092] Bio-1,2-alkanediols, having a chain length of about 5 to about 20 carbon atoms and synthesized by conversion of a first bio-alkene having a carbon chain of about 5 to about 20 carbon atoms and a bio-1-alkene regioselectivity of at least about 80%, more preferably 92% to about 99% and most preferably about 95% to about 99%. In one embodiment, a bio-1-alkanol having a carbon chain of about 5 to about 20 carbon atoms is preferably first converted to a bio-alkene regioselectively such that the resulting bio-alkene contains a bio-1-alkene content of at least about 80% or higher as noted above. Then the bio-1-alkene is converted to the 1,2-alkanediol by any known method known in the art. The resulting bio-1,2-alkanediol after conversion may be further refined such as by distillation, vacuum distillation, fractionation or other similar steps as are noted above for refining the bio-1-alkene to provide a refined, final bio-1,2-alkanediol.

[0093] Resulting bio-1,2-alkanediols, having a chain length of about 5 to about 20 carbon atoms are preferably synthesized by first dehydrating a bio-1-alkanol having a carbon chain of about 5 to about 20 carbon atoms to a bio-1-alkene having a regioselectivity of at least about

80%, more preferably about 92% to about 99% and most preferably about 95% to about 99% of bio-1-alkene is formed, then treating the bio-1-alkene with formic or acetic acid in the presence of hydrogen peroxide, and further with an aqueous base solution. The bio-1,2-alkanediol may then be separated from the aqueous solution by any suitable technique known in the art of making dihydroxyalkanes in general, and more specifically 1,2-alkanediols. In a preferred embodiment, a distillation step is included for this purpose.

[0094] The bio-1,2-alkanediols as described above, may be used in a variety of compositions, whether used alone or in combination with other different bio-1,2-alkandiols according to the present invention. Such compositions may incorporate one, two or more different bio-1,2-alkanediols according to the invention herein that may act within an antimicrobial system. Such bio-1,2-alkanediol(s), may be used alone as an antimicrobial additive or in an antimicrobial system incorporating other bio-compounds (*i.e.*, any suitable naturally derived, and preferably authentic natural product as tested using mass spectroscopy, gas chromatography and/or the ASTM standard noted above) such as bio-organic acids, bio-diols such as 1,3-propanediol, bio-1,2-butanediol, and 1,2-pentanediol that are extracts from fermentation products of bio-based starting materials and/or other antimicrobial materials, alternative preservatives, traditional preservatives or hurdle technology components as are known in the art or to be developed. An example of a preferred source of bio-compounds for use within the scope of the invention are triglycerides. In yet a further example, another chemical group of bio-compounds that can be used in preparing alternative preservatives is commonly described as terpenoids. These natural terpenoids can have from 5 to 20 carbon atoms and can be readily obtained through sustainable farming practices and may be used within the scope of “bio-compounds” as that term is used herein for us in combination with the bio-1,2-alkanediols herein.

[0095] When used in a composition, the bio-1,2-alkanediols of the invention are preferably incorporated in an amount of about 0.1 to about 10 weight percent, and preferably 0.3 to about 2 weight percent, of the total composition; which amount may be varied depending on whether they are used alone for antimicrobial effect or with other components in an antimicrobial system. In the latter instance, the bio-1,2-alkanediols are preferably present in a ratio of the bio-1,2, alkanediol(s) to any other antimicrobial component(s) of about 99:1 to about 1:99, and preferably about 75:25 to about 25:75 in the antimicrobial system (wherein the system would

include the bio-1,2-alkanediol(s) herein and/or any other antimicrobial, traditional preservative, alternative preservation and/or hurdle technology component(s) in the composition).

[0096] When used in certain compositions that are themselves viewed as “antimicrobial products” for providing to other formulators in various industries, the 1,2-bio-alkanediol(s) of the invention may be prepared initially as antimicrobial products that include one or more of the 1,2-bio-alkanediol materials made in accordance with the invention as described above and that incorporate one or more of the compositions as noted above, wherein such antimicrobial products may include also other bio-compounds, known antimicrobials, preservatives, alternative preservation materials or hurdle technology materials.

[0097] Examples of known preservatives and alternative preservative materials or compounds used in alternative preservation systems that may be used with the bio-1,2-alkanediols of the invention, include those suitable for use by various industries in which the present invention may be beneficial. For example, in the cosmetic and personal care industry, the bio-1,2-alkanediol(s) formed according to the present invention can be used alone, in combinations of two or more such materials and/or with other biocompounds and/or with known cosmetic preservatives and alternative preservation materials and/or hurdle technology components. Examples of preservative materials are listed by the FDA in the U.S. as including: (i) traditional preservatives, such as parabens (methyl, ethyl, propyl, and butyl), Quaternium 15 (aka “Dowicil”), diazolidinyl urea, imidazolidinyl urea, DMDM hydantoin, 2-bromo-2-nitropropane-1,3-diol (aka “Bronopol”), sodium hydroxyglycinate, phenoxyethanol, sorbic acid, potassium sorbate, methylisothiazolinone (aka “MI”), methylchloroisothiazoline (aka “CMI” often in combination with MI as Kathon CG), sodium benzoate, caprylyl glycol, sodium dehydroacetate, and formaldehyde; (ii) non-traditional or alternative preservatives: such as extracts of botanicals, organic acids, alcohols and glycerols, fermentation products, glyceryl caprylate, levulinic acid, p-anisic acid, eucalyptus globulus, glycyrrhiza, glabra (licorice) root extract, salvia officinalis, citrus grandis (organic grapefruit) extract, arnica montana (organic arnica) extract, boraxitrus seed extracts, leuconostoc/radish root ferment filtrate. goldseal (hydrastis canadensis root extract), citrus medica, limonum (Lemon) peel extract, caprylhydroxamic acid; and (iii) so-called “self-preserving” materials such as ethanol (when present at > 15%), butylene glycol (when present at >10%), propylene glycol (when present at > 20%); as well as (iv) other components used in alternative or traditional preservation systems in cosmetics such as MDM hydantoin, sodium hydroxymethylglycinate, benzisothiazolinone,

benzyl alcohol, dehydroacetic acid, benzoic acid, salicylic acid, iodopropynyl butylcarbamate chloroxylonol, methyldibromo glutaronitrile, chlorphenesin, triclosan, benzalkonium chloride, chlorhexidine, polyaminopropyl biguanide, 5-bromo-5-nitro-1,3-dioxane (bronidox), hexamidine diisethionate, pentyleneglycol, ethylhexylglycerin, triclocarban, glyceryl caprylate, o-cymen-5-ol, chlorphenesin, and glyceryl monolaurate, and traditional petrochemically-derived 1,2-alkanediols such as 1,2-hexanediol, 1,2-octanediol.

[0098] Other countries have similar lists with variations on the nature and type of preservatives, alternative preservatives or preservative system or hurdle technology additives that may be used in those countries. However, the present bio-1,2-alkanediols may be used in such other materials as well. In each of the above-noted systems and compositions, the preferred bio-alkene used in the invention is a bio-octene and the at least one first bio-1,2-alkanediol is bio-1,2-octanediol.

[0099] Examples of compositions that may benefit from an antimicrobial system incorporating one or more of the bio-1,2-alkanediols formed according to the process noted above and/or in compositions as noted above include personal care compositions, such as hair care, oral care, skin care or cosmetic compositions; household product compositions, such as fabric care or cleaning products; industrial compositions; and pharmaceutical, vitamin, nutraceutical or other health care compositions, any of which could benefit from an antimicrobial system, component or antimicrobial product derived from an authentic, natural, bio-based material.

[0100] The bio-1,2-alkanediols are preferably incorporated into a cosmetic or personal care composition (on a wet-basis or total weight basis) so as to make up about 0.001% by weight to about 25% by weight of the composition, and more preferably about 0.01% by weight to about 10% by weight of the composition. The amount used may vary depending on whether other hurdle technology components or other preservatives are also being used in the composition.

[0101] Such bio-1,2-alkanediols alone, in combinations of two or more different bio-1,2-alkandiols, and/or in antimicrobial systems incorporating the bio-1,2-alkanediol(s) alone or with other bio-compounds and/or other preservative, alternative preservative or hurdle technology components, may also be used in a method to provide an antimicrobial effect to a composition, wherein the compositions may be any of the variety of types of compositions as noted above. It is preferred that the bio-1,2-alkanediols herein provide an antimicrobial effect and efficacy to a composition into which the bio-1,2-alkanediols are incorporated, whether into

a personal care, household, industrial, pharmaceutical, vitamin, nutraceutical or other health care composition. Such an antimicrobial effect may be demonstrated by using a variety of suitable antimicrobial effectiveness tests (AET). Such tests include, for example, a compendial test performed during formulation development and stability testing in parenteral drug products intended as a multi-dose product. Suitable test procedures and acceptance criteria are described in the *U.S. Pharmacopeia*, AET, the *European Pharmacopeia* (Efficacy of Antimicrobial Preservation), and the *Japanese Pharmacopeia* (Preservation Effectiveness Tests). Other suitable challenge tests may be used. The FDA also recommends suitable challenge testing.

[0102] One group of antimicrobials, some of which are in the group noted above, are other alcohols, and preferably at least one other alcohol, preferably at least one other diol, and most preferably one or more other vicinal diols that may be petrochemically derived, albeit, it is preferred that such materials are used as diluents or in smaller amounts for providing some antimicrobial effect, but are not so great as to diminish the impact of the natural, bio-based 1,2-alkane diols of the present invention. By the term, "vicinal diols," it is meant materials that have hydroxyl groups which are bonded to atoms in the molecule which are next to each other, *i.e.*, wherein two atoms each bearing a hydroxyl group are bonded to each other. Examples of vicinal diol compounds suitable for use in the invention, include, but are not limited to, ethylene glycol and propylene glycol. Such materials are used in the personal care, cosmetic and pharmaceutical arts as humectants and solvents, and as described in U.S. Publication No. 2007-0207105-A1 as having some modest antimicrobial activity.

[0103] Preferred vicinal diols for use with the bio-1,2-alkanediols herein, in compositions described for use in personal care and pharmaceutical use compositions are medium-chain length, linear vicinal diols that demonstrate some antimicrobial activity including petrochemically-derived 1,2-pentanediol, 1,2-hexanediol, 1,2-octanediol, and 1,2-decanediol. Other vicinal diols useful in the compositions described herein include molecules derived from glycerin. Glycerin can be reacted with other molecules at its 1- or 3-position, leaving two vicinal hydroxyl groups. For example, glyceryl monoethers, such as ethylhexylglycerin [3-(2-ethylhexyloxy)propane-1,2-diol], available commercially as SENSIVA®SC50 from Schulke & Mayr, are useful, traditional, liquid vicinal diols having antimicrobial properties. Glyceryl monoesters such as glyceryl monolaurate, glyceryl monocaproate, or glyceryl monocaprylate, the latter of which is commercially available from Inolex Chemical Company, Philadelphia, PA, are also useful antimicrobial vicinal diols. For the preservation of cosmetics, toiletries and

pharmaceuticals, vicinal diols are known to be effective against bacteria and yeast but weak against fungi and to date there are only limited natural choices, none of which to applicant's knowledge are bio-derived natural 1,2-alkanediols of from 5 to 20 carbon atoms.

5 **[0104]** The compositions herein preferably do not include, or include only to a minor amount any preservation materials such as parabens, or other known preservation materials that can be viewed as harmful to the user.

10 **[0105]** Such personal care and pharmaceutical compositions may optionally further include a solubilizing agent in amounts of about 1% to about 70% by weight of the combination of the solubilizing material with the bio-1,2-alkane diol(s) (or if used with other preservation component(s) by weight of the entire antimicrobial system with the solubilizing material). Suitable solubilizing agents include vicinal and other traditional diols.

15 **[0106]** Also useful in with the bio-1,2-alkanediols in any antimicrobial system are hydroxamic acid and the like which may be used in a variety of industries. Suitable hydroxamic acids include alkylhydroxamic acids and bio-alkylhydroxamic acids that include at least one alkyl group of a chain length of about two to about twenty-two carbon atoms, which may be branched or linear in structure, substituted or unsubstituted, and saturated or unsaturated as noted hereinabove. Preferred alkylhydroxamic acids contain alkyl groups of a chain length of about six to about twelve carbon atoms and most preferably linear chains of that length. Most preferred alkylhydroxamic acids are caprylohydroxamic acid, having a linear terminal chain of
20 eight carbon atoms and caprohydroxamic acid, having a linear chain of ten carbon atoms. Such alkylhydroxamic acids may be used alone or in combination and in amounts as noted above for an optional solubilizing agent.

25 **[0107]** Formulations prepared for personal care use, and pharmaceutical compositions, depending on the end use (topical or oral) may include any other colorants, fragrances, active ingredients or other additives typically used and/or to be developed in the art for use in personal care and pharmaceutical formulations, in which additives will vary depending upon the formulation in which the preferred bio-1,2-alkanediols, or antimicrobial products or systems containing the bio-1,2-alkanediols are used, for example, in topical skin toners, skin cleansers, night creams, skin creams, shaving creams, skin care lotions, or other cosmetic preparations;
30 make-up, such as foundation, liquid and powder-based make-up, mascara, lipstick, blush, gloss, eye-liner and the like; or other personal care and/or pharmaceutical compositions, such as, sunscreens, lip balms, fragrances, massage oil, shampoos, conditioners, conditioning shampoos,

hair styling gels, hair reparatives, hair tonics, hair fixatives, hair mousses, bath and shower gels, liquid soaps, moisturizing sprays, makeup, pressed powder formulations, bath additives, ophthalmic preparations, foaming soaps and body washes, sanitizing wipes, hand sanitizers, medicaments (tablets or liquid), towelettes and wipes and others. It should be understood, based on this disclosure that a wide variety of personal care and pharmaceutical compositions could benefit from the properties of the bio-1,2-alkanediols of the present invention, wherein, as used herein, pharmaceutical composition is one having at least one active pharmaceutical ingredient (API).

[0108] The personal care and pharmaceutical formulations, if liquid based (such as gels, hydrogels, lotions, shampoos, liquid pharmaceuticals and the like) will also preferably include water as part of the liquid base. The formulations and compositions may include other additives as well depending on the end formulation desired, such as without limitation, at least one humectant, at least one emulsifier and/or thickener, chelating agent(s), gelling agent(s), amino acid(s), emollient(s), various solvents, free radicals and initiators, sunscreen UVA and/or UVB blocking agents, antioxidants, other preservatives, waxes, polymers and copolymers, inorganic and organic pigments and/or one more fragrances, favoring(s), coloring agent(s), herbs, natural extracts, essential oils, pharmaceutical drug products, other APIs and other additives commonly used in such formulations.

[0109] Personal care and pharmaceutical compositions using the bio-1,2-alkanediols herein may be lotion-based, oil-in-water emulsions, water-in-oil emulsions, water-in-silicone emulsions, silicon-in-water emulsions, gels, solids, liquids, cream based, oil based, aqueous/alcoholic or glycolic solution based, dispersions, suspensions or syrups, microemulsions or a liposome-based formulations.

[0110] In water-based formulations, other than solids and thicker gels, etc., it is preferred that about 20% by weight to about 95% by weight (on a wet basis) of water is incorporated therein. The various additives aside from the water and preferred antimicrobial systems noted herein, would make up the remaining portion of various personal care and pharmaceutical compositions. Preferably, each additive is present in an amount of up to about 75 percent by weight of the entire formulation, and more preferably up to about 40 percent by weight, with a collective amount of such additives of preferably no greater than about 50 percent by weight.

[0111] In a household product, antimicrobials are also useful additives. Household product compositions can include household cleaners as well as fabric care compositions. Cleaning

compositions (whether solids or solutions) can incorporate cleaning agents that are active ingredients for cleaning (bleach, vinegar, ammonia, citric acid and the like). For liquid cleaning agents, aqueous solutions may be used as are known in the art or to be developed, such as quaternary ammonium compounds, bleach, vinegar, or basic or acidic cleansers.

5 Commercially available quaternary ammonium-based cleaning products include various antibacterial all-purpose cleaners among others which are intended and well-suited for sanitizing or disinfecting efficacy, however, such compositions still incorporate antimicrobials and other preservatives for shelf life and to prevent growth of foreign agents. Thus, such compositions also benefit from use of the natural bio-1,2-alkanediols herein.

10 **[0112]** For more natural cleaning solutions, such as citric acid-based agents or other green cleaning agents (ecologically friendly), consumers would be interested in further additives that are also natural, and in this case that are derived from a biological source. Thus, such compositions benefit from natural bio-based 1,2-alkanediols herein as well as antimicrobial systems and products incorporating the bio-1,2-alkanediols. Such natural cleaning

15 compositions as well as standard cleaning compositions as noted above may also incorporate various optional additives in varying amounts as noted below. Citric acid-based cleaning products may include lemon, orange or grapefruit-based cleaning agents. Other suitable components may include grape seed oil, vegetable oils combined with one or more of mild peroxide agents, surfactants, and the like, as well as pigment(s) or colorant additive(s) to

20 provide a visual alerts when the cleaners are present, conventional or alternative preservation compound(s), antimicrobial(s), bactericide(s) or fungicide(s) (each of which may be used along or in combination with the bio-1,2-alkanediols of the present invention in an antimicrobial system or product), thixotropic agents and rheological modifiers, pH adjusting additives or buffers, as well as fragrance additive(s) for providing a clean smell (pine scent, lemon scent,

25 orange scent, floral scent, etc.). In addition, other agents for foaming, color change or effervescence (bubbling) may be provided if desired to demonstrate cleaning action. Solid cleaners can incorporate similar additives, but can be compressed, incorporated or formed from depositing a cleaning material on a substrate (sponge, scrubber, mop head or the like), and various inactive agents for holding the solid cleaning material together (hardeners, gelling

30 agents, mineral powder and the like). Other additives for household cleaning compositions may include pH buffering agent(s), a fragrance encapsulate(s) or carrier(s), fluorescer(s), hydrotrope(s), soil-release agent(s), polyelectrolyte(s), enzyme(s), optical brightening agent(s),

anti-oxidant(s), UV absorbing compound(s), propylene glycol, dipropylene glycol, opacifier(s), pearlescent(s) and combinations of these as well as other cleaning product additives known or to be developed.

[0113] The fabric care compositions can include any active fabric cleaning component as well as various conditioning components as are known or to be developed in the art. Such compositions may include ingredients used for fabric cleaning or laundering, fabric conditioning or softening, fabric dye(s), water conditioner(s) and/or fabric care composition(s) such as spot removers or stain treatments. Such ingredients include without limitation antifoam agent(s), antideposition agent(s), fragrance(s) and their carrier(s) or encapsulate(s), traditional or conventional diols (although such diols may be omitted if the bio-1,2-alkanediols are useful in the same or an enhanced or boosted capacity for an existing diol), colorant(s) such as pigment(s) or dye(s), and co-softening agent(s). Others additives for fabric care compositions may include, without limitation, other traditional preservative(s), antimicrobial(s), bacteriocide(s), and/or fungicide(s)(each of which may be used alone or in an antimicrobial product or system as described herein), pH modifier(s) or buffering agent(s), fluorescer(s), hydrotrope(s), soil-release agent(s), polyelectrolyte(s), enzyme(s), optical brightening agent(s), anti-shrinking agent(s), anti-wrinkle agent(s), anti-spotting agent(s), anti-oxidant(s), UV absorbing compound(s), anti-corrosion agent(s), drape imparting agent(s), anti-static agent(s), ironing aid(s), odor-preventing compound(s), perfume encapsulate(s), cotton seed oil, tea tree oil, aloe vera extract, propylene glycol, dipropylene glycol, opacifier(s), pearlescent(s) and combinations of these components.

[0114] The antimicrobial bio-1,2-alkanediols herein may also be used in the treatment of the finished textile(s) and/or treatment of the fibers or yarns from which a textile is to be fabricated to achieve the desired benefit. Textiles may include woven and non-woven textiles, such as felt and tapa cloth and other bark cloths, or blends and combinations of the same. Textile fiber (whether it exists in finished textile form, yarn or fiber form) may be any known or developed in the art and include synthetic fibers, "natural" fibers, such as animal derived fibers or cellulosic/plant-derived fibers and blends or combinations of any of these.

[0115] Animal-derived fibers may include and derived from the hairs or fur of an animal. Examples are, without limitation, lambs or sheep's wool, alpaca, angora wool, azlon, byssus, camel hair, cashmere wool, chiengora, chatgora, llama, mohair wool, qiviut, rabbit, silk, vicuna, yak, pashmina wool and combinations of the same. Cellulosic or plant-derived fibers may

include, without limitation, those obtained from flax (linen fibers), cotton, ramie, jute, kenaf, beach hibiscus, roselle, urena, hemp (e.g., *Crotalaria juncea*, *Cannabis sativa*, *Apocynum cannabinum*), hoop vine, sisal, henequen, yucca, abaca, genus *Sansevieria*, New Zealand flax, cotton, coir, milkweed, kapok, floss silk, *Proboscidea parviflora*, bamboo, bast, fique, banana, modal, lyocell, pina, raffia, rayon, soy protein, acetate and combinations of the same. Synthetic fibers may include any known or to be developed, such as for example, and without limitation, acrylic, Kevlar®, modacrylic, Nomex®, nylon, polyester, lycra, spandex, rayon, and combinations of the same.

[0116] Fabric treatment compositions may be applied to the textile or fibers. The compositions may be applied as either a wet or dry composition and during a laundering cycle with water or a drying cycle. Such fabric treatment materials may be used for softening and/or conditioning a textile or fiber; reducing and/or preventing wrinkles, imparting fragrances to a textile or fiber; reducing ironing time, improving softness and the like.

[0117] The invention also incorporates use of the 1,2-bio-alkanediol materials formed according to the invention as a material for boosting the antimicrobial efficiency of existing antimicrobials, preservatives, alternative preservation materials and/or hurdle technologies.

[0118] By boosting the antimicrobial efficacy, it is meant that the antimicrobial efficacy of an existing antimicrobial and/or preservative (including alternative preservation materials or hurdle technologies) when combined with the 1,2-bio-alkandiols achieve an improvement of antimicrobial effectiveness that is more than insubstantial, *i.e.*, at least about 5%, preferably at least about 10%, and more preferably at least about 20% or more improvement, while providing a natural boosting material. Boosting effects and antimicrobial effects in a formulation are evaluated by measuring performance using a preservative efficacy test ("PET") or a challenge test. Preservatives and antimicrobials used in cosmetic, toiletry and pharmaceutical products must enable the products to successfully pass microbiological testing protocols, known as "challenge tests," established by government regulations and trade organizations. Challenge tests are performed by adding known quantities of microorganisms to a product and measuring the increase or decrease in microorganism population over time. The organisms include Gram-positive bacteria, Gram-negative bacteria, yeast and mold. The Cosmetic, Toiletries, and Fragrance Association (CTFA) has defined a challenge test that is widely accepted as the standard in the cosmetic, toiletry and pharmaceutical industry. The test requires that the quantity of bacteria be reduced by 99% in seven days, and that the quantity of yeast and fungi

(mold) be reduced by 90% in seven days. In order to pass a challenge test, the product must contain the appropriate amounts and types of preservative compounds that will enable antimicrobial efficacy against a broad spectrum of microorganisms in a short period of time.

[0119] In addition to the content noted to provide antimicrobial efficacy, if using as a boosting material to improve the effectiveness of an existing antimicrobial and the like as noted above it is preferred that the 1,2-bioalkanediol(s) are incorporated in an amount of about 0.1 to about 10 weight percent, and preferably 5.0 to about 3.0 weight percent, of the total composition; and in a ratio of about 99.999:0.001 to about 0.001:99.999, and preferably about 99.9:0.1 to about 0.1:99.9 of the total amount of existing antimicrobial, preservative, alternative preservation and/or hurdle technology components already existing in the composition.

[0120] The invention will now be described with respect to the following non-limiting examples:

EXAMPLES

[0121] Bio-1-octanol is formed from the hydrogenation of bio-octanoic acid (suitable sources of which may be derived from coconut, palm or any other renewable source or process that can produce octanoic acid). The bio-1-octanol is dehydrated regioselectively by feeding the bio-1-octanol at an elevated temperature into a fixed bed reactor containing a catalyst according to the invention herein.

[0122] Gas Chromatography (GC) was an important method used to characterize both petroleum and natural-renewable derivatives. Products (*e.g.* octenes) were characterized using a Thermo Scientific Trace 1310 Gas Chromatograph employing an FID detector and Chromeleon software (version 7.2.4.8525). For dehydration reactions products the GC employed a Restek MXT-5 column (30 m length, 0.5 μ m film, 0.53 ID), helium carry gas (3.0 mL/min), CT split injection 45 mL/min (5.0 mL/min purge flow), injector 250 °C, detector 300 °C, oven 70 °C hold for 8 min, then ramp to 300 °C (15 °C/min) with a final hold for 6.67 min. For alkanediol products GC analysis employed a Restek MXT-WAX column (30 m length, 0.5 μ m film, 0.53 ID), helium carry gas (5.0 mL/min), CT split injection 10 mL/min (5.0 mL/min purge flow), injector 220 °C, detector 250 °C, oven 70 °C hold for 0.25 min, then ramp to 250 °C (10 °C/min) with a final hold for 6.67 min.

EXAMPLE 1

[0123] γ -Alumina powder was treated with an aqueous solution of calcium acetate using the technique of incipient wetting to afford a catalyst containing 1.50% calcium (based on CaO) after calcination in air at 440°C for a period of 12 h.

5

EXAMPLE 2

[0124] γ -alumina powder was treated with an aqueous solution of calcium acetate using the technique of incipient wetting to afford a catalyst containing 1.50% calcium (based on CaO) after calcination in air at 500°C for a period of 12 h.

EXAMPLE 3

10 [0125] Catalysts prepared in EXAMPLE 1 and EXAMPLE 2 were loaded into separate 75 mL (Sigma Aldrich Part No. Z173592) reactors, each was wrapped with heating tape and covered with fiberglass insulation. The temperature was controlled by affixing a thermocouple to the outside skin of the reactor, this input was used for a temperature controller. Bio-1-octanol was fed into the reactor maintained at 315°C using an HPLC pump. The bio-1-octanol
15 feed rate was adjusted in a manner to obtain conversion more than 95%, but less than 100%. After 1 h of continuous operation a sample was collected and analyzed for analyzing chemical conversion of the bio-1-octanol and regioselectivity of bio-1-octene. The results are shown below:

Table 2

Catalyst	Calcination Temperature (°C)	1-Octene (%)	2-Octene & 3-Octenes (%)	1-Octanol (%)	1-Octene Selectivity (%)
EXAMPLE 1	440	94.0	3.2	1.6	97.4
EXAMPLE 2	500	88.9	6.6	3.5	93.1

20

EXAMPLE 4

[0126] γ -alumina in the form of 1/16" extrudate, Porocel® CatGuard® was cut to have length to diameter ratios in the range of 2 to 4. The extrudate was modified with an aqueous solution of calcium acetate. The weight of solution to alumina was 0.55 by weight and the
25 calcium acetate concentration was at level to deliver 1.50% of CaO (after calcination). This catalyst was subjected to calcination in air at 440°C for a period of 12 h.

EXAMPLE 5

[0127] The 48 g of the catalyst prepared in EXAMPLE 4 was loaded into a 75 mL (Sigma Aldrich Part No. Z173592) reactor, wrapped with heating tape, and covered with fiberglass insulation. The temperature was controlled by affixing a thermocouple to the outside skin of the reactor, this input was used for a temperature controller. Bio-1-octanol was fed at 0.2 mL/min into the reactor maintained at 315°C. After >1,400 h of TOS, that included regular shut-downs and start-ups, catalyst performance with regard 1) chemical conversion of the bio-1-octanol, 2) product selectivity, 3) and regioselectivity for bio-1-octene was unchanged. A GC chromatogram of the crude product collected from the reactor is shown in Fig. 3 with an octene selectivity of 96% and with chemical yield of bio-1-octene of 94%.

EXAMPLE 6

[0128] The product in EXAMPLE 5 was subjected to simple distillation at atmospheric pressure. The product obtained was analyzed by GC and the chromatogram is shown in Fig. 4. The product from the distillation was 99.9% bio-octenes with a 96.7% content of bio-1-octene.

EXAMPLE 7

[0129] The product in EXAMPLE 6 was converted to the bio-1,2-octanediol by treatment with formic acid and peroxides, then a base hydrolysis, and finally purified by fractional distillation. The GC chromatogram is shown in Fig. 5. The bio-1,2-octanediol obtained in this example has a chemical purity 98.7% by GC analysis. A typical GC chromatogram of the petro-1,2-octanediol currently used in commercial cosmetic applications is displayed in Fig. 6.

EXAMPLE 8

[0130] Stable isotope analyses were carried out on petroleum-based and those prepared from the natural and renewable feedstocks prepared in EXAMPLES 6 and 7. The values are shown below:

Table 3

Compound	$\delta^{13}\text{C}$	$\delta^2\text{H}$
Bio-1-Octanol	32.3	-273
1-Octanol (petro-based)	30.3	-87
Bio-1-Octene	32.0	-288
1-Octene (petro-based)	31.8	Not tested
Bio-1,2-Octanediol	32.2	-245
1,2-Octanediol (petro-based)	31.5	-50

EXAMPLE 9

- 5 **[0131]** The bio-1,2-octanediol prepared in EXAMPLE 7 was subjected to testing that is currently used to qualify the petroleum, non-renewable, non-natural equivalent. The bio-1,2-octanediol prepared in EXAMPLE 7 was found to meet all the batch analytical testing requirements:

Table 4

Analysis	Natural 1,2-octanediol	Petroleum 1,2-octanediol	Specification
Odor	Conforming	conforming	mild
Color, Lovibond (yellow)	0.1	0.1	≤ 1.5
Color, Lovibond (red)	0.0	0.0	≤ 0.3
Sediment	Conforming	Conforming	No discoloration
Color, APHA 142	8	1	≤ 100
COLOR, APHA 142-01	8	1	≤ 30
Infrared Spectrum	Conforming	Conforming	Matches Std.
Hydroxyl value Mg KOH/g	761	740	740 to 770
Moisture % w/w	0	0	≤ 2
Appearance	Conforming	Conforming	Clear liquid above 35 °C
Assay, %	98.7	99.5	≥ 98.0
% 1,2-octane oxide	0.1	0.1	Report result
Color 999-03	Conforming	Conforming	Matches Standard

EXAMPLE 10

[0132] In a comparative example, bio-1-octanol was fed into a 75 mL reactor packed with a catalyst prepared as follows: gamma-alumina powder was modified with a sodium hydroxide solution (5 wt-% NaOH) to create a second catalyst, the second catalyst was dried in an oven and then treated with diethoxydiphenylsilane (1 wt-% based on alumina) dissolved in ethanol. The solvent was removed, the catalyst washed with ethanol, and dried in an oven to create a

third catalyst. This third catalyst was calcined at 400°C for 12 h. The catalyst was loaded into a 75 mL reactor, heated to a target temperature of 325°C and bio-1-octanol feed rates were adjusted to optimize both conversion and regioselectivity.

5

EXAMPLE 11

[0133] Petro-1-hexanol was fed into a 75 mL reactor packed with the catalyst prepared in EXAMPLE 4. The catalyst used in this example had greater than 1,400 h of TOS used for bio-1-octanol dehydration to bio-1-octene. For this series of dehydration reaction examples, the temperature was varied from 330°C to 370°C and the feed rate was adjusted in order to achieve between 1 and 2% of hexanol passing through the reactor. The results for the hexanol dehydration are shown below:

10

Table 5

Catalyst	Reactor Temperature (°C)	1-Hexene (%)	2-Hexenes & 3-Hexene (%)	1-Hexanol (%)	1-Hexene Selectivity (%)
EXAMPLE 11A	330	92.8	3.5	1.8	95.8
EXAMPLE 11B	350	93.8	3.1	1.7	96.8
EXAMPLE 11C	370	90.1	3.2	1.6	96.6

[0134] In EXAMPLE 11C where the reactor is maintained at 370°C a new peak in the GC chromatogram appears have an area-% of 3.6; thus, indicating a lower chemical yield of 1-hexene and formation of another product.

15

EXAMPLE 12

[0135] After 1400 h of TOS for the dehydration of bio-1-octanol, some catalyst was removed at the entrance side of the tube reactor. In Fig. 7 the used catalyst is photographed next to catalyst with 0 h TOS. The used catalyst shows only a slight discoloration, and as noted herein, displays no loss in chemical conversion or loss in regioselectivity.

20

[0136] It will be appreciated by those skilled in the art that changes could be made to the embodiments described above without departing from the broad inventive concept thereof. It is

understood, therefore, that this invention is not limited to the particular embodiments disclosed, but it is intended to cover modifications within the spirit and scope of the present invention as defined by the appended claims.

CLAIMS

What is claimed is:

1. A method for making a bio-alkene, comprising:
 - 5 dehydrating a bio-1-alcohol by heating the bio-1-alcohol in a reactor with a catalyst, wherein the resulting bio-alkene has a carbon chain of about 5 to about 20 carbon atoms and a bio-1-alkene regioselectivity of at least about 80%.
 2. The method of claim 1, wherein the bio-alkene has a carbon chain of about 6 to about 14 carbon atoms.
 - 10 3. The method according to claim 2, wherein the bio-alkene has a carbon chain length of about 6 to about 10 carbon atoms.
 4. The method according to claim 3, wherein the bio-alkene has a carbon chain length of about 6 to about 8 carbon atoms.
 5. The method according to claim 1, wherein the bio-alkene is bio-octene.
 - 15 6. The method according to claim 1, wherein the reactor is a fixed bed reactor.
 7. The method according to claim 6, wherein the fixed bed reactor is a fluidized bed reactor.
 8. The method according to claim 1, wherein the catalyst is selected from ZnAl_2O_4 and a χ -alumina catalyst.
 - 20 9. The method according to claim 1, wherein the bio-alkene has a bio-1-alkene regioselectivity of about 92% to about 99%.
 10. The method according to claim 9, wherein the bio-alkene has a bio-1-alkene regioselectivity of about 95% to about 99%.
 11. The method according to claim 1, wherein the catalyst is a γ -alumina catalyst is treated
25 with a base to form a modified γ -alumina catalyst.
 12. The method according to claim 11, wherein the base comprises a Group I or a Group II metal.
 13. The method according to claim 11, wherein the γ -alumina catalyst is treated with a calcium promoter to provide a modified γ -alumina catalyst.
 - 30 14. The method according to claim 13, wherein the modified γ -alumina catalyst is calcined to provide a calcined γ -alumina catalyst.

15. The method according to claim 13, wherein the calcium promoter is used in an amount of about 0.01 weight percent to about 4 weight percent based on the weight of CaO determined after calcination.

16. The method according to claim 15, wherein the calcium promoter is used in an amount
5 of about 1 weight percent to about 2 weight percent based on the weight of CaO determined after calcination.

17. The method according to claim 14, wherein a temperature during calcination is about 400°C to about 500°C.

18. The method according to claim 17, wherein the temperature during calcination is about
10 420°C to about 480°C.

19. The method according to claim 18, wherein the temperature during calcination is about 440°C to about 460°C.

20. The method according to claim 14, wherein calcination is carried out in an oven.

21. The method according to claim 14, wherein the calcination is carried out in an
15 atmosphere of air or inert gas.

22. The method according to claim 1, wherein the method comprises a distillation step to refine the bio-alkene.

23. The method according to claim 1, wherein the bio-alkene results from a process wherein the bio-1-alcohol in water is dehydrated by heating the bio-1-alcohol with a catalyst under a
20 purge gas.

24. The method according to claim 1, wherein the bio-alkene is further reacted to form a bio-based compound different from the bio-alkene or a bio-based polymer.

25. The method according to claim 24, wherein the bio-alkene is further reacted by a free radical or a catalytic polymerization process to form a bio-based polymer.

26. A bio-alkene made by the method of claim 1.

27. The bio-alkene according to claim 28, wherein the bio-alkene is selected from straight or branched chain bio-alkenes.

28. The bio-alkene according to claim 28, wherein the resulting bio-1-alkene is selected from bio-1-pentene, bio-1-iso-pentene, bio-1-hexene, bio-1-heptene, bio-1-octene, bio-1-
30 nonene, bio-1-decene, and bio-1-dodecene.

ABSTRACT OF THE DISCLOSURE

A process is incorporated herein for the synthesis of bio-1,2-alkanediols, comprising: providing a bio-alkene having a carbon chain of about 5 to about 20 carbon atoms and a bio-1-alkene regioselectivity of at least about 80%, at least about 92% and/or at least
5 about 95%; and converting the bio-alkene to a bio-1,2-alkanediol having a carbon chain length of about 5 to about 20 carbon atoms. Methods for treating catalysts which may be incorporated in the process for the synthesis of bio-1,2-alkanediols are also included herein. Such bio-1,2-alkanediols are used in compositions and products alone as antimicrobial materials, or with
10 existing bio-compounds and/or antimicrobials, preservatives, alternative preservation systems and/or hurdle technology components. The bio-1,2-alkanediols incorporate a natural and bio-based pathway for antimicrobial effects in various compositions such as cosmetic, pharmaceutical, industrial and household products.

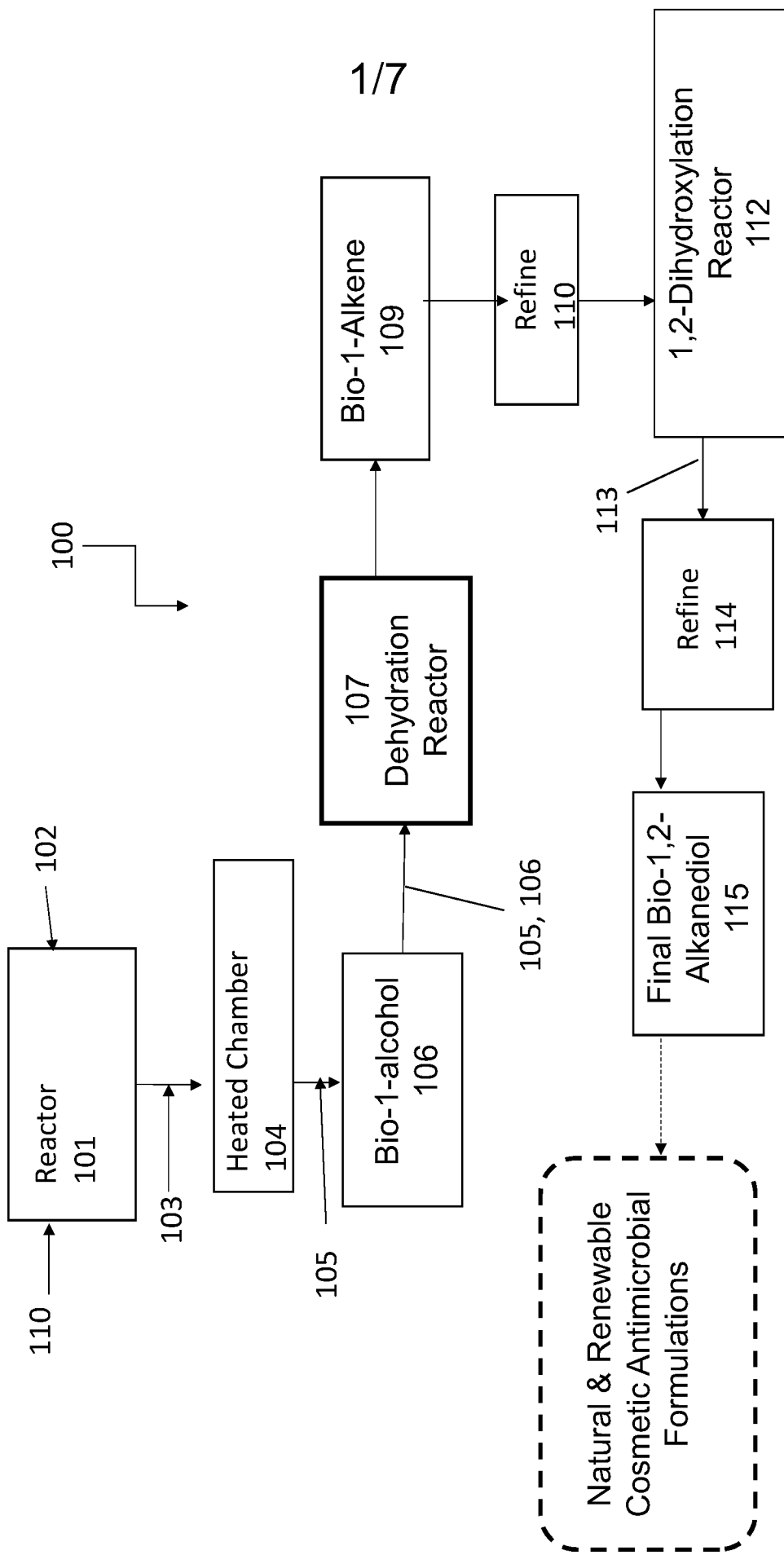


Fig. 1

2/7

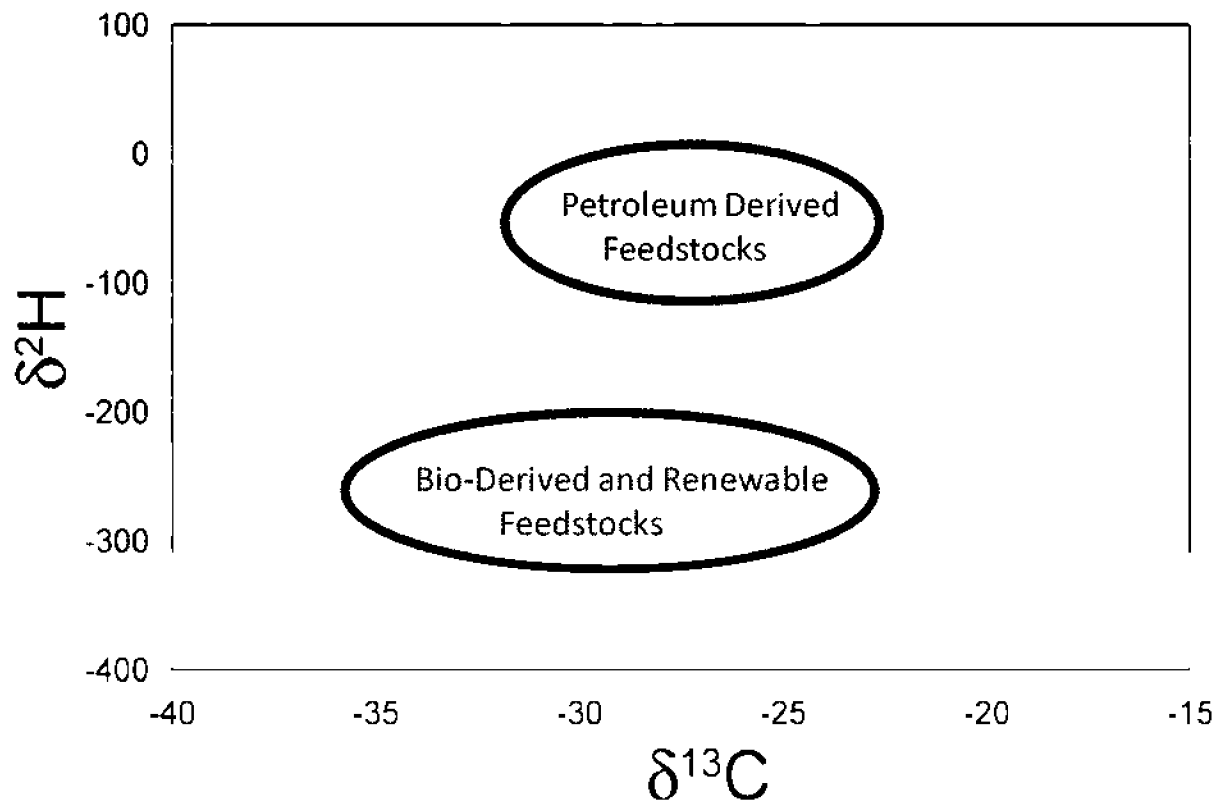


Fig. 2

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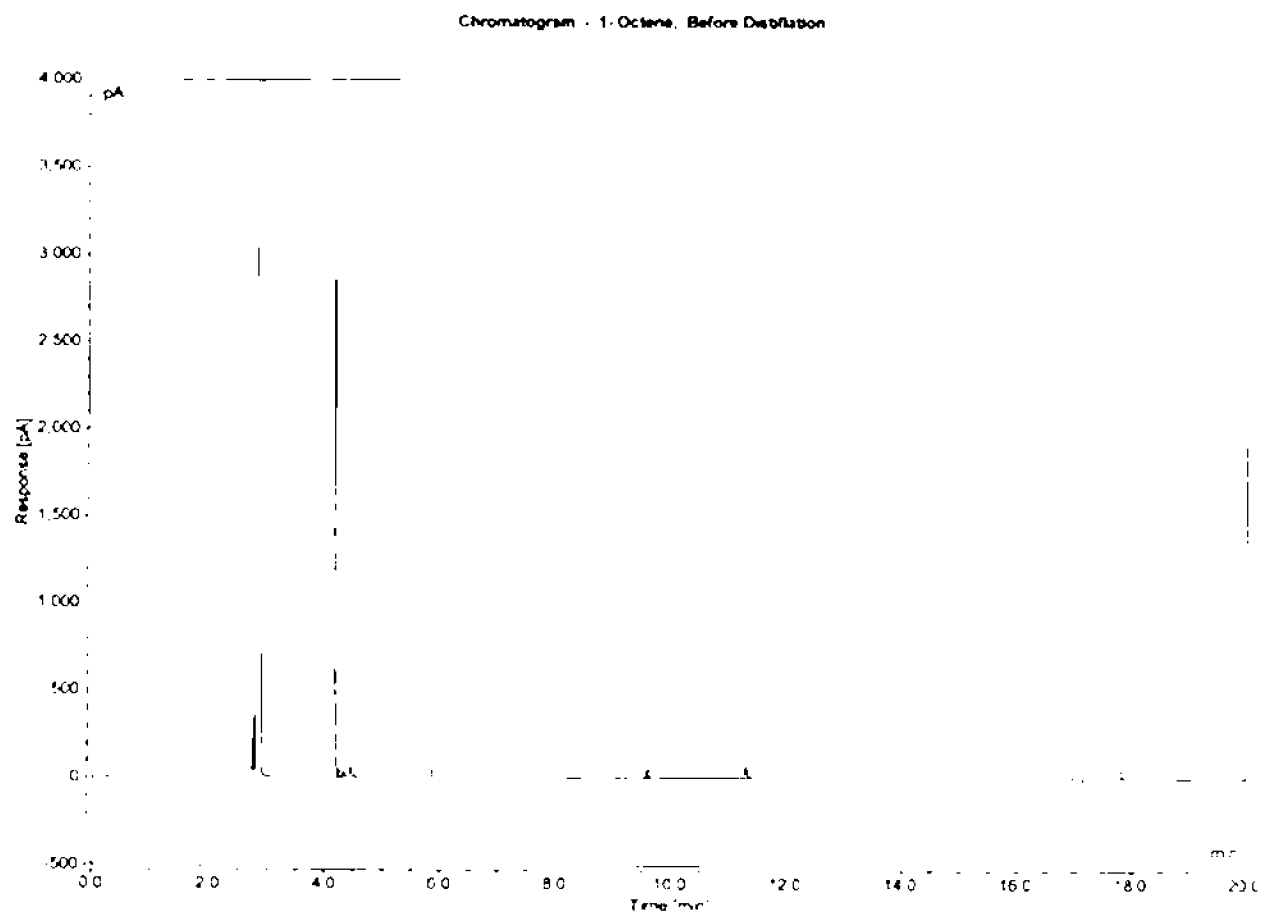


Fig. 3

4/7

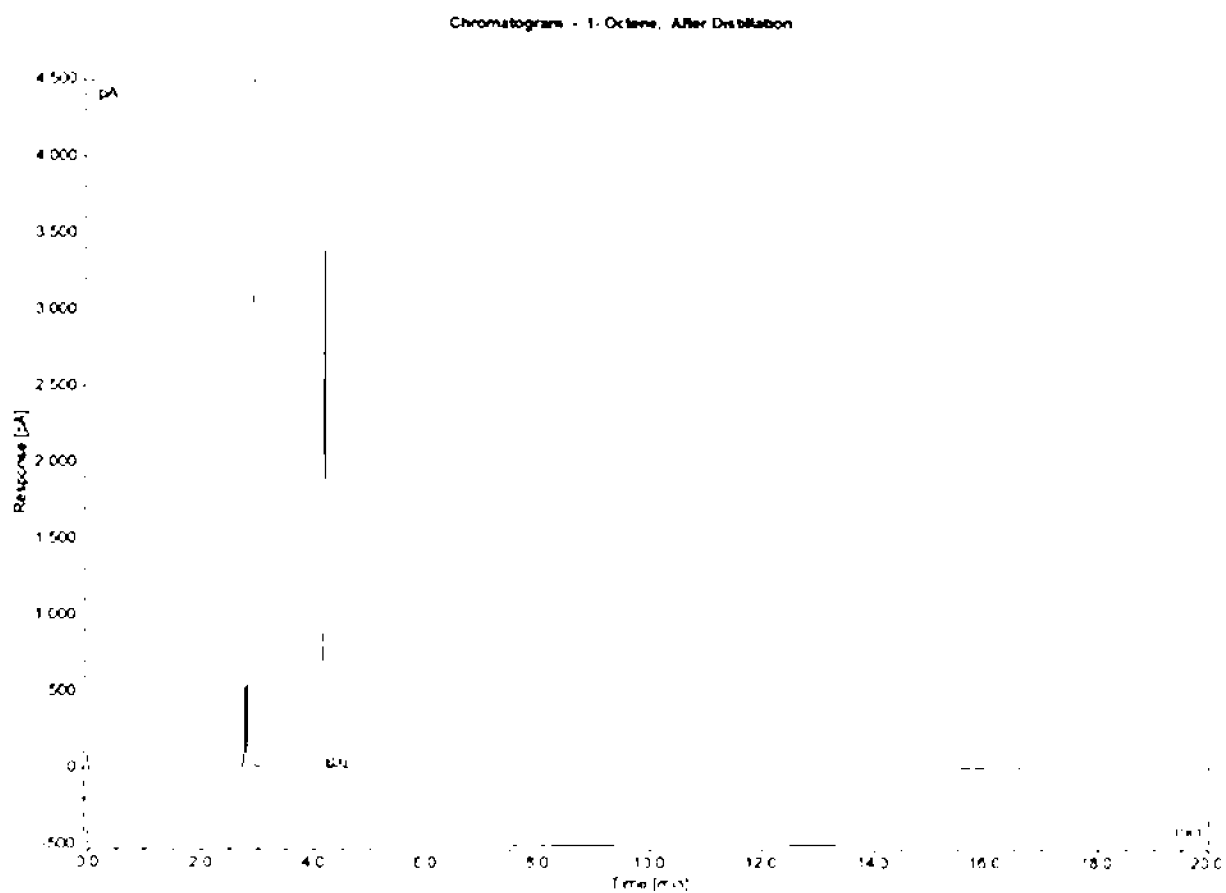


Fig. 4

5/7

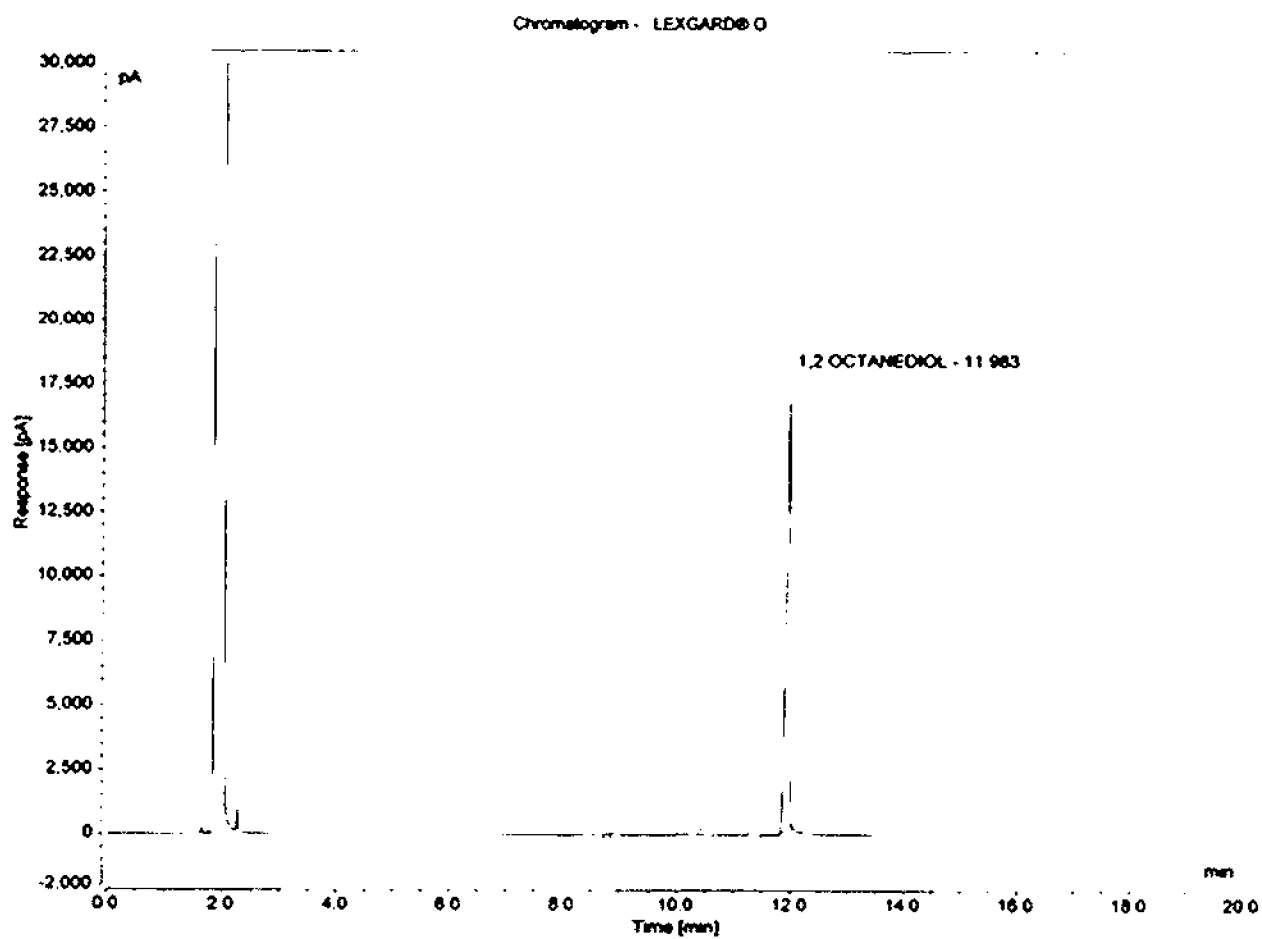


Fig. 5

6/7

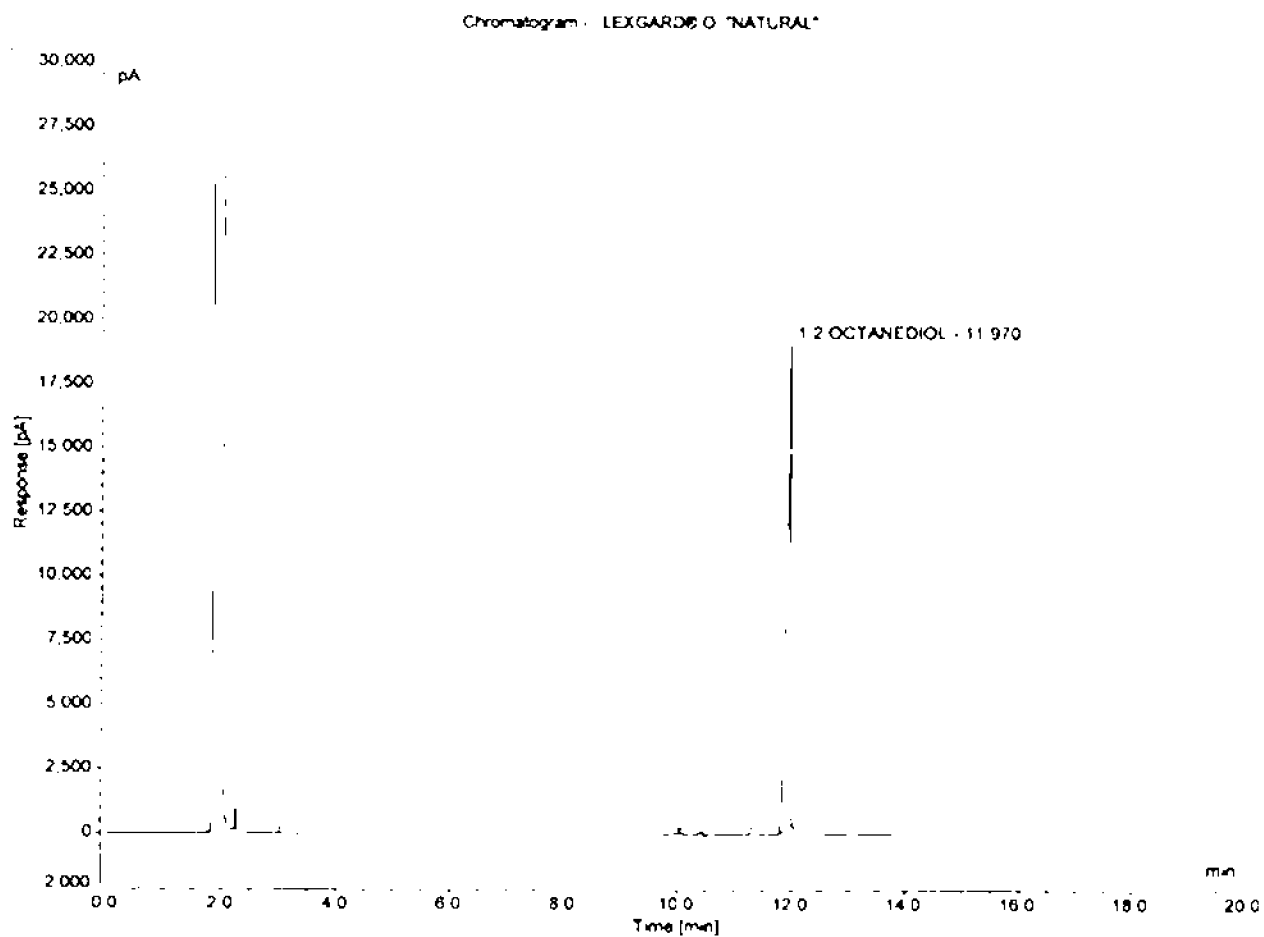


Fig. 6

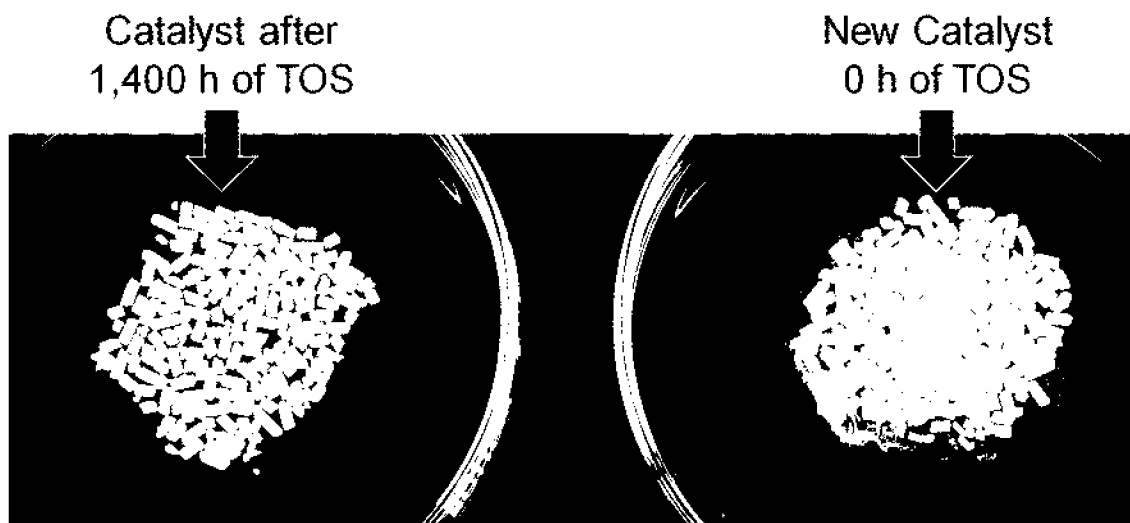


Fig. 7

DECLARATION
(Original application)

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

I believe I am an original sole inventor (if only one name is listed below) or an original joint inventor (if plural names are listed below) of the subject matter that is claimed and for which a patent is sought on the invention entitled:

**NATURAL 1,2-ALKANEDIOLS, COMPOSITIONS HAVING NATURAL 1,2-
ALKANEDIOLS AND PROCESSES FOR MAKING THE SAME.**

the specification of which is attached hereto and/or was filed on _____ as Application No. _____.

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to herein.

The above-identified application was made or was authorized to be made by me.

I hereby claim foreign priority benefits under 35 U.S.C. §119(a)-(d), of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

FOREIGN PRIORITY APPLICATION(S)

		Priority Claimed
(Number)	(Country)	[] Yes [] No
		[] Yes [] No
(Number)	(Country)	
	(Day/month/year filed)	

I hereby claim the benefit under 35 U.S.C. §119(e) of any United States provisional patent application(s) listed below:

PROVISIONAL PRIORITY PATENT APPLICATION(S)

62/623,985	January 30, 2018	Priority Claimed
(Application No.)	(Filing Date)	[X] Yes [] No

_____	_____	[] Yes [] No
(Application No.)	(Filing Date)	

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements made in this Declaration are punishable under 18 U.S.C. §1001 by fine or imprisonment of not more than five (5) years.

Full name of first or sole inventor	Rocco V. Burgo
-------------------------------------	----------------

Inventor's Signature

Date

Residence	Mullica Hill, New Jersey
-----------	--------------------------

Citizenship	United States
-------------	---------------

Post Office Address	604 Widgeon Court, Mullica Hill, New Jersey 08062
---------------------	---

Full name of second inventor	Michael E. Wright
------------------------------	-------------------

Inventor's Signature

Date

Residence	Hurricane, Utah
-----------	-----------------

Citizenship	United States
-------------	---------------

Post Office Address	4175 S. 1200 W., Hurricane, Utah 84737
---------------------	--

Full name of third
inventor Gary B. Mosser

Inventor's Signature

Date

Residence Tabernacle, New Jersey

Citizenship United States

Post Office Address 5 Colonial Court, Tabernacle, New Jersey 08088

Full name of fourth
inventor Michael J. Fevola

Inventor's Signature

Date

Residence Belle Mead, New Jersey

Citizenship United States

Post Office Address 409 Township Line Road, Belle Mead, New Jersey 08502

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	I0113-198U2
		Application Number	
Title of Invention	Natural 1,2-Alkanediols, Compositions Having Natural 1,2-Alkanediols and Processes for Making the Same		
The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76. This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.			

Secrecy Order 37 CFR 5.2:

☐	Portions or all of the application associated with this Application Data Sheet may fall under a Secrecy Order pursuant to 37 CFR 5.2 (Paper filers only. Applications that fall under Secrecy Order may not be filed electronically.)
--------------------------	---

Inventor Information:

Inventor	1				Remove
Legal Name					
Prefix	Given Name	Middle Name	Family Name	Suffix	
	Rocco	V.	Burgo		
Residence Information (Select One) ☒ US Residency ☐ Non US Residency ☐ Active US Military Service					
City	Mullica Hill	State/Province	NJ	Country of Residence	US

Mailing Address of Inventor:

Address 1	604 Widgeon Court				
Address 2					
City	Mullica Hill	State/Province	NJ		
Postal Code	08062	Country	US		

Inventor	2				Remove
Legal Name					
Prefix	Given Name	Middle Name	Family Name	Suffix	
	Michael	E.	Wright		
Residence Information (Select One) ☒ US Residency ☐ Non US Residency ☐ Active US Military Service					
City	Hurricane	State/Province	UT	Country of Residence	US

Mailing Address of Inventor:

Address 1	4175 S. 1200 W.				
Address 2					
City	Hurricane	State/Province	UT		
Postal Code	84737	Country	US		

Inventor	3				Remove
Legal Name					
Prefix	Given Name	Middle Name	Family Name	Suffix	
	Gary	B.	Mosser		
Residence Information (Select One) ☒ US Residency ☐ Non US Residency ☐ Active US Military Service					

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	I0113-198U2
		Application Number	
Title of Invention	Natural 1,2-Alkanediols, Compositions Having Natural 1,2-Alkanediols and Processes for Making the Same		

City	Tabernacle	State/Province	NJ	Country of Residence	US
------	------------	----------------	----	----------------------	----

Mailing Address of Inventor:

Address 1	5 Colonial Court				
Address 2					
City	Tabernacle	State/Province	NJ		
Postal Code	08088	Country	US		
Inventor	4				Remove
Legal Name					

Prefix	Given Name	Middle Name	Family Name	Suffix
	Michael	J.	Fevola	

Residence Information (Select One) ☒ US Residency ☐ Non US Residency ☐ Active US Military Service					
City	Belle Mead	State/Province	NJ	Country of Residence	US

Mailing Address of Inventor:

Address 1	409 Township Line Road				
Address 2					
City	Belle Mead	State/Province	NJ		
Postal Code	08502	Country	US		
All Inventors Must Be Listed - Additional Inventor Information blocks may be generated within this form by selecting the Add button. Add					

Correspondence Information:

Enter either Customer Number or complete the Correspondence Information section below. For further information see 37 CFR 1.33(a).			
☐ An Address is being provided for the correspondence information of this application.			
Customer Number	159443		
Email Address	USP@calderonebullock.com	Add Email	Remove Email

Application Information:

Title of the Invention	Natural 1,2-Alkanediols, Compositions Having Natural 1,2-Alkanediols and Processes for Making the Same		
Attorney Docket Number	I0113-198U2	Small Entity Status Claimed ☐	
Application Type	Nonprovisional		
Subject Matter	Utility		
Total Number of Drawing Sheets (if any)	7	Suggested Figure for Publication (if any)	1

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	I0113-198U2
		Application Number	
Title of Invention	Natural 1,2-Alkanediols, Compositions Having Natural 1,2-Alkanediols and Processes for Making the Same		

Filing By Reference:

Only complete this section when filing an application by reference under 35 U.S.C. 111(c) and 37 CFR 1.57(a). Do not complete this section if application papers including a specification and any drawings are being filed. Any domestic benefit or foreign priority information must be provided in the appropriate section(s) below (i.e., "Domestic Benefit/National Stage Information" and "Foreign Priority Information").

For the purposes of a filing date under 37 CFR 1.53(b), the description and any drawings of the present application are replaced by this reference to the previously filed application, subject to conditions and requirements of 37 CFR 1.57(a).

Application number of the previously filed application	Filing date (YYYY-MM-DD)	Intellectual Property Authority or Country

Publication Information:

☐ Request Early Publication (Fee required at time of Request 37 CFR 1.219)

☐ **Request Not to Publish.** I hereby request that the attached application not be published under 35 U.S.C. 122(b) and certify that the invention disclosed in the attached application **has not and will not be** the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing.

Representative Information:

Representative information should be provided for all practitioners having a power of attorney in the application. Providing this information in the Application Data Sheet does not constitute a power of attorney in the application (see 37 CFR 1.32). Either enter Customer Number or complete the Representative Name section below. If both sections are completed the customer Number will be used for the Representative Information during processing.

Please Select One:	☒ Customer Number	☐ US Patent Practitioner	☐ Limited Recognition (37 CFR 11.9)
Customer Number	159443		

Domestic Benefit/National Stage Information:

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, 365(c), or 386(c) or indicate National Stage entry from a PCT application. Providing benefit claim information in the Application Data Sheet constitutes the specific reference required by 35 U.S.C. 119(e) or 120, and 37 CFR 1.78.

When referring to the current application, please leave the "Application Number" field blank.

Prior Application Status	Expired	Remove	
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
	Continuation of	16/262902	2019-01-30

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	I0113-198U2
		Application Number	
Title of Invention	Natural 1,2-Alkanediols, Compositions Having Natural 1,2-Alkanediols and Processes for Making the Same		
Prior Application Status	Pending	Remove	
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
16/262902	Claims benefit of provisional	62623985	2018-01-30
Additional Domestic Benefit/National Stage Data may be generated within this form by selecting the Add button.			Add

Foreign Priority Information:

This section allows for the applicant to claim priority to a foreign application. Providing this information in the application data sheet constitutes the claim for priority as required by 35 U.S.C. 119(b) and 37 CFR 1.55. When priority is claimed to a foreign application that is eligible for retrieval under the priority document exchange program (PDX)ⁱ the information will be used by the Office to automatically attempt retrieval pursuant to 37 CFR 1.55(i)(1) and (2). Under the PDX program, applicant bears the ultimate responsibility for ensuring that a copy of the foreign application is received by the Office from the participating foreign intellectual property office, or a certified copy of the foreign priority application is filed, within the time period specified in 37 CFR 1.55(g)(1).

			Remove
Application Number	Country ⁱ	Filing Date (YYYY-MM-DD)	Access Code ⁱ (if applicable)
Additional Foreign Priority Data may be generated within this form by selecting the Add button.			Add

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications

This application (1) claims priority to or the benefit of an application filed before March 16, 2013 and (2) also contains, or contained at any time, a claim to a claimed invention that has an effective filing date on or after March 16, 2013. ☐ NOTE: By providing this statement under 37 CFR 1.55 or 1.78, this application, with a filing date on or after March 16, 2013, will be examined under the first inventor to file provisions of the AIA.
--

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	I0113-198U2
		Application Number	
Title of Invention	Natural 1,2-Alkanediols, Compositions Having Natural 1,2-Alkanediols and Processes for Making the Same		

Authorization or Opt-Out of Authorization to Permit Access:

When this Application Data Sheet is properly signed and filed with the application, applicant has provided written authority to permit a participating foreign intellectual property (IP) office access to the instant application-as-filed (see paragraph A in subsection 1 below) and the European Patent Office (EPO) access to any search results from the instant application (see paragraph B in subsection 1 below).

Should applicant choose not to provide an authorization identified in subsection 1 below, applicant **must opt-out** of the authorization by checking the corresponding box A or B or both in subsection 2 below.

NOTE: This section of the Application Data Sheet is **ONLY** reviewed and processed with the **INITIAL** filing of an application. After the initial filing of an application, an Application Data Sheet cannot be used to provide or rescind authorization for access by a foreign IP office(s). Instead, Form PTO/SB/39 or PTO/SB/69 must be used as appropriate.

1. Authorization to Permit Access by a Foreign Intellectual Property Office(s)

A. Priority Document Exchange (PDX) - Unless box A in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the European Patent Office (EPO), the Japan Patent Office (JPO), the Korean Intellectual Property Office (KIPO), the State Intellectual Property Office of the People's Republic of China (SIPO), the World Intellectual Property Organization (WIPO), and any other foreign intellectual property office participating with the USPTO in a bilateral or multilateral priority document exchange agreement in which a foreign application claiming priority to the instant patent application is filed, access to: (1) the instant patent application-as-filed and its related bibliographic data, (2) any foreign or domestic application to which priority or benefit is claimed by the instant application and its related bibliographic data, and (3) the date of filing of this Authorization. See 37 CFR 1.14(h)(1).

B. Search Results from U.S. Application to EPO - Unless box B in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the EPO access to the bibliographic data and search results from the instant patent application when a European patent application claiming priority to the instant patent application is filed. See 37 CFR 1.14(h)(2).

The applicant is reminded that the EPO's Rule 141(1) EPC (European Patent Convention) requires applicants to submit a copy of search results from the instant application without delay in a European patent application that claims priority to the instant application.

2. Opt-Out of Authorizations to Permit Access by a Foreign Intellectual Property Office(s)

☐ A. Applicant **DOES NOT** authorize the USPTO to permit a participating foreign IP office access to the instant application-as-filed. If this box is checked, the USPTO will not be providing a participating foreign IP office with any documents and information identified in subsection 1A above.

☐ B. Applicant **DOES NOT** authorize the USPTO to transmit to the EPO any search results from the instant patent application. If this box is checked, the USPTO will not be providing the EPO with search results from the instant application.

NOTE: Once the application has published or is otherwise publicly available, the USPTO may provide access to the application in accordance with 37 CFR 1.14.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	I0113-198U2
		Application Number	
Title of Invention	Natural 1,2-Alkanediols, Compositions Having Natural 1,2-Alkanediols and Processes for Making the Same		

Applicant Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

Applicant	1	Remove
If the applicant is the inventor (or the remaining joint inventor or inventors under 37 CFR 1.45), this section should not be completed. The information to be provided in this section is the name and address of the legal representative who is the applicant under 37 CFR 1.43; or the name and address of the assignee, person to whom the inventor is under an obligation to assign the invention, or person who otherwise shows sufficient proprietary interest in the matter who is the applicant under 37 CFR 1.46. If the applicant is an applicant under 37 CFR 1.46 (assignee, person to whom the inventor is obligated to assign, or person who otherwise shows sufficient proprietary interest) together with one or more joint inventors, then the joint inventor or inventors who are also the applicant should be identified in this section. Clear		
☒ Assignee	Legal Representative under 35 U.S.C. 117	Joint Inventor
Person to whom the inventor is obligated to assign.		Person who shows sufficient proprietary interest
If applicant is the legal representative, indicate the authority to file the patent application, the inventor is:		
Name of the Deceased or Legally Incapacitated Inventor:		
If the Applicant is an Organization check here. ☒		
Organization Name	Inolex Investment Corporation	
Mailing Address Information For Applicant:		
Address 1	103 Springer Building	
Address 2	3411 Silverside Road	
City	Wilmington	State/Province DE
Country	US	Postal Code 19810
Phone Number		Fax Number
Email Address		
Additional Applicant Data may be generated within this form by selecting the Add button. Add		

Assignee Information including Non-Applicant Assignee Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	I0113-198U2
		Application Number	
Title of Invention	Natural 1,2-Alkanediols, Compositions Having Natural 1,2-Alkanediols and Processes for Making the Same		

Assignee	1			
Complete this section if assignee information, including non-applicant assignee information, is desired to be included on the patent application publication. An assignee-applicant identified in the "Applicant Information" section will appear on the patent application publication as an applicant. For an assignee-applicant, complete this section only if identification as an assignee is also desired on the patent application publication.				
				Remove
If the Assignee or Non-Applicant Assignee is an Organization check here.				☐
Prefix	Given Name	Middle Name	Family Name	Suffix
Mailing Address Information For Assignee including Non-Applicant Assignee:				
Address 1				
Address 2				
City		State/Province		
Country ⁱ		Postal Code		
Phone Number		Fax Number		
Email Address				
Additional Assignee or Non-Applicant Assignee Data may be generated within this form by selecting the Add button.				Add

Signature:

NOTE: This Application Data Sheet must be signed in accordance with 37 CFR 1.33(b). However, if this Application Data Sheet is submitted with the **INITIAL** filing of the application and either box A or B is not checked in subsection 2 of the "Authorization or Opt-Out of Authorization to Permit Access" section, then this form must also be signed in accordance with 37 CFR 1.14(c).

This Application Data Sheet **must** be signed by a patent practitioner if one or more of the applicants is a **juristic entity** (e.g., corporation or association). If the applicant is two or more joint inventors, this form must be signed by a patent practitioner, **all** joint inventors who are the applicant, or one or more joint inventor-applicants who have been given power of attorney (e.g., see USPTO Form PTO/AIA/81) on behalf of **all** joint inventor-applicants.

See 37 CFR 1.4(d) for the manner of making signatures and certifications.

Signature	/Lynda L. Calderone/		Date (YYYY-MM-DD)	2018-01-30
First Name	Lynda L.	Last Name	Calderone	Registration Number
				35837
Additional Signature may be generated within this form by selecting the Add button.				Add

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	I0113-198U2
		Application Number	
Title of Invention	Natural 1,2-Alkanediols, Compositions Having Natural 1,2-Alkanediols and Processes for Making the Same		

This collection of information is required by 37 CFR 1.76. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 23 minutes to complete, including gathering, preparing, and submitting the completed application data sheet form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these records.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Electronic Patent Application Fee Transmittal				
Application Number:				
Filing Date:				
Title of Invention:		Natural 1,2-Alkanediols, Compositions Having Natural 1,2-Alkanediols and Processes for Making The Same		
First Named Inventor/Applicant Name:		Rocco Burgo		
Filer:		Kristyne Alison Bullock		
Attorney Docket Number:		I0113-198U3		
Filed as Large Entity				
Filing Fees for Utility under 35 USC 111(a)				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
UTILITY APPLICATION FILING	1011	1	300	300
UTILITY SEARCH FEE	1111	1	660	660
UTILITY EXAMINATION FEE	1311	1	760	760
Pages:				
Claims:				
CLAIMS IN EXCESS OF 20	1202	8	100	800
Miscellaneous-Filing:				
LATE FILING FEE FOR OATH OR DECLARATION	1051	1	160	160

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
Total in USD (\$)				2680

Electronic Acknowledgement Receipt

EFS ID:	37728042
Application Number:	16682059
International Application Number:	
Confirmation Number:	6533
Title of Invention:	Natural 1,2-Alkanediols, Compositions Having Natural 1,2-Alkanediols and Processes for Making The Same
First Named Inventor/Applicant Name:	Rocco Burgo
Customer Number:	159443
Filer:	Kristyne Alison Bullock
Filer Authorized By:	
Attorney Docket Number:	I0113-198U3
Receipt Date:	13-NOV-2019
Filing Date:	
Time Stamp:	11:42:55
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	\$2680
RAM confirmation Number	E2019ACB43399641
Deposit Account	602689
Authorized User	KRISTYNE BULLOCK

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

37 CFR 1.16 (National application filing, search, and examination fees)

37 CFR 1.17 (Patent application and reexamination processing fees)

37 CFR 1.19 (Document supply fees)
37 CFR 1.20 (Post Issuance fees)
37 CFR 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Transmittal of New Application	Transmittal.pdf	227234	no	3
			228d85c4236055061aa42001161808475f46c789		
Warnings:					
Information:					
2		Specification.pdf	431965	yes	44
			442aee1800e663c907fdc9f57f00e217ceabfd42		
	Multipart Description/PDF files in .zip description				
	Document Description		Start	End	
	Specification		1	41	
	Claims		42	43	
	Abstract		44	44	
Warnings:					
Information:					
3	Drawings-only black and white line drawings	Drawings.pdf	98804	no	7
			a97d5bd4168fa5f5441deadd8ff4987a4c27c149		
Warnings:					
Information:					
4	Oath or Declaration filed	Declaration.pdf	101955	no	3
			6cd38152f89d596aa40570765d3cd45821a5cf68		
Warnings:					
Information:					
5	Application Data Sheet	ADS198U3.pdf	1354430	no	9
			b3ddb8f41867ccdfc88642a7099fbd974062656d		

Warnings:					
Information:					
6	Fee Worksheet (SB06)	fee-info.pdf	38697	no	2
			55c7ac09b40cbaf50df423a83a4ee72fc0b9db6a		
Warnings:					
Information:					
Total Files Size (in bytes):				2253085	
This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503. <u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application. <u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course. <u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.					



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY. DOCKET NO	TOT CLAIMS	IND CLAIMS
16/682,059	11/13/2019		2680	I0113-198U3	28	1

CONFIRMATION NO. 6533

159443

Calderone Bullock LLC
Two Greentree Centre, Suite 301
9000 Lincoln Drive East
Marlton, NJ 08053

FILING RECEIPT



0000000113043978

Date Mailed: 12/04/2019

Receipt is acknowledged of this non-provisional utility patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF FIRST INVENTOR, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection.

Please verify the accuracy of the data presented on this receipt. If an error is noted on this Filing Receipt, please submit a written request for a corrected Filing Receipt, including a properly marked-up ADS showing the changes with strike-through for deletions and underlining for additions. If you received a "Notice to File Missing Parts" or other Notice requiring a response for this application, please submit any request for correction to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections provided that the request is grantable.

Inventor(s)

Rocco V. Burgo, Mullica Hill, NJ;
Michael E. Wright, Hurricane, UT;
Gary B. Mosser, Tabernacle, NJ;
Michael J. Fevola, Belle Mead, NJ;

Applicant(s)

Inlex Investment Corporation, Wilmington, DE;

Assignment For Published Patent Application

Inlex Investment Corporation

Power of Attorney: None

Domestic Priority data as claimed by applicant

This application is a CON of 16/262,902 01/30/2019
which claims benefit of 62/623,985 01/30/2018

Foreign Applications for which priority is claimed (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see <http://www.uspto.gov> for more information.) - None.

Foreign application information must be provided in an Application Data Sheet in order to constitute a claim to foreign priority. See 37 CFR 1.55 and 1.76.

Permission to Access Application via Priority Document Exchange: Yes

Permission to Access Search Results: Yes

Applicant may provide or rescind an authorization for access using Form PTO/SB/39 or Form PTO/SB/69 as appropriate.

If Required, Foreign Filing License Granted: 12/02/2019

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 16/682,059**

Projected Publication Date: To Be Determined - pending completion of Corrected Papers

Non-Publication Request: No

Early Publication Request: No

Title

Natural 1,2-Alkanediols, Compositions Having Natural 1,2-Alkanediols and Processes for Making the Same

Preliminary Class

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications: No

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at <http://www.uspto.gov/web/offices/pac/doc/general/index.html>.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, <http://www.stopfakes.gov>. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific

countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4258).

LICENSE FOR FOREIGN FILING UNDER
Title 35, United States Code, Section 184
Title 37, Code of Federal Regulations, 5.11 & 5.15

GRANTED

The applicant has been granted a license under 35 U.S.C. 184, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" followed by a date appears on this form. Such licenses are issued in all applications where the conditions for issuance of a license have been met, regardless of whether or not a license may be required as set forth in 37 CFR 5.15. The scope and limitations of this license are set forth in 37 CFR 5.15(a) unless an earlier license has been issued under 37 CFR 5.15(b). The license is subject to revocation upon written notification. The date indicated is the effective date of the license, unless an earlier license of similar scope has been granted under 37 CFR 5.13 or 5.14.

This license is to be retained by the licensee and may be used at any time on or after the effective date thereof unless it is revoked. This license is automatically transferred to any related applications(s) filed under 37 CFR 1.53(d). This license is not retroactive.

The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data. Licensees should apprise themselves of current regulations especially with respect to certain countries, of other agencies, particularly the Office of Defense Trade Controls, Department of State (with respect to Arms, Munitions and Implements of War (22 CFR 121-128)); the Bureau of Industry and Security, Department of Commerce (15 CFR parts 730-774); the Office of Foreign Assets Control, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

NOT GRANTED

No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).

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The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The U.S. offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to promote and facilitate business investment. SelectUSA provides information assistance to the international investor community; serves as an ombudsman for existing and potential investors; advocates on behalf of U.S. cities, states, and regions competing for global investment; and counsels U.S. economic development organizations on investment attraction best practices. To learn more about why the United States is the best country in the world to develop

technology, manufacture products, deliver services, and grow your business, visit <http://www.SelectUSA.gov> or call +1-202-482-6800.

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875						Application or Docket Number 16/682,059	
APPLICATION AS FILED - PART I							
(Column 1)		(Column 2)		SMALL ENTITY		OTHER THAN SMALL ENTITY	
FOR	NUMBER FILED	NUMBER EXTRA	RATE(\$)	FEE(\$)		RATE(\$)	FEE(\$)
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	300
SEARCH FEE (37 CFR 1.16(k), (l), or (m))	N/A	N/A	N/A			N/A	660
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	760
TOTAL CLAIMS (37 CFR 1.16(j))	28	minus 20 = * 8			OR	x 100 =	800
INDEPENDENT CLAIMS (37 CFR 1.16(h))	1	minus 3 = *				x 460 =	0.00
APPLICATION SIZE FEE (37 CFR 1.16(s)) If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$310 (\$155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).							0.00
							0.00
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							0.00
			TOTAL			TOTAL	2520
* If the difference in column 1 is less than zero, enter "0" in column 2.							
APPLICATION AS AMENDED - PART II							
(Column 1)		(Column 2)		(Column 3)		SMALL ENTITY	
AMENDMENT A	CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE(\$)	ADDITIONAL FEE(\$)		RATE(\$)
	Total (37 CFR 1.16(i))	*	Minus **	=	x =	OR	x =
	Independent (37 CFR 1.16(h))	*	Minus ***	=	x =	OR	x =
	Application Size Fee (37 CFR 1.16(s))					OR	
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))					OR	
			TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	
(Column 1)		(Column 2)		(Column 3)		SMALL ENTITY	
AMENDMENT B	CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE(\$)	ADDITIONAL FEE(\$)		RATE(\$)
	Total (37 CFR 1.16(i))	*	Minus **	=	x =	OR	x =
	Independent (37 CFR 1.16(h))	*	Minus ***	=	x =	OR	x =
	Application Size Fee (37 CFR 1.16(s))					OR	
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))					OR	
			TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	
* If the entry in column 1 is less than the entry in column 2, write "0" in column 3. ** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20". *** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3". The "Highest Number Previously Paid For" (Total or Independent) is the highest found in the appropriate box in column 1.							



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
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P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
16/682,059	11/13/2019	Rocco V. Burgo	I0113-198U3

CONFIRMATION NO. 6533

FORMALITIES LETTER



OC000000113043977

159443
Calderone Bullock LLC
Two Greentree Centre, Suite 301
9000 Lincoln Drive East
Marlton, NJ 08053

Date Mailed: 12/04/2019

NOTICE TO FILE CORRECTED APPLICATION PAPERS

Filing Date Granted

An application number and filing date have been accorded to this application. The application is informal since it does not comply with the regulations for the reason(s) indicated below. Applicant is given **TWO MONTHS** from the date of this Notice within which to correct the informalities indicated below. Extensions of time may be obtained by filing a petition accompanied by the extension fee under the provisions of 37 CFR 1.136(a).

The required item(s) identified below must be timely submitted to avoid abandonment:

- A substitute specification in compliance with 37 CFR 1.52, 1.121(b)(3), and 1.125, is required. The substitute specification must be submitted with markings and be accompanied by a clean version (without markings) as set forth in 37 CFR 1.125(c) and a statement that the substitute specification contains no new matter (see 37 CFR 1.125(b)). The specification, claims, and/or abstract page(s) submitted is not acceptable and cannot be scanned or properly stored because:
 - The claims page(s) 42 contain improper margins. Each sheet must have a left margin of at least 2.5 cm (1") and top, bottom, and right margins of at least 2.0 cm (3/4"). A complete claim listing, with all pages containing the proper margins, must be submitted.
- Replacement drawings in compliance with 37 CFR 1.84 and 37 CFR 1.121(d) are required. The drawings submitted are not acceptable because:
 - The drawings have a line quality that is too light to be reproduced (weight of all lines and letters must be heavy enough to permit adequate reproduction) or text that is illegible (reference characters, sheet numbers, and view numbers must be plain and legible) see 37 CFR 1.84(l) and (p)(1)); See Figure(s) 3-6.
 - The drawings submitted to the Office are not electronically reproducible because portions of figures 3-6 are missing and/or blurry.

Applicant is cautioned that correction of the above items may cause the specification and drawings page count to exceed 100 pages. If the specification and drawings exceed 100 pages, applicant will need to submit the required application size fee.

Items Required To Avoid Processing Delays:

Applicant is notified that the above-identified application contains the deficiencies noted below. No period for reply is set forth in this notice for correction of these deficiencies. However, if a deficiency relates to the inventor's oath or declaration, the applicant must file an oath or declaration in compliance with 37 CFR 1.63, or a substitute statement in compliance with 37 CFR 1.64, executed by or with respect to each actual inventor no later than the expiration of the time period set in the "Notice of Allowability" to avoid abandonment. See 37 CFR 1.53(f).

- A properly executed inventor's oath or declaration has not been received for the following inventor(s):
Rocco V. Burgo
Michael E. Wright
Gary B. Mosser
Michael J. Fevola

Replies must be received in the USPTO within the set time period or must include a proper Certificate of Mailing or Transmission under 37 CFR 1.8 with a mailing or transmission date within the set time period. For more information and a suggested format, see Form PTO/SB/92 and MPEP 512.

Replies should be mailed to:

Mail Stop Missing Parts
Commissioner for Patents
P.O. Box 1450
Alexandria VA 22313-1450

Registered users of EFS-Web may alternatively submit their reply to this notice via EFS-Web, including a copy of this Notice and selecting the document description "Applicant response to Pre-Exam Formalities Notice".
<https://portal.uspto.gov/authenticate/AuthenticateUserLocalEPF.html>

For more information about EFS-Web please call the USPTO Electronic Business Center at 1-866-217-9197 or visit our website at <http://www.uspto.gov/ebc>.

If you are not using EFS-Web to submit your reply, you must include a copy of this notice.

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at (571) 272-4000 or (571) 272-4200 or 1-888-786-0101.

/hchin/

SCORE Placeholder Sheet for IFW Content

Application Number: 16682059

Document Date: 01/16/2020

The presence of this form in the IFW record indicates that the following document type was received in electronic format on the date identified above. This content is stored in the SCORE database.

Since this was an electronic submission, there is no physical artifact folder, no artifact folder is recorded in PALM, and no paper documents or physical media exist. The TIFF images in the IFW record were created from the original documents that are stored in SCORE.

- Drawing

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In Re Patent Application of:	:	
Inolex Investment Corporation	:	
	:	
Conf. No.: 6533	:	Group Art Unit: Not Yet Assigned
	:	
Appln. No.: 16/682,059	:	Examiner: Not Yet Assigned
	:	
Filing Date: November 13, 2019	:	Attorney Docket No.: I0113-198U3
	:	
Title: Natural 1,2-Alkanediols, Compositions Having Natural 1,2-Alkanediols and Processes for Making the Same	:	

RESPONSE TO NOTICE TO FILE CORRECTED APPLICATION PAPERS

This is in response to Notice to File Corrected Application Papers ("Notice") dated December 4, 2019. This response is being timely filed on or before February 4, 2020. The Notice requested new drawings sheets for Figures 3-6. Attached are Replacement Drawing Sheets 3-6 that satisfy the issue cited in the Notice to File Corrected Application Papers (weight of lines were not heavy enough to permit adequate reproduction). In addition, we voluntarily submit new clean drawing sheets 1-2 and 7. No new matter has been incorporated in the new drawing sheets.

The Notice objects to the specifications, page 42, which is the first page of the claims as having margins that do not meet the minimum margin requirements. Applicant inspected the paper copy and uploaded PAIR copy and each is fully compliant with the minimum margin requirements. The objection appears to be in error on the PTO's part and should be withdrawn.

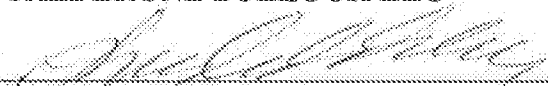
Applicant respectfully submits that the issues raised in the Notice have been fully addressed. Publication and examination are requested.

Response to Notice to File Corrected Application Papers dated December 4, 2019
Application No. 16/682,059

Respectfully submitted,

CALDERONE BULLOCK LLC

1/16/20

By: 

LYNDA L. CALDERONE

Registration No. 35,837

Two Greentree Centre

9000 Lincoln Drive East, Suite 301

Marlton, NJ 08053

Telephone: 856-446-6047

Direct Dial: 856-446-6045

Facsimile: 856-267-5370

E-Mail: lcalderone@calderonebullock.com

LLC:dw

Enclosures: Replacement Drawing Sheets 1-7

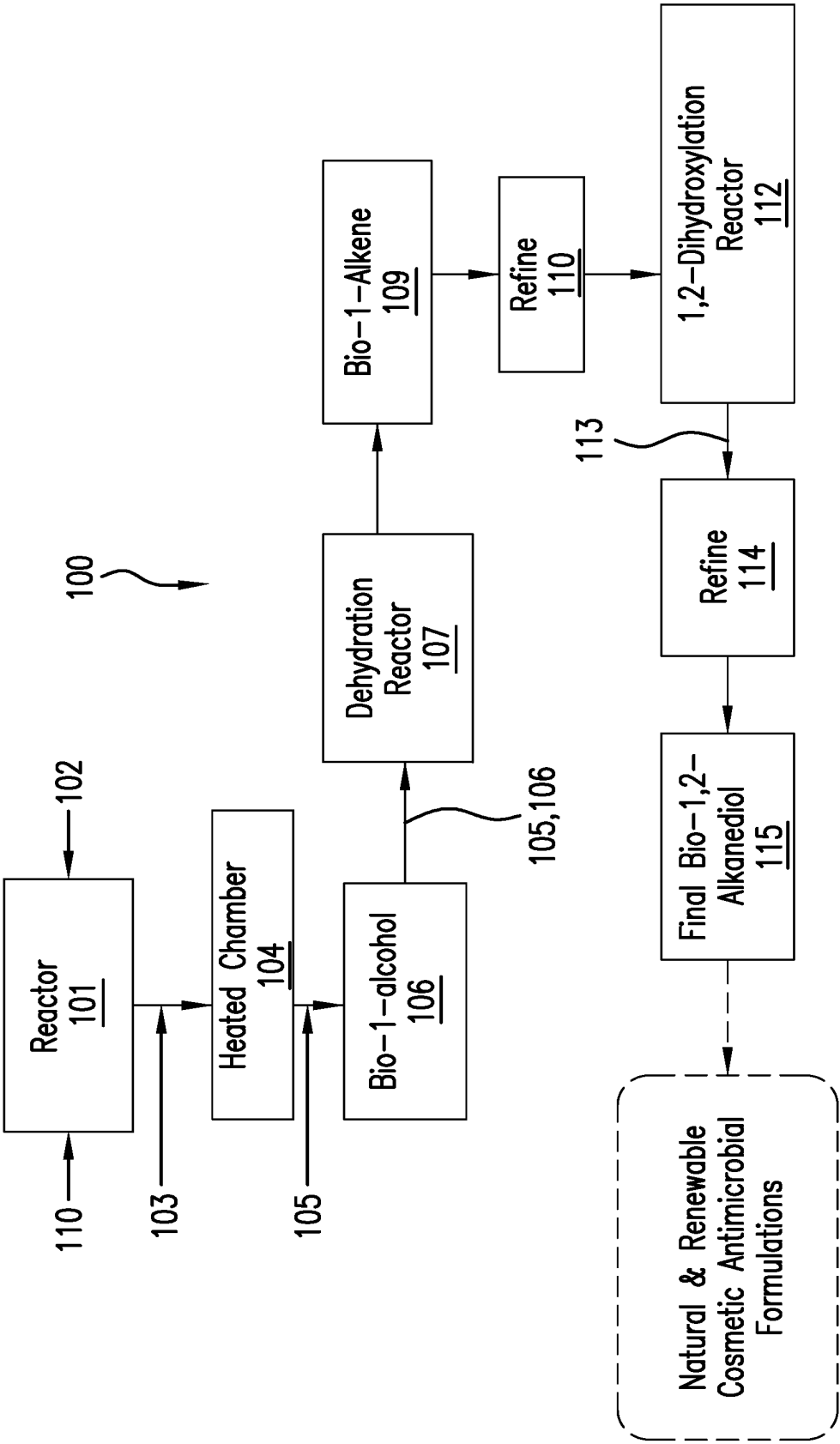


FIG.1

REPLACEMENT SHEET

2/7

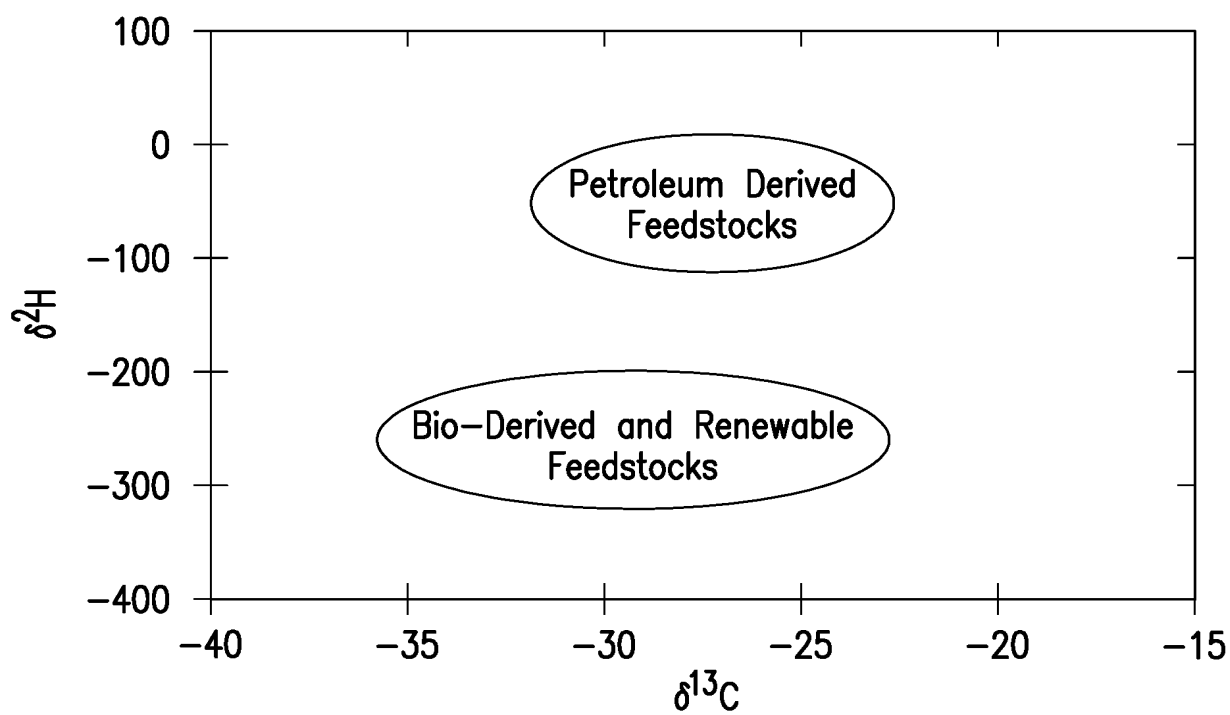


FIG.2

REPLACEMENT SHEET

3/7

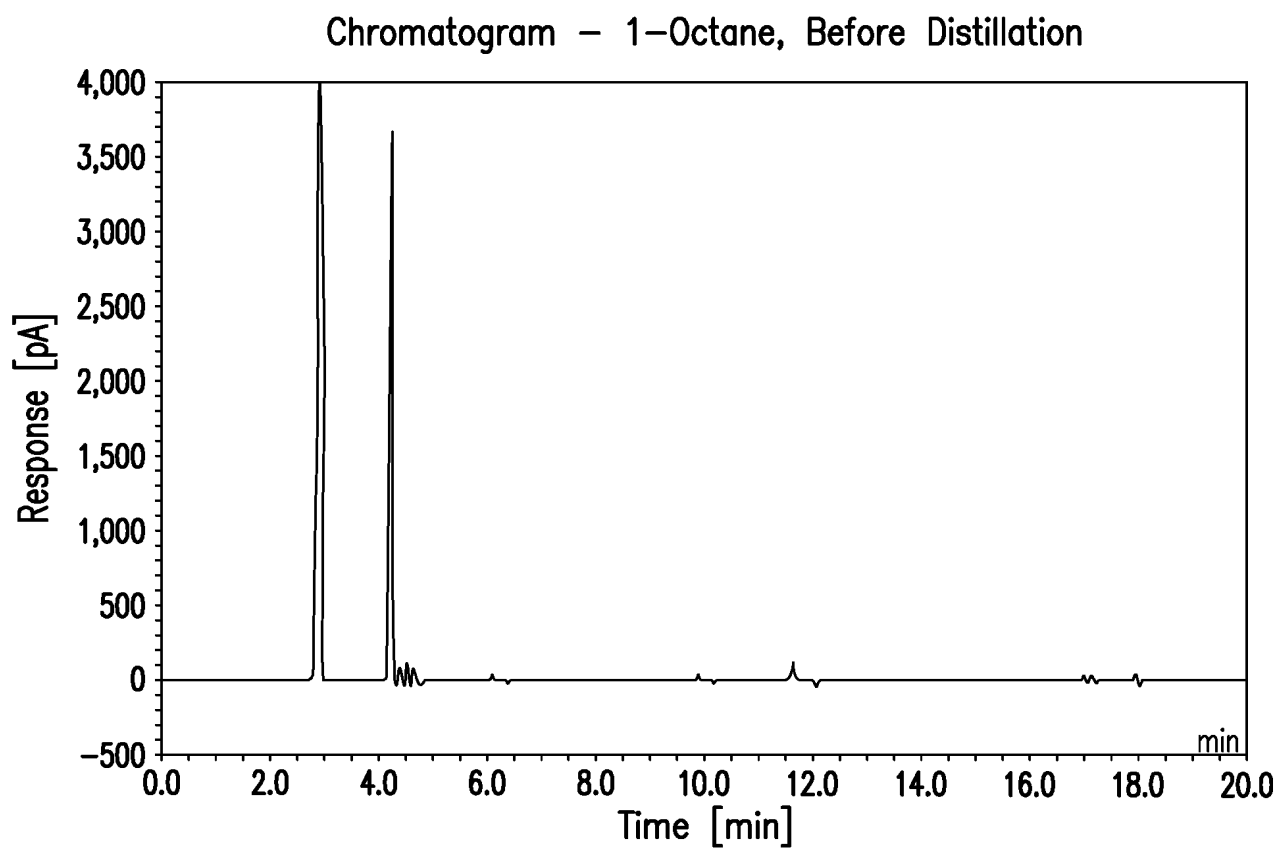


FIG.3

REPLACEMENT SHEET

4/7

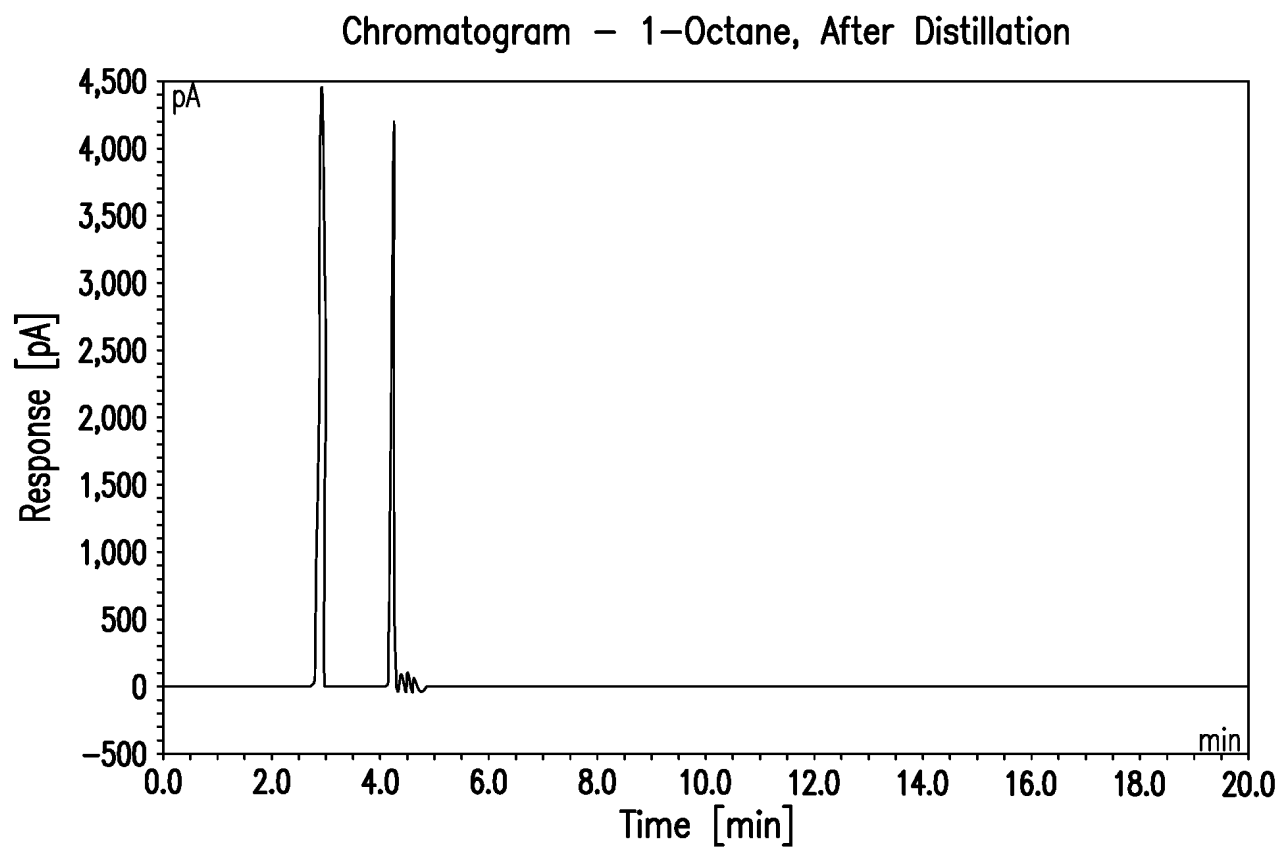


FIG.4

REPLACEMENT SHEET

5/7

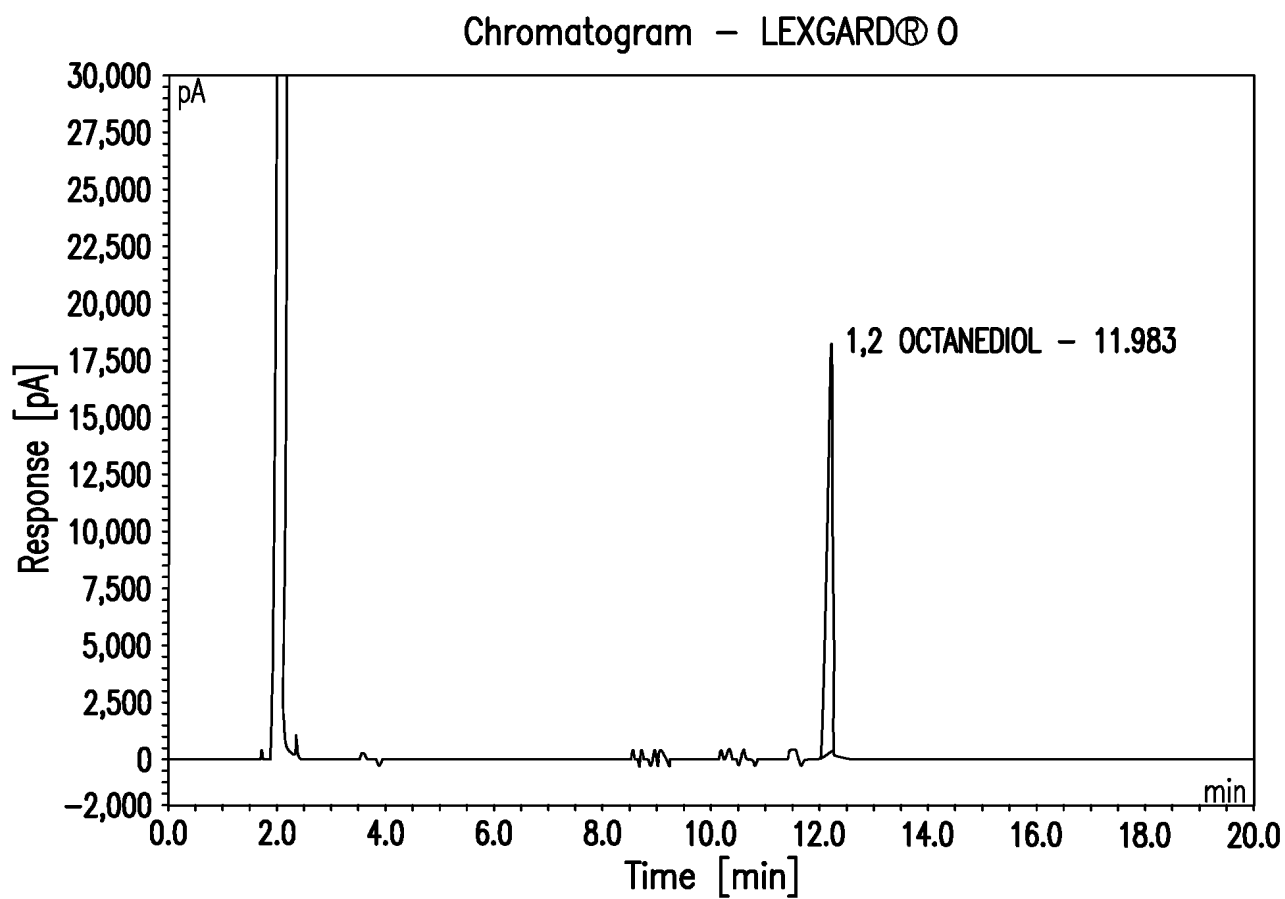


FIG.5

REPLACEMENT SHEET

6/7

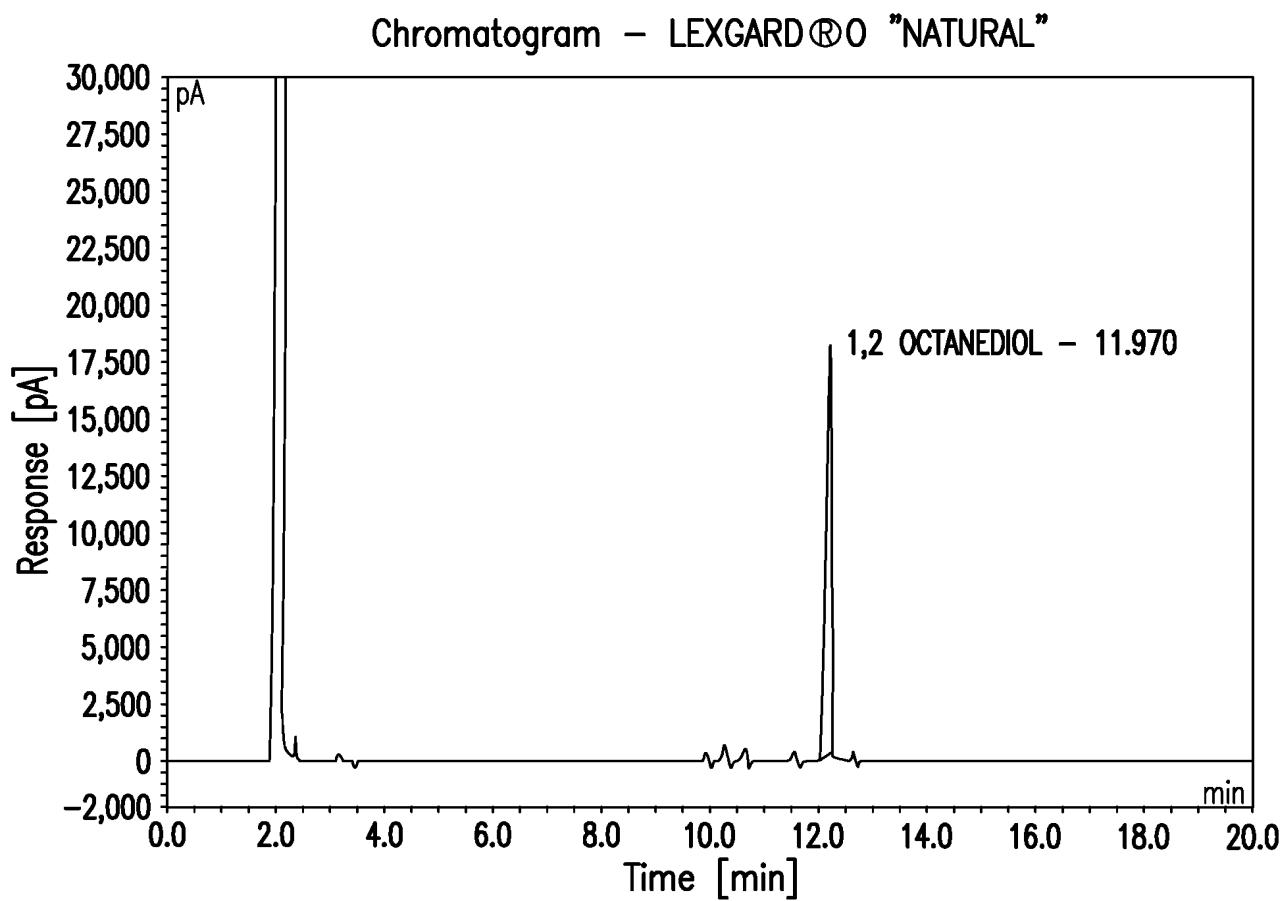


FIG.6

REPLACEMENT SHEET

7/7

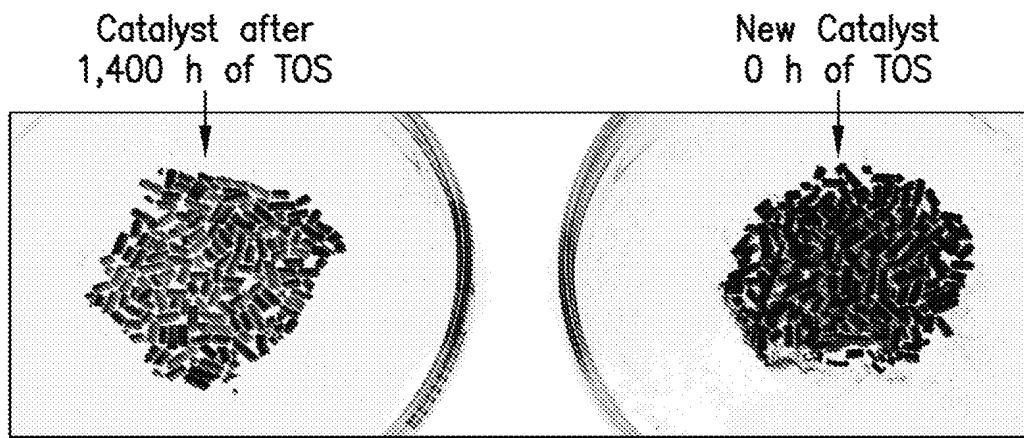


FIG.7

Electronic Acknowledgement Receipt

EFS ID:	38319607
Application Number:	16682059
International Application Number:	
Confirmation Number:	6533
Title of Invention:	Natural 1,2-Alkanediols, Compositions Having Natural 1,2-Alkanediols and Processes for Making the Same
First Named Inventor/Applicant Name:	Rocco V. Burgo
Customer Number:	159443
Filer:	lynda Leigh Calderone
Filer Authorized By:	
Attorney Docket Number:	I0113-198U3
Receipt Date:	16-JAN-2020
Filing Date:	13-NOV-2019
Time Stamp:	17:20:53
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no
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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Applicant Response to Pre-Exam Formalities Notice	ResponsetoNoticetoFileCorrectedApplicationPapers.pdf	66966	no	2
			98604b6705e8c09b9fee2ecaec94deb72affbc69		

Warnings:

Information:					
2	Drawings-only black and white line drawings	replacementdrawings.pdf	756521	no	7
			58ad33754f7e90afb719ea7567d6c626e4254a38		
Warnings:					
Information:					
Total Files Size (in bytes):				823487	
This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503. <u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application. <u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course. <u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.					

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875						Application or Docket Number 16/682,059				
APPLICATION AS FILED - PART I										
(Column 1)		(Column 2)		SMALL ENTITY		OR OTHER THAN SMALL ENTITY				
FOR	NUMBER FILED	NUMBER EXTRA	RATE(\$)	FEE(\$)		RATE(\$)	FEE(\$)			
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	300			
SEARCH FEE (37 CFR 1.16(k), (l), or (m))	N/A	N/A	N/A			N/A	660			
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	760			
TOTAL CLAIMS (37 CFR 1.16(j))	28 minus 20 =	*				x 100 =	800			
INDEPENDENT CLAIMS (37 CFR 1.16(h))	1 minus 3 =	*				x 460 =	0.00			
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$310 (\$155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).						0.00			
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							0.00			
* If the difference in column 1 is less than zero, enter "0" in column 2.				TOTAL		TOTAL	2520			
APPLICATION AS AMENDED - PART II										
(Column 1)		(Column 2)		(Column 3)		SMALL ENTITY		OR OTHER THAN SMALL ENTITY		
AMENDMENT A		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE(\$)	ADDITIONAL FEE(\$)		RATE(\$)	ADDITIONAL FEE(\$)
	Total (37 CFR 1.16(i))	*	Minus	**	=	x =			x =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x =			x =	
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))									
						TOTAL ADD'L FEE			TOTAL ADD'L FEE	
AMENDMENT B		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE(\$)	ADDITIONAL FEE(\$)		RATE(\$)	ADDITIONAL FEE(\$)
	Total (37 CFR 1.16(i))	*	Minus	**	=	x =			x =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x =			x =	
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))									
						TOTAL ADD'L FEE			TOTAL ADD'L FEE	
* If the entry in column 1 is less than the entry in column 2, write "0" in column 3. ** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20". *** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3". The "Highest Number Previously Paid For" (Total or Independent) is the highest found in the appropriate box in column 1.										



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
16/682,059	11/13/2019	Rocco V. Burgo	I0113-198U3

CONFIRMATION NO. 6533

FORMALITIES LETTER



OC000000114076358

159443
Calderone Bullock LLC
Two Greentree Centre, Suite 301
9000 Lincoln Drive East
Marlton, NJ 08053

Date Mailed: 01/22/2020

NOTICE OF INCOMPLETE REPLY (NONPROVISIONAL)

Filing Date Granted

The U.S. Patent and Trademark Office has received your reply on 01/16/2020 to the NOTICE TO FILE CORRECTED APPLICATION PAPERS (Notice) mailed 12/04/2019 and it has been entered into the application. The reply, however, is not a complete reply for the reason(s) listed below. A complete reply must be timely filed to prevent ABANDONMENT of the above-identified application. Replies should be mailed to: Mail Stop Missing Parts, Commissioner for Patents, P.O.Box 1450, Alexandria VA 22313-1450.

The period for reply continues to run from the date of the Notice mailed 12/04/2019. Applicant must submit all required items and pay any fees required below within two months from the date of the NOTICE TO FILE CORRECTED APPLICATION PAPERS to avoid abandonment. If the reply is submitted after two months from the date of the NOTICE TO FILE CORRECTED APPLICATION PAPERS, extensions of time may be obtained by filing a petition accompanied by the extension fee under the provisions of 37 CFR 1.136(a).

Items Required to Avoid Abandonment:

The required items noted below SHOULD be filed along with any items required above.

The application is informal since it does not comply with the regulations for the reason(s) indicated below.

The required item(s) identified below must be timely submitted to avoid abandonment:

- A substitute specification in compliance with 37 CFR 1.52, 1.121(b)(3), and 1.125, is required. The substitute specification must be submitted with markings and be accompanied by a clean version (without markings) as set forth in 37 CFR 1.125(c) and a statement that the substitute specification contains no new matter (see 37 CFR 1.125(b)). The specification, claims, and/or abstract page(s) submitted is not acceptable and cannot be scanned or properly stored because:
 - The claims page(s) 42 contain improper margins. Each sheet must have a left margin of at least 2.5 cm (1") and top, bottom, and right margins of at least 2.0 cm (3/4"). A complete claim listing, with all pages containing the proper margins, must be submitted.

Applicant is cautioned that correction of the above items may cause the specification and drawings page count to exceed 100 pages. If the specification and drawings exceed 100 pages, applicant will need to submit the required application size fee.

Items Required To Avoid Processing Delays:

Applicant is notified that the above-identified application contains the deficiencies noted below. No period for reply is set forth in this notice for correction of these deficiencies. However, if a deficiency relates to the inventor's oath or declaration, the applicant must file an oath or declaration in compliance with 37 CFR 1.63, or a substitute statement in compliance with 37 CFR 1.64, executed by or with respect to each actual inventor no later than the expiration of the time period set in the "Notice of Allowability" to avoid abandonment. See 37 CFR 1.53(f).

- A properly executed inventor's oath or declaration has not been received for the following inventor(s):

Rocco V. Burgo
Michael E. Wright
Gary B. Mosser
Michael J. Fevola

Mail date of Notice: 12/04/2019

Last date that extension may be obtained: (Note: The petition and fee must be received 07/04/2020 by this date, or include a proper certificate of mailing under 37 CFR 1.8 with a date on or before this date, and extend the time to include this date.)

Length of Extension of Time (response due on or before)	Fee under 37 CFR 1.17(a) effective March 19, 2013		
	Undiscounted	Small Entity	Micro Entity
One Month (03/04/2020)	\$200	\$100	\$50
Two Months (04/04/2020)	\$600	\$300	\$150
Three Months (05/04/2020)	\$1400	\$700	\$350
Four Months (06/04/2020)	\$2200	\$1100	\$550
Five Months (07/04/2020)	\$3000	\$1500	\$750

Replies must be received in the USPTO within the set time period or must include a proper Certificate of Mailing or Transmission under 37 CFR 1.8 with a mailing or transmission date within the set time period. For more information and a suggested format, see Form PTO/SB/92 and MPEP 512.

Replies should be mailed to:

Mail Stop Missing Parts
Commissioner for Patents
P.O. Box 1450
Alexandria VA 22313-1450

Registered users of EFS-Web may alternatively submit their reply to this notice via EFS-Web, including a copy of this Notice and selecting the document description "Applicant response to Pre-Exam Formalities Notice".
<https://sportal.uspto.gov/authenticate/AuthenticateUserLocalEPF.html>

For more information about EFS-Web please call the USPTO Electronic Business Center at 1-866-217-9197 or visit our website at <http://www.uspto.gov/ebc>.

If you are not using EFS-Web to submit your reply, you must include a copy of this notice.

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at (571) 272-4000 or (571) 272-4200 or 1-888-786-0101.

/dtdinh/

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In Re Patent Application of:	:	
Inolex Investment Corporation	:	
	:	
	:	Group Art Unit:
Conf. No.: 6533	:	Not Yet Assigned
	:	
	:	
Appln. No.: 16/682,059	:	Examiner:
	:	Not Yet Assigned
	:	
Filing Date: November 13, 2019	:	Attorney Docket No.: I0113-198U3
	:	
Title:	:	
Natural 1,2-Alkanediols, Compositions Having Natural 1,2-Alkanediols and Processes for Making the Same	:	

RESPONSE TO NOTICE OF INCOMPLETE REPLY AND SUPPLEMENTAL
RESPONSE TO NOTICE TO FILE CORRECTED APPLICATION PAPERS

This is in response to the Notice of Incomplete Reply dated January 22, 2020 ("Notice"). Applicant previously received a Notice to File Corrected Application Papers dated December 4, 2019 ("December 4 Notice"). Applicant responded to that Notice on January 16, 2020, noting that the December 4 Notice read that the claims pages did not include margins in compliance with the Rules and further requested replacement drawings. The applicant filed a *complete response* to the Notice on January 16, 2020 in that applicant responded to the margin issued noted by explaining that the margins were correct. Applicant also provided the requested replacement drawings.

This present Notice of January 22 was issued indicating that applicant's previous reply was "incomplete." The Notice again complains that the specification does not include prior margins in the specification beginning on page 42 (which is the first page of the claims).

The undersigned contacted the Office of Data Management after receiving this Notice explaining that the margin issue had been addressed. The response was that while the Notice

mentions margins, what is actually being requested is a correction to the line spacing of one of the claims on that page. This is not mentioned in the Notice. The person assisting in the call acknowledged this but noted that they do not always have the right language. Based on these facts, it is the Notice itself that is admittedly inadequate in conveying with clarity what the applicant is to provide and correct. It was not the applicant's response to the Notice to File Corrected Application Papers, but the PTO's Notice that was inadequate and incomplete.

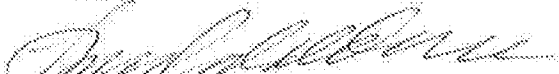
Applicant now responds based on the undersigned phone call to the Office of Data Management Office and encloses a replacement Specification fixing the claims page 42 to have the right line spacing in a single claim. Notably, the present Notice of January 22nd was also incomplete and inadequate in explaining what was required.

As the Notice provides that the time period from the original December 2, 2019 Notice continues to run, a response is being timely filed today, March 4, 2020 including a one month Petition for Extension of Time. However, in view of the PTO's inadequate Notice, applicant respectfully requests a waiver of and refund of the extension of time fee.

Applicant respectfully submits that the issues raised in the original Notice have been fully addressed. Publication and examination are requested.

Respectfully submitted,

CALDERONE BULLOCK LLC

3/4/2020 By: 
LYNDA L. CALDERONE
Registration No. 35,837
Two Greentree Centre
9000 Lincoln Drive East, Suite 301
Marlton, NJ 08053
Telephone: 856-446-6047
Direct Dial: 856-446-6045
Facsimile: 856-267-5370
E-Mail: lcalderone@calderonebullock.com

LLC:llc

Enclosures: Substitute Specification

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In Re Patent Application of:
Inolex Investment Corporation

Conf. No.: 6533

Appln. No.: 16/682,059

Filing Date: November 13, 2019

Title: Natural 1,2-Alkanediols, Compositions Having Natural 1,2-Alkanediols and
Processes for Making the Same

Group Art Unit: Not Yet Assigned

Examiner: Not Yet Assigned

Attorney Docket No.: I0113-198U3

PETITION FOR EXTENSION OF TIME UNDER (37 C.F.R. § 1.136(a))

Applicant in the above-identified application hereby petitions for a one-month extension of time to and including March 4, 2020 for responding to the Notice of Incomplete Reply (and as a supplemental response to the Notice to File Corrected Application Papers dated December 4, 2019. A Response to the Notice of Incomplete Reply and Supplemental Response to the Notice to File Corrected Application Papers is being filed simultaneously with the filing of this Petition.

☒ Applicant herewith charges the required fee under 37 C.F.R. §1.136(a) in the amount of \$200 to credit card account, Calderone Bullock American Express (Billing No. I0113.0255).

☒ The Commissioner is hereby authorized to charge or credit as appropriate Deposit Account No. 60-2689 (Billing No. I0113.0255) for: [] The required fee in the amount of \$___; ☒ Any deficiencies or overpayments in the above-calculated fee.

Respectfully submitted,

INOLEX INVESTMENT CORPORATION

3/4/2020
(Date)

By:

Lynda L. Calderone

LYNDA L. CALDERONE

Registration No. 35,837

CALDERONE BULLOCK LLC

Two Greentree Centre

9000 Lincoln Drive East, Suite 301

Marlton, NJ 08053

Telephone: (856) 446-6047

Direct Dial: 856-446-6056

Facsimile: (856) 267-5370

E-Mail: lcalderone@calderonebullock.com

LLC:llc

Electronic Patent Application Fee Transmittal

Application Number:	16682059			
Filing Date:	13-Nov-2019			
Title of Invention:	Natural 1,2-Alkanediols, Compositions Having Natural 1,2-Alkanediols and Processes for Making the Same			
First Named Inventor/Applicant Name:	Rocco V. Burgo			
Filer:	lynda Leigh Calderone			
Attorney Docket Number:	I0113-198U3			
Filed as Large Entity				
Filing Fees for Utility under 35 USC 111(a)				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Extension - 1 month with \$0 paid	1251	1	200	200
Miscellaneous:				
Total in USD (\$)				200

Electronic Acknowledgement Receipt

EFS ID:	38770797
Application Number:	16682059
International Application Number:	
Confirmation Number:	6533
Title of Invention:	Natural 1,2-Alkanediols, Compositions Having Natural 1,2-Alkanediols and Processes for Making the Same
First Named Inventor/Applicant Name:	Rocco V. Burgo
Customer Number:	159443
Filer:	lynda Leigh Calderone
Filer Authorized By:	
Attorney Docket Number:	I0113-198U3
Receipt Date:	04-MAR-2020
Filing Date:	13-NOV-2019
Time Stamp:	16:36:22
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	\$200
RAM confirmation Number	E202034G36591580
Deposit Account	602689
Authorized User	Lynda Calderone

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

37 CFR 1.19 (Document supply fees)

37 CFR 1.21 (Miscellaneous fees and charges)

File Listing:					
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Applicant Response to Pre-Exam Formalities Notice	respnnoticeincompletetereply.pdf	103925	no	2
			7102be12a5afbd3556ff803b68f451e2ee8bad0f		
Warnings:					
Information:					
2	Specification	SubSpec.pdf	240796	no	44
			ea99fb237b5e72719f6450dbe8dbe7093c72fbb9		
Warnings:					
Information:					
3	Extension of Time	eot.pdf	60772	no	1
			6891bc3ffb92caf471f5c539b0c5d32219547450		
Warnings:					
Information:					
4	Fee Worksheet (SB06)	fee-info.pdf	30753	no	2
			c265153e3b9941638167151718a65bff502d7c17		
Warnings:					
Information:					
Total Files Size (in bytes):			436246		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

TITLE OF THE INVENTION

[0001] Natural 1,2-Alkanediols, Compositions Having Natural 1,2-Alkanediols and Processes for Making The Same

5

CROSS-REFERENCE TO RELATED APPLICATIONS

[0002] This U.S. Non-Provisional Patent Application is a continuation of co-pending United States Patent Application Serial No. 16/262,902, entitled “Natural 1,2-Alkanediols, Compositions Having Natural 1,2-Alkanediols and Methods of Making Same”, filed January 30, 2019, which in turn claims the benefit under 35 U.S.C. §119(e) of U.S. Provisional Patent Application No. 62/623,985, filed January 30, 2018, entitled “Natural 1,2-Alkanediols, Compositions Having Natural 1,2-Alkanediols and Methods of Making Same,” the entire disclosures of each of which are incorporated herein by reference.

10

BACKGROUND OF THE INVENTION

15 FIELD OF THE INVENTION

[0003] The invention herein relates to the field of natural and renewable, *i.e.*, sustainable, antimicrobial components that enable alternative preservation systems for use in compositions applicable to various industries, including personal care, household and institutional or industrial cleaning products, medical or other related uses, and particularly in personal care compositions. More particularly to the preparation of natural and renewable 1,2-alkanediols, methods for making natural and renewable 1,2-alkanediols and compositions including such 1,2-alkanediols prepared from natural and renewable (“sustainable”) feedstocks.

20

DESCRIPTION OF RELATED ART

[0004] In most countries, including the United States, cosmetic and/or personal care (“personal care products”) and other consumer products are manufactured and packaged in clean, but not typically sterile conditions, and many are sold in non-sterile forms. As a result, inconsequential (and usually harmless) amounts of bacteria, mold or yeast spores (collectively, “microbes”) may be caught in products. In addition, once a consumer has purchased, opened and begun using such a product, further contamination may occur. For example, in personal

25

care products, small amounts of microbes from the air or a consumer's skin may further contaminate the product.

5 **[0005]** Over time, during transit, storage or use the initial microbe population that was negligible may increase to a level significant enough to result in discoloration or fouling of the product, including the appearance of visible mold, which can impact the usefulness or performance of the product. In the case of personal care products or other consumer products that are applied or ingested (such as vitamins, etc.), it can have a health impact as well, and in some circumstances can lead to adverse skin reactions upon application, including infection.

10 **[0006]** To address the issue of microbial growth, manufacturers in the personal care industry and in other industries commonly add chemical preservatives, which are typically petrochemically based, to such products and compositions. However, the type and amount of preservative that can be used is subject to restrictions on several fronts: (1) legislative (in some countries, use of particular preservatives are prohibited); (2) technical (the type/amount of preservative must demonstrate its efficacy by meeting certain empirically assessed criteria
15 (“challenge testing”); (3) consumer preference (consumers may perceive certain preservative chemicals as undesirable, such as petroleum-based or non-sustainable products, so products including them are not commercial viable); (4) logistical (*e.g.*, the selected preservative must be effective in the relevant chemical environment (where parameters such as pH, hydrophobicity/hydrophilicity, etc. may vary) and production-cost friendly); and (5)
20 sustainability, *i.e.*, it should be prepared using sustainable processes and feedstock sourcing as described further herein.

[0007] There is also a desire to develop alternatives to traditional preservation and to find more user-friendly chemical component combinations that are derived from sustainable and renewable resources (*i.e.*, “feedstocks”). These natural and renewable antimicrobial
25 components and alternatives to traditional preservatives (“alternative preservation”), should provide equal or better protection and performance to the consumer.

[0008] To resolve issues with traditional preservatives, the applicant herein developed a prior art preservative for personal care compositions that does not include parabens, formaldehyde donors or chlorinated compounds, that can be used in all types of personal care
30 formulations (*e.g.*, both “leave-on” and “rinse-off” products). Such paraben-free or other non-petroleum-based alternative preservation products are attractive to consumers. The paraben-free preservative demonstrates efficacy against a broad spectrum of microorganisms at various

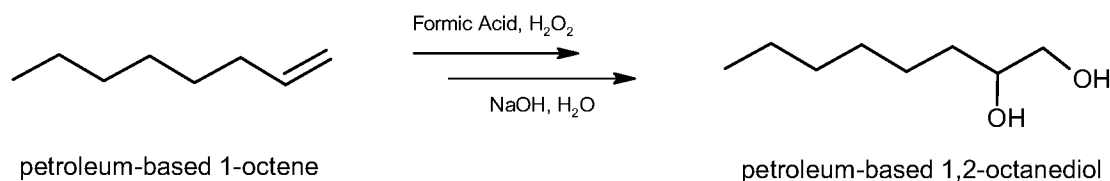
levels of pH, especially around neutral pH levels which are typically in or on the human body. This preservative is described in U.S. Patent Publication No. 2017/0360035 A1, in which one of the components in that preservative system is a 1,2-alkanediol.

[0009] Another attempt in the art to reduce the use of traditional preservatives is in the application of “hurdle technology.” Hurdle technology is the practice of applying several types of restricting or preservative materials or processes so that microbes have a “hurdle(s)” to overcome before they can proliferate to spoilage levels (e.g., adding something to change pH to reduce proliferation and a smaller amount of preservative or other compound that together retard or create “hurdles” to microbial growth). Use of alternative preservation can be one step or “hurdle” in hurdle technology.

[0010] There is a need in the art to further develop “alternative preservation” additives. These alternative preservation systems include consumer-friendly, paraben-free materials that move away from traditional preservation or antimicrobials and towards “natural” and “sustainable” (“renewable”) formulations and feedstocks, as those terms are defined hereinbelow.

[0011] One diol employed in preservation, caprylyl glycol, is believed by the applicant to be the fastest growing alternative preservation component in the world. Other 1,2-alkanediols such as 1,2-hexanediol, 1,2-decanediol, and 1,2-dodecanediol are also growing in popularity and function in alternative preservation formulations.

[0012] An example of one reaction sequence to prepare caprylyl glycol (1,2-octanediol) using an alkene as a key starting material is shown below. The starting material used is a petrochemically-derived 1-octene:



In the above reaction sequence, a petrochemically-derived 1-octene is reacted in the presence of formic acid and peroxide to form an intermediate chemical mixture which, e.g., undergoes a further ring-opening reaction in water with sodium hydroxide to complete formation of the 1,2-octanediol. This provides an excellent alternative preservation additive and is paraben-free, however, the starting material (*i.e.*, 1-octene) is derived from a fossil-based (petrochemical)

resource and importantly, represents a non-renewable feedstock, *i.e.*, a non-sustainable resource.

[0013] Thus, as noted above there is a need for more consumer- and eco-friendly, alternative preservation systems (used alone or as part of hurdle technologies), including those that are paraben-free. There is further a need in the art for a material that is an alternative preservation material or that may be used in an alternative preservation system that is a 100% natural and renewable (“sustainable”) feedstock to create an antimicrobial agent that can be used as or in alternative preservation systems. An example of a “natural” antimicrobial is one that is prepared from a bio-derived feedstock (*e.g.*, from current and sustainable agricultural activities, like non-GMO based-fermentation, algae-, plant- or vegetable-derived, *e.g.*, it comes from vegetable sources, or biomass, and it is not petrochemically-derived (such as being derived from sustainable tree and plant farms active in the 21st century). Such feedstocks are referred to herein as “natural” and “renewable” (*i.e.*, “sustainable”) and are known as a non-petroleum-derived feedstock. Further, such materials are formed by “new” carbon and not from petroleum or other fossil fuel sources (“old” carbon). Such products are referred to herein as “natural” products and are known in the art as non-petrochemically-derived or “bio” products. By “sustainable,” herein, the applicants are referring to materials that come from renewable sources, and not those that deplete a limited natural resource, such as a fossil fuel or other non-renewable resource such as petroleum. Thus a natural or bio product, which is not petrochemically derived, and/or is made from sources that are not petrochemically derived would be sustainable and renewable.

[0014] True natural products (bio-compounds) are formed using biomass (*e.g.*, material stored from carbon cycle processes in living plants and roots, etc. or released through animal respiration or through decomposition). When carbon decomposes and is broken down over millions of years under pressure, it creates fossil fuels (the source of petrochemically-derived carbon). Bio-compounds herein are intended to include materials derived from the carbon of plant sources/biomass, that exist recently and are also sustainable, and are not derived from fossil fuels.

[0015] These bio-based or “natural” feedstocks may be used in the production of alternative preservation formulations. The bio-based or “natural” products from such feedstocks may be tested to determine that they come from a true, natural and sustainable (as those terms are defined herein) feedstock source. Some products are known or advertised as being from natural

sources when, in fact, they may not be prepared from truly natural and/or sustainable feedstock. A natural organic product is typically defined as a compound produced naturally by a living organism. To distinguish a petroleum-based product from a truly natural and/or sustainable product, one must test for the authenticity using established and credible test methods. The most current method employs a detailed analysis of stable isotopes using mass spectroscopy and evaluating carbon-12/carbon-13 and/or hydrogen-1/hydrogen-2 ratios. Such testing is available through several analytical service testing organizations and is much faster, more cost effective, and yields more detailed information compared to radiocarbon testing methods.

[0016] Stable isotope analysis is based on the principle of kinetic isotope effect. The latter effect is well-known to those in the art of chemical kinetics. In the broadest terms, heavy isotopes of a particular element react slower than their lighter equivalent (*e.g.*, carbon-12 as opposed to carbon-13). So, as plants incorporate carbon dioxide into their biomass, the ratio of carbon-12 to carbon-13 will vary depending on the type of chemistry used in the plant to make biomass (*e.g.*, whether the plant undergoes a C₃ or C₄ photosynthesis pathway). This is commonly reported as the $\delta^{13}\text{C}/^{12}\text{C}$ ratio (*i.e.*, $\delta^{13}\text{C}$), and is referenced to a current carbon dioxide standard. In addition, similar isotope kinetic effects are observed when water is incorporated into new biomass, and this is measured as the $\delta^2\text{H}/^1\text{H}$ ratio (*i.e.*, $\delta^2\text{H}$). Using a combination of $\delta^{13}\text{C}$ and $\delta^2\text{H}$ ratios, one familiar with in the relevant art is able to readily distinguish and validate the nature of the feedstock that was used to prepare the product being analyzed (*i.e.*, whether it is petrochemically-derived or derived from recently living or living algae-, plant- or similar bio-sources).

[0017] In Fig. 2, it can be seen in general terms how isotope ratios can be used to determine the source of various detergents that have a strong relation to the feedstocks described herein, like 1-octanol. From the plot in Fig. 2, the $\delta^2\text{H}$ values have a more clearly defined difference between petroleum-based and renewable feedstocks and so in this case prove more valuable and defining than the $\delta^{13}\text{C}$ values. However, the combination using $\delta^2\text{H}$ and $\delta^{13}\text{C}$ values together is a preferred technique employed in the invention herein to prove a feedstock is, in fact, natural and renewable.

[0018] Radiocarbon is an unstable isotope of carbon, known as ^{14}C . ^{14}C is an unstable isotope that emits radiation energy in the form of *beta* particles at a very consistent rate and ultimately decays to the more stable ^{14}N (*i.e.*, a half-life for radiocarbon is 5730 years).

Because petroleum-based (*i.e.*, petrochemically-derived) feedstocks are derived from plants and

5 animals buried millions of years ago, the feedstocks' radiocarbon (*i.e.*, ^{14}C) has been lost to decay. The ASTM International standards provide testing standards to determine the authenticity of a "bio-based compound" using radiocarbon, which may be found in ASTM D6866-16. This standard distinguishes newer carbon from carbon derived from fossil-fuel, or petroleum- and petrochemically-derived sources, *i.e.*, "old carbon." The amount of ^{14}C in
10 recent or current biomass is known, so a percentage of carbon from a renewable source can be estimated from a total organic carbon analysis, which provides the data necessary to determine if a compound is truly derived from a "natural" and/or "sustainable" ("renewable") feedstock source or is derived conversely from a compound of "old" sequestration (*i.e.*, a petrochemically-derived or petroleum-based source). The use of petroleum-based or often
15 labeled fossil-based feedstocks is generally accepted as being non-sustainable, *i.e.*, old carbon is a non-sustainable and not a renewable feedstock, and furthermore, is not considered "natural" and "sustainable" in the art. As defined herein, it would not be considered to be a "natural" product or useful in a "natural" formulation. Hence, use of such feedstocks does not represent a path forward to development of "natural" and "renewable" alternative preservatives.

20 [0019] Dehydration of terminal alcohols using traditional methods to form alkene starting materials chemically yields a mixture of 1- alkenes, 2- alkenes, and 3- alkenes due to rearrangements and migrations of the 1-alkene product during the dehydration process. Using such a mixture of alkenes ultimately provides a mixture of diols upon dihydroxylation, providing a low yield of the desired terminal 1,2-diol material and unwanted contaminants.

25 [0020] In one known path of forming caprylyl glycol (1,2-octanediol) starting with 1-octanol, made from petrochemically-derived (*i.e.*, petroleum-derived or fossil fuel-derived) feedstocks, the following reaction is known to occur:

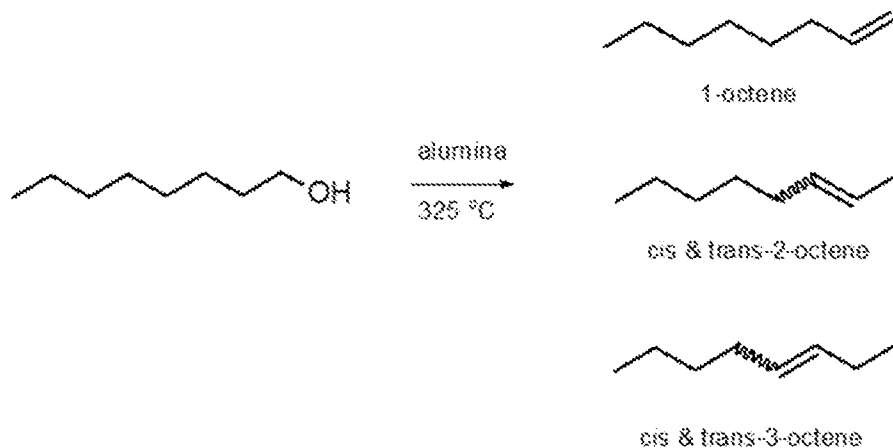
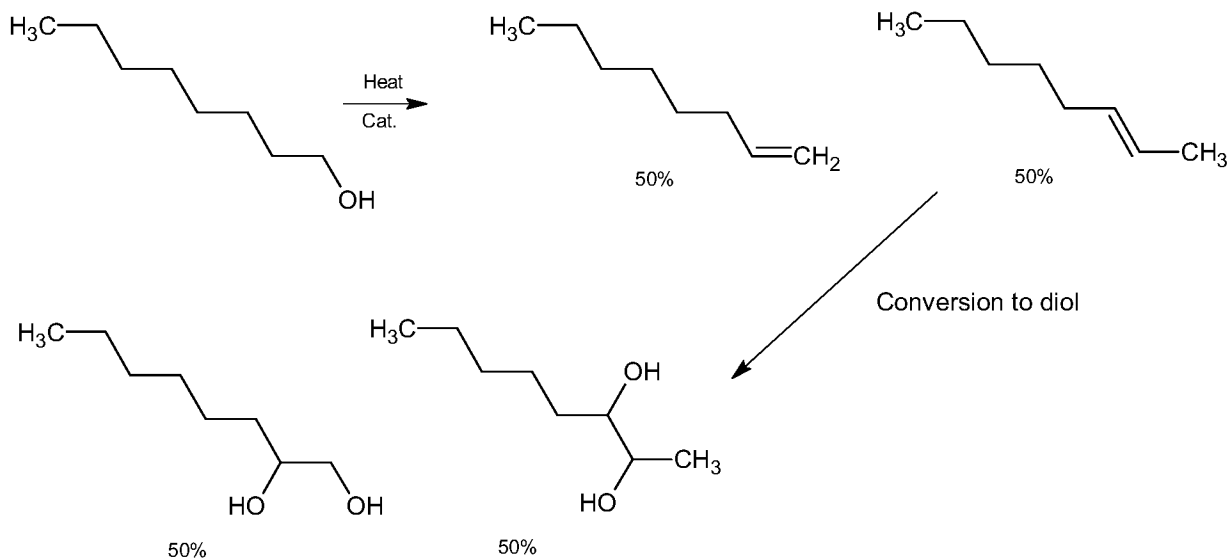


Table A

Catalyst	1-Octene (%)	2-Octene & 3-Octenes (%)	1-Octanol (%)	1-Octene Selectivity (%)
Alumina	87.7	5.3	4.7	94.3

5



As can be seen from the above-reaction schemes, the use of heat and a traditional acid catalyst converts 1-octanol to an alkene, *i.e.*, octene. Exposure to the acid sites in the catalyst allows the more thermodynamically stable 2-octene to form along with 1-octene. The 2-octene regioisomers formed (including 3-octene as shown above and 4-octene (not shown)) are very

difficult to separate from the 1-octene and afford a lower net chemical yield of the desired 1-octene. It follows that an increased or higher regioselectivity is a critical factor in the catalytic dehydration of 1-octanol to 1-octene and a desired goal to achieve in the relevant art. When using renewable and natural feedstocks, reaction efficiency (*i.e.*, chemical yield) of the desired product (*i.e.*, 1-alkenes) is critical. There remains a need in the art for a highly regioselective dehydration of 1-octanol that also has high chemical conversion using efficient process equipment and operating in a rapid and energy efficient manner.

[0021] Thus, traditional pathways using an octene mixture of regioisomers as shown above for conversion to a desired terminal 1,2-octanediol is reduced and the yield is also reduced.

This makes the ability to form the desired alternative preservative materials chemically inefficient and not cost effective, creates more waste in process, and makes the overall process less sustainable. There is a strong need in the art for a highly regioselective, and high-chemical conversion rate process for creating a bio-1-octene from a bio-1-octanol.

[0022] International patent Publication No. WO 2004/078336 A2 uses a γ -alumina having no additional promoters but that was instead given a very large pore size and volume to enhance regioselectivity for dehydration of 1-octanol. In this work, the regioselectivity was high (97.7%), but, the chemical conversion was 65% and product selectivity for octenes was only 25%. Thus, the chemical yield of 1-octene from 1-octanol using this catalyst system was only about 15.9%.

[0023] In another example, U.S. Patent No. 7,576,250 B2, formation of 1-octene by cracking an ether derivative of 1-octanol is described. In this patent, the 1-octanol must first be converted to the methyl ether (*i.e.* methyl octyl ether) and then the ether is subjected to and passed over a γ -alumina catalyst. This involves extra chemical and added cost to make the ether and loss of the methanol in the process leading to a very ineffective and atom inefficient method. Most notably, the catalyst goes from having good conversion and regioselectivity in the first few hours, then, in just a mere 20 h of time-on-stream (“TOS”), all catalysts disclosed in the art show a constant and significant decrease in chemical conversion with a concomitant loss in regioselectivity. This type of short catalyst life time is not acceptable in commercial production efforts.

[0024] A lead-containing alumina catalyst is described in Chinese Patent No. 105312044 B, wherein plumbite pseudoboehmite showed high apparent selectivity and conversion. The catalyst had a carbon deposition rate of ~0.04%/h, which is highly undesirable and would be

unsatisfactory for something like 1000 h of continuous operation. Even more limiting is these catalysts incorporate a toxic heavy metal, namely lead. The use of these catalysts would require costly environmental controls and worker safety precautions if used on the industrial scale for commercial production

5 **[0025]** One path to making a “natural” alkanediol is by fermentation of biomass to form a straight chain, linear alkanediol. For example, U.S. Patent Application Publication No. 2005/0069997 A1 teaches formation of 1,3 propanediol from fermentation broth. However, 1,3-propanediol is not a 1,2-alkanediol. Fermentation processes that form long chain diols are chemically inefficient (*i.e.*, poor life-cycle-analysis numbers) and additionally require use of
10 GMO-bacteria or -yeast, especially if one attempts to make a long carbon 1,2-alkandiol.

[0026] Another example of a natural bio-alcohol that is described in the art is bio-1-butanol, a known substance that has been used in commercial production since the discovery by Pasteur in 1862 of the acetone-butanol-ethanol fermentation process carried out by *clostridium* bacteria (a non-GMO bacteria), although it is used in very limited quantities currently. These bacteria

15 ferment both C₅ and C₆ sugars to form a mixture of acetone, 1-butanol and ethanol (*i.e.*, ABE). Since the discovery of ABE, advances in fermentation processes can provide optimized production of bio-1-butanol over acetone and ethanol production. While the production is improved, it remains difficult and energy intensive to purify the bio-1-butanol from the fermentation broth and other impurities involved in the fermentation process such as ethanol
20 and acetone. In addition, applicant is unaware of a non-GMO bacteria or yeast process that can form longer chain alcohols (*i.e.*, chains of six or more such as 1-hexanol or 1-octanol).

[0027] Bio-1-butanol is known as a source to make biofuels and provides a pathway for converting straight-chain, linear, primary four-carbon alcohols to bio-1-alkenes at very high yield to improve biofuel production and can also be used, for example in production of eco-
25 friendly tires. In this method, bio-1-alcohols are dehydrated to bio-1-alkenes with high selectivity and chemical yield. The resulting bio-1-alkenes are useful in preparing high flashpoint diesel and jet biofuels useful for civilian and military applications. The bio-1-butanol is dehydrated using a solid phase dehydration catalyst that includes an inorganic support, such as γ -alumina or zinc aluminate (ZnAl₂O₄), and that has been treated/modified
30 with a basic aqueous solution. The support may be further treated with an organosilane diluted in at least one hydrocarbon solvent. The process can convert bio-1-butanol from a fermentation

process that contains 0.1 to about 90 wt% water and produces a corresponding 1-alkene at a 92-99% regioselectivity, with only a single pass over the solid-phase catalyst, producing a reaction conversion of greater than 95% and a chemical yield of greater than 90% of the bio-1-butene. However, even with such a result for bio-1-butene, it is noted that the conversion of 1-octanol to 1-octene is not simply a homolog of a conversion of 1-butanol to bio-1-butene. In fact, comparative examples described herein below, illustrated that silanization of the catalyst leads to a *loss* of regioselectivity for the dehydration chemistry of 1-octanol.

[0028] Based on the foregoing, while progress has been made, there is a need in the art for continued improvement to consumer products such as personal care products, household products, industrial products and pharmaceutical products to provide additives, especially for antimicrobial use or for boosting the effects of known preservatives or alternative preservation systems, so as to keep products safe from contamination and fresh in storage and in use, while avoiding traditional preservatives and finding and relying on components for consumer product compositions from natural bio-sources. There is more particularly a need for a natural, and preferably renewable/sustainable feedstock source to create a natural, bio-caprylyl glycol (*i.e.*, a natural or bio-1,2-octanediol) and the associated bio-1-alkene intermediate.

BRIEF SUMMARY OF THE INVENTION

[0029] The invention provides efficient pathways to achieve a 100% “natural” or “bio-compound” that is an authentic “natural” material, and preferably includes bio-1,2-alkanediols of carbon lengths from about 5 to about 20, and preferably from 5 to about 14, that can be used alone, in combinations of different types of bio-1,2-alkanediols, or in blends with other natural or traditional antimicrobials and other cosmetic additives.

[0030] The invention includes a process for the synthesis of bio-1,2-alkanediols, comprising: providing a bio-alkene having a carbon chain of about 5 to about 20 carbon atoms and a bio-1-alkene regioselectivity of at least about 80%; and converting the bio-alkene to a bio-1,2-alkanediol having a carbon chain length of about 5 to about 20 carbon atoms.

[0031] In one embodiment of the process, the bio-alkene and the bio-1,2-alkanediol each have a carbon chain of about 6 to about 14 carbon atoms. The bio-alkene and the bio-1,2-alkanediol each may have a carbon chain length of about 6 to about 10 carbon atoms. The bio-alkene and the bio-1,2-alkanediol each may have a carbon chain length of about 6 to about 8

carbon atoms. For example, the bio-alkene may be bio-octene and the bio-1,2-alkane diol may be bio-1,2-octanediol.

5 **[0032]** In a further embodiment of the process, the bio-alkene preferably results from a process wherein a bio-1-alcohol is dehydrated by heating the bio-1-alcohol in a reactor with a catalyst. The reactor may be a fixed bed reactor. The fixed bed reactor may also be, *e.g.*, a fluidized fixed bed reactor. In such an embodiment, the catalyst may be selected from ZnAl_2O_4 and a γ -alumina catalyst.

10 **[0033]** The bio-alkene in a preferred embodiment has a bio-1-alkene regioselectivity of about 92% to about 99%, and preferably about 95% to about 99%. The process also preferably yields at least about 92% to about 99% of the bio-1,2-alkanediol.

15 **[0034]** As noted above in one embodiment a catalyst treatment may be used. The catalyst may be a γ -alumina catalyst treated with a base to form a modified γ -alumina catalyst. The base may comprise a Group I or a Group II metal. The γ -alumina catalyst may be treated, *e.g.*, with a calcium promoter to provide a modified γ -alumina catalyst. The modified γ -alumina catalyst may then be calcined to provide a calcined γ -alumina catalyst. In one embodiment, wherein a calcium promoter is used, the calcium promoter may be used in an amount of about 0.01 weight percent to about 4 weight percent based on the weight of CaO determined after calcination, and preferably about 1 weight percent to about 2 weight percent based on the weight of CaO determined after calcination.

20 **[0035]** A preferred temperature during calcination is about 400°C to about 500°C, more preferably about 420°C to about 480°C, and most preferably about 440°C to about 460°C. Calcination may be carried out in an oven. The calcination may be performed in air or under an atmosphere of nitrogen or other inert gas(es).

25 **[0036]** The bio-alkene preferably undergoes a distillation step to refine the bio-alkene prior to converting the bio-alkene to the bio-1,2-alkanediol. The bio-1,2-alkanediol formed from the bio-alkene may also undergo a final distillation step to refine the bio-1,2-alkanediol.

30 **[0037]** In another embodiment of the process, the bio-alkene may result from a process wherein the bio-1-alcohol in water is dehydrated by heating the bio-1-alcohol with a catalyst using no purge gas or under a purge gas. The purge gas may preferably be nitrogen but other inert gases may be used within the scope of the invention.

[0038] The bio-alkene in the process may also be converted to the bio-1,2-alkanediol by reacting the bio-alkene in the presence of at least one of peracid, *e.g.*, formic acid or acetic acid,

and hydrogen peroxide to form a mixture of bio-1,2-epoxyalkane having an epoxy ring and bio-1,2-alkanediol, and contacting this mixture with water and sodium hydroxide to complete formation to the bio-1,2-alkanediol.

5 [0039] The overall process preferably process yields at least about 60% to about 99% of the bio-1,2-alkanediol, and more preferably yields at least about 72% to about 99% of the bio-1,2-alkanediol.

[0040] The invention further includes a process for making bio-1,2-alkanediols, comprising: providing a bio-1-alcohol and a catalyst treated with a base; dehydrating the bio-1-alcohol in the presence of the catalyst to form a bioalkene having a carbon chain of about 5 to
10 about 20 carbon atoms and a bio-1-alkene regioselectivity of at least about 80%; and converting the bio-alkene to a bio-1,2-alkanediol having a carbon chain length of about 5 to about 20 carbon atoms. Preferably, the catalyst is treated with a promoter and then calcined.

[0041] The catalyst in this process may also be a γ -alumina catalyst and the base may comprise calcium. The γ -alumina catalyst is preferably treated with a calcium promotor and
15 after treatment is calcined at a temperature of about 400°C to about 500°C. The process preferably yields about 92% to about 99% of the bio-1,2-alkanediol.

[0042] The invention further includes a method for treating a catalyst for use in dehydration of alcohols, comprising providing a γ -alumina catalyst; treating the γ -alumina catalyst with a base, preferably a promoter as described herein, comprising a Group I or a Group II metal; and
20 heating the γ -alumina catalyst to a temperature of about 400°C to about 500°C, which is preferably done in a very controlled and deliberate manner. The base may comprise calcium, and preferably the base may be a calcium promoter and the heating occur during calcination. The calcium promoter may be used in an amount of about 0.01 weight percent to about 4 weight percent based on the weight of CaO determined after calcination, and more preferably in
25 an amount of about 1 weight percent to about 2 weight percent based on the weight of CaO determined after calcination, preferably after careful calcination. The temperature during calcination in a preferred embodiment may be about 420°C to about 480°C, and more preferably may be about 440°C to about 460°C. Beneficial results are achieved based on the applicant's process including the preferred ranges noted. Applicant's determined that high
30 calcination temperatures decrease catalyst regioselectivity and thus chemical yield of bio-1-alkene.

[0043] The invention further includes a composition, comprising at least one first bio-1,2-alkanediol having a carbon chain length of about 5 to about 20 carbon atoms which is synthesized by conversion of a first bio-alkene having a carbon chain of about 5 to about 20 carbon atoms and a bio-1-alkene regioselectivity of at least about 80%.

5 **[0044]** The composition may be a personal care composition, such as a hair care composition, an oral care composition, a skin care composition or a cosmetic composition.

[0045] The composition may also be a composition for a household product, such as a fabric care product or a cleaning product.

10 **[0046]** The composition may also be an industrial composition, or a pharmaceutical composition, a vitamin composition, or a health care composition.

[0047] In one embodiment of the composition herein, the composition may comprise a second bio-1,2-alkanediol, different than the first bio-1,2-alkanediol, the second bio-1,2-alkanediol having a carbon chain length of about 5 to about 20 carbon atoms which is synthesized by conversion of a second bio-alkene, preferably regioselectively, such that the
15 resulting bio-alkene of about 5 to about 20 carbon atoms has a terminal bio-alkene content of at least about 80% and a bio-1-alkene regioselectivity of at least about 80%. The composition may comprise at least one other bio-compound different from the first and the second bio-1,2-alkanediols. In another embodiment, the composition may comprise an antimicrobial compound different from the first and the second bio-1,2-alkanediol and different from the
20 other bio-compound. The composition may also further comprise at least one other bio-compound different from the at least one bio-1,2-alkanediol, and in another embodiment, such a composition may also further comprise at least one antimicrobial compound different from the at least one bio-1,2-alkanediol and different from the other bio-compound. The first bio-1-alkene in such composition preferably has a regioselectivity of about 92% to about 99% and
25 more preferably about 95% to about 99%. The first bio-alkene may be a bio-octene and the at least one first bio-1,2-alkane diol may be a bio-1,2-octanediol.

[0048] Also included in the invention is a method for providing an antimicrobial effect to a composition, including incorporating an antimicrobial system to the composition, wherein the antimicrobial system comprises at least one first bio-1,2-alkanediol having a carbon chain
30 length of about 5 to about 20 carbon atoms which is synthesized by conversion of at least one first bio-alkene having a carbon chain of about 5 to about 20 carbon atoms and a bio-1-alkene regioselectivity of at least about 80%. The antimicrobial system may further comprise a

second bio-1,2-alkanediol different than the first bio-1,2-alkanediol, wherein the first bio-1,2-alkanediol has a carbon chain length of about 5 to about 20 carbon atoms and is formed by regioselectively converting a second bio-alkene, different than the first bio-alkene, having a carbon chain length of about 5 to about 20 carbon atoms and a bio-1-alkene regioselectivity of at least about 80%. The composition may further comprise at least one other bio-compound different from the first and the second bio-1,2-alkanediols, and in another embodiment may comprise at least one other preservative compound different from the first and the second bio-1,2-alkanediol and different from the other bio-compound. Such a composition may also further comprise at least one other bio-compound different from the at least one first bio-1,2-alkanediol. The antimicrobial may also further comprise at least one other antimicrobial compound and/or preservative compound different from the at least one first bio-1,2-alkanediol and different from the other bio-compound. The antimicrobial system may be made so as to demonstrate antimicrobial efficacy. The first bio-1-alkene preferably has a regioselectivity of about 92% to about 99%, and preferably about 95% to about 99%. The first bio-alkene may be bio-octene and the at least one first 1,2-alkane diol may be a bio-1,2-octanediol.

[0049] The invention further includes in one embodiment a method for boosting the antimicrobial efficiency of an antimicrobial and/or a preservative in a composition, comprising incorporating an antimicrobial system into the composition, wherein the second antimicrobial system comprises at least one first bio-1,2-alkanediol having a carbon chain length of about 5 to about 20 carbon atoms which is synthesized by regioselective conversion of a first bio-alkene having a carbon chain of about 5 to about 20 carbon atoms and a bio-1-alkene regioselectivity of at least about 80%. In the method, the antimicrobial system may further comprise a second bio-1,2-alkanediol different than the first bio-1,2-alkanediol, wherein the second bio-1,2-alkanediol has a carbon chain length of about 5 to about 20 carbon atoms and is formed by conversion of a second bio-alkene, different than the first bio-alkene, having a carbon chain length of about 5 to about 20 carbon atoms and a bio-1-alkene regioselectivity of at least about 80%. In the composition, it may further comprise at least one other bio-compound different from the antimicrobial and/or preservative and different from the first and the second bio-1,2-alkanediols. The composition may also further comprise at least one other bio-compound different from the at least one first bio-1,2-alkanediol. The first bio-1-alkene preferably has a regioselectivity of about 92% to about 99%, and more preferably about 95% to about 99%. In one embodiment, the antimicrobial system demonstrates antimicrobial efficacy. The first bio-

alkene may be a bio-octene and the at least one first bio-1,2-alkane diol may be a bio-1,2-octanediol.

[0050] In yet a further embodiment, the invention includes an antimicrobial product, comprising at least one first bio-1,2-alkanediol having a carbon chain length of about 5 to about 20 carbon atoms which is synthesized by conversion of a first bio-alkene having a carbon chain of about 5 to about 20 carbon atoms and a bio-1-alkene regioselectivity of at least about 80%. The product may further comprise a second bio-1,2-alkanediol, different than the at least one first bio-1,2-alkanediol, the second bio-1,2-alkanediol having a carbon chain length of about 5 to about 20 carbon atoms and formed by conversion of a second bio-alkene, different than the first bio-alkene, having a carbon chain length of about 5 to about 20 carbon atoms and a bio-1-alkene regioselectivity of at least about 80%.

[0051] The antimicrobial product may further comprise at least one other bio-compound different from the at least one first and the second bio-1,2-alkanediols. In one embodiment, the product may further comprise a second antimicrobial and/or a preservative different from the antimicrobial product. The product may also further comprise at least one other bio-compound different from the at least one first bio-1,2-alkanediol, and may also further comprise a second antimicrobial and/or a preservative different from the antimicrobial product. The first bio-1-alkene preferably has a regioselectivity of about 92% to about 99%.

[0052] The antimicrobial product preferably also demonstrates antimicrobial efficacy. The first bio-alkene may be bio-octene and the at least one first 1,2-alkane diol may be a bio-1,2-octanediol.

[0053] The invention also includes a product for boosting the efficacy of an antimicrobial and/or a preservative in a composition, the product comprising at least one first bio-1,2-alkanediol having a carbon chain length of about 5 to about 20 carbon atoms which is synthesized by conversion of a first bio-alkene having a carbon chain of about 5 to about 20 carbon atoms and a bio-1-alkene regioselectivity of at least about 80%. Such product may further comprise a second bio-1,2-alkanediol, different than the at least one first bio-1,2-alkanediol, the second bio-1,2-alkanediol having a carbon chain length of about 5 to about 20 carbon atoms and formed by conversion of a second bio-alkene, different than the first bio-alkene, having a carbon chain length of about 5 to about 20 carbon atoms and a bio-1-alkene regioselectivity of at least about 80%. The composition of the product may also further comprise at least one other bio-compound different from the at least one first and the second

bio-1,2-alkanediols, and also may further comprise at least one other bio-compound different from the at least one first bio-1,2-alkanediol. The first bio-1-alkene preferably has a regioselectivity of about 92% to about 99%. The first bio-alkene may be bio-octene and the at least one first bio-1,2-alkane diol may be bio-1,2-octanediol. The product preferably demonstrates antimicrobial efficacy.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

[0054] The foregoing summary, as well as the following detailed description of preferred embodiments of the invention, will be better understood when read in conjunction with the appended drawings. For the purpose of illustrating the invention, there is shown in the drawings embodiments which are presently preferred. It should be understood, however, that the invention is not limited to the precise arrangements and instrumentalities shown. In the drawings:

[0055] Fig. 1 is a process flow chart of steps in a preferred embodiment of a process described herein;

[0056] Fig. 2 is graphical representation of $\delta^2\text{H}$ and $\delta^{13}\text{C}$ values for petroleum-based alcohols, alkenes and acids and the corresponding natural and renewable analogs;

[0057] Fig. 3 is the Gas Chromatograph (GC) chromatogram of the reactor output from the dehydration of bio-1-octanol using the catalyst prepared in Example 4 at 0.2ml of bio-1-octanol feed and heated to 315°C;

[0058] Fig. 4 is the GC chromatogram of the bio-1-octene obtained from the reactor after distillation;

[0059] Fig. 5 is the GC chromatogram of the bio-1,2-octanediol obtained from dehydration of bio-1-octene, conversion to the 1,2-octanediol and then fractional distillation of the 1,2-octanediol;

[0060] Fig. 6 is the GC chromatogram of the petro-1,2-octanediol currently approved for use in cosmetic formulation; and

[0061] Fig. 7 is a photo comparing catalyst with 1400 h TOS (left) and new catalyst (on right).

DETAILED DESCRIPTION OF THE INVENTION

[0062] The invention includes a process for the synthesis of bio-1,2-alkanediols. As used herein, "bio" when used with "alkanediol," or any specific alkanediol compounds noted within this class of compounds is intended to mean as described above that the compound, and preferably all of the carbons in the compound within this class of compounds, as described further below are "natural" compounds that are also authentic natural compounds derived from plant sources (algae-, plant-, animal- or biomass-derived) and are non-petrochemically derived (*i.e.*, not derived from a non-renewable resource such as fossil fuel, petroleum or other "old" carbon source). In this sense, as they are derived from renewable materials, they are also sustainable compounds. It also means that such materials are formed from bio-alkenes. When used in the terms, "bio-alcohol," or "bio-alkene," and similar compounds herein, "bio" is intended also to have the same connotation as noted above for describing "bio-1,2-alkanediol." Such materials should preferably satisfy the requirements of having and being derived from an authentic or "new" carbon material (non-petrochemically derived) feedstock as confirmable through testing such a compound using mass spectroscopy as described above and/or gas chromatography, the current ASTM D6866-16 standard or prior methods such as specific stable isotope analysis (CSIA). The invention further includes the bio-1-alkenes and bio-1,2-alkanediols resulting from the synthesis process, as well as various products incorporating them. The invention further includes a method for treating a catalyst, which may be used in embodiments herein for dehydrating a bio-1-alcohol to form a bio-alkenes used in the processes herein for forming bio-1,2-alkanediols.

[0063] The invention provides efficient pathways to 100% "natural" or "bio" compounds that are from new carbon or authentic carbon materials that are not petrochemically derived and are preferably used in compositions and products that can be made for a wide variety of end uses and compositions, including as components of antimicrobial compositions and as cosmetic additives, among other uses described herein.

[0064] Also disclosed herein are methods of using bio-1,2-alkanediols for use as antimicrobials in a composition such as in or with an alternative preservation system and/or as hurdle technology. Also disclosed are various compositions comprising bio-1,2-alkanediols, including when used as an antimicrobial. Also described are methods of boosting the antimicrobial efficacy of a composition already including a preservative or alternative

preservation system, and the resulting boosted antimicrobial efficacy composition. Each of such methods includes incorporating into the composition a bio-1,2-alkanediol, combination(s) of at least two different bio-1,2-alkanediols, or combination(s) of at least one bio-1,2-alkanediol with at least one other bio-compound different from the at least one bio-1,2-alkanediol, wherein the bio-1,2-alkanediol(s) either act as a antimicrobial or boost the efficacy of another antimicrobial, preservative or other alternative preservation system already present in a composition. The bio-1,2-alkanediols may themselves be an antimicrobial product and/or a antimicrobial efficacy boosting product whether used alone, in combinations of one or more different bio-1,2-alkanediols, or in combination(s) of one or more different bio-1,2-alkanediols with at least one other bio-compound different from the bio-1,2-alkanediols and/or an optional, different antimicrobial, preservative or alternative preservation system. The bio-1,2-alkanediols when used in compositions herein exhibit antimicrobial efficacy.

[0065] In one embodiment herein, a process is described herein for synthesis of bio-1,2-alkanediols. As noted above, materials referred to herein as “natural” are intended to include materials that are non-petrochemically derived and are sustainable, whether synthesized from non-petrochemically derived, natural materials or formed from a natural, and preferably an authentic natural or bio-based source.

[0066] The method includes providing a bio-alkene having a carbon chain of about 5 to about 20 carbon atoms, preferably about 6 to about 14 carbon atoms, and more preferably about 6 to about 10 carbon atoms, with a bio-1-octene being preferred. The bio-alkene is preferably a bio-1-alkene with a traditional α -olefinic structure. It also preferably has a regioselectivity when prepared of at least about 80%, more preferably at least about 92% and most preferably at least about 95% up to as much as 99%.

[0067] Such bio-alkenes may be bio-1-pentene, bio-1-iso-pentene, bio-1-hexene, bio-1-heptene, bio-1-octene, bio-1-nonene, bio-1-decene, bio-1-dodecene, and related bio-1-alkenes up to chain length of 20 carbons. Larger or smaller bio-alkenes may also be made, however, the preferred bio-alkenes for use herein are those with sufficient chain length to serve as effective antimicrobials when converted to bio-1,2-alkanediols without losing the desired properties. Such bio-alkenes may be straight or branched chain molecules, although straight chain molecules are preferred and may include one or more functional or substituted groups for desired end effects in the end use application, for example, sulfonate groups, hydroxyl groups, ether groups, amide groups, carbonyl groups, carboxylic acid groups, amine groups, fluorinated

groups, aryl or arene groups, and similar functional groups without intending to be limiting. Preferably any such functional or substituted groups do not interfere with conversion to an alkanediol or with the antimicrobial end application desired for the particular alkanediol.

[0068] Such bio-alkenes, such as bio-1-hexene and bio-1-octene, as are generated according to the invention, may be used to make bio-1,2-alkanediols as described herein, and may also be used to make other bio-based compounds and polymers, including, *e.g.*, for synthesis of bio-based olefin copolymers. Bio-1-alkenes herein may be used, for example, in free radical or catalytic polymerization processes as are known in the art, to yield a variety of bio-polyalphaolefins homopolymers and copolymers, which are useful as lubricants and cosmetic ingredients. A further example, includes bio-linear low-density polyethylene (bio-LLDPE) can be prepared via copolymerization of bio-ethylene (derived via dehydration of sugarcane derived bio-ethanol to bio-ethylene) with bio-1-alkene copolymers yielding 100% renewable bio-LLDPE, a thermoplastic resin useful in film applications such as food and non-food packaging and shrink/stretch films.

[0069] The process of the invention includes an embodiment wherein the process makes bio-1,2-alkanediols, including providing a bio-1-alcohol and a catalyst treated with a base, preferably with a promoter and then calcined; dehydrating the bio-1-alcohol in the presence of the catalyst to form a bioalkene having a carbon chain length of about 5 to about 20 carbon atoms and a bio-1-alkene regioselectivity of at least about 80%; and converting the bio-alkene to a bio-1,2-alkanediol having a carbon chain length of about 5 to about 20 carbon atoms.

[0070] An overall flow diagram of a preferred process of making bio-1,2-alkanediols, that incorporates a preferred method of treating a catalyst as described further below is provided as embodiment 100 as shown in Fig. 1.

[0071] In the process generally referred to herein as process 100, in Fig. 1, prior to

introducing the bio-1-alcohol, a catalyst is prepared. A suitable γ -alumina catalyst, *e.g.*, Al_2O_3 , 110 is introduced into a reactor 101 into which a calcium promotor or other base treatment material 102 as described further below is introduced. After a suitable treatment described in detail below, a modified catalyst 103 leaves reactor 101 and enters a heated chamber 104 such as an oven for heat treatment. If a catalyst promoter is used, for example, a calcination step occurs at preferred and controlled temperature ranges to increase a level of regioselectivity in a resulting bio-alkene in the next step. After, *e.g.*, calcination in chamber 104, the calcined or otherwise heat-treated catalyst 105 is introduced along with a bio-1-alcohol 106 such as bio-1-

hexanol or bio-1-octanol into a reactor 107 to promote intimate contact between the alcohol and the catalyst. Suitable reactors included fixed bed reactors, fluidized bed reactors, tubular reactors, and other suitable reactors. After sufficient time for dehydration of the bio-1-alcohol to a bio-alkene 109, which highly regioselects to a bio-1-alkene, a further, optional distillation or other purification or refining step in a column(s) or other equipment 110, may occur. The refined or otherwise purified and highly regioselective bio-alkene, which should be of a high quantity of bio-1-alkene, is then introduced to a reactor 112 in order to convert the bio-1-alkene into a bio-1,2-alkane diol 113. Such bio-1,2-alkane diol 113 may be further and optionally refined such as by distillation in a column(s) or through other steps in equipment 114. After purification or distillation, a final high yield of up to 99% is removed as the final bio-1,2-alkane diol 115.

[0072] The bio-1-alkene may be made using a catalytic process, and preferably using a catalyst that has been treated according to the method described herein. In one embodiment, the bio-alkene, which is preferably made herein to be of a high regioselectivity bio-1-alkene is formed using a bio-1-alcohol that is dehydrated by heating the bio-1-alcohol in the presence of a catalyst. This may be done, for example, by passing the bio-1-alcohol through a fixed bed reactor, or a fluidized bed reactor. The fixed bed may be packed with a catalyst, preferable a treated catalyst having been treated using techniques as described below.

[0073] For example, a bio-1-alcohol derived from a plant source, including biomass that can produce a related acid (*e.g.*, 1-octanol may be derived from coconut, palm or other plant source or biomass that can produce octanoic acid, which is subsequently reduced via catalytic dehydrogenation to 1-octanol). The bio-1-alcohol is then dehydrated regioselectively by feeding the material at an elevated temperature into, *e.g.*, a fixed bed reactor or other suitable reactor providing intimate contact between the bio-1-alcohol and the catalyst. The fixed bed may be packed with or otherwise arranged to provide sufficient contact with a catalyst. Other suitable reactors may be provided for this purpose provided they can achieve suitable contact for assisting in dehydration. Examples include tubular reactors, fixed and fluidized bed reactors, and the like.

[0074] The reactor can be designed as a simple heated reaction tube packed with catalyst and a flow of the gaseous bio-1-alcohol over the catalyst, preferably in a single pass affording greater than about 95% conversion, with greater than about 98% a preferred embodiment, and in all cases with no recycle stream used whatsoever in the overall process flow. In one

embodiment, the reaction tube is heated isothermally, the tube having from 1 to 10 reaction zone temperatures along the length of the tube, each heated in the range of about 240°C to about 360°C in order to optimize catalyst performance. In a preferred embodiment, the reaction tube has 1 to 4 reaction zone temperatures in the range of about 260°C to about 340°C.

5 [0075] In one embodiment the process is carried out in a fluidized bed reactor operated in the temperature range of about 240°C to about 360°C. Other continuous flow reactor designs can be used in accordance with procedures and practices used by those familiar with the art of chemical engineering.

[0076] The catalyst used may be prepared by treating γ -alumina (*e.g.*, Porocel®
10 CatGuard®) with at least one base, preferably a promoter, such as with sodium hydroxide, potassium hydroxide, calcium acetate and the like to create a second catalyst. This second catalyst is then calcined to create a third catalyst. The calcination temperature has been found to be most unexpected and critical to creating the most effective catalyst. As seen below when calcined at about 500°C, a significant drop occurs in regioselectivity compared to catalysts
15 calcined at lower temperatures. In one embodiment, as demonstrated in Table 1 below, preferred calcination temperature is about 400°C to about 480°C, and a more preferred calcination temperature is about 440°C to 460°C.

Table 1

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Catalyst	Calcination Temperature (°C)	1-Octene (%)	2-Octene & 3-Octenes (%)	1-Octanol (%)	1-Octene Selectivity (%)
EXAMPLE 1	440	94.0	3.2	1.6	97.4
EXAMPLE 2	500	88.9	6.6	3.5	93.1

[0077] Varying catalysts may be used for assisting the bio-1-alcohol in the dehydration step. However, it is preferred that a suitable catalyst that can achieve high levels as
25 regioselectivity as described herein is used. Suitable catalysts include γ -alumina-based catalysts and ZnAl_2O_4 . Preferably, the catalyst is treated with a base, such as with sodium hydroxide, potassium hydroxide, calcium acetate and the like. In one preferred example, the catalyst is a γ -alumina catalyst treated with a base including a Group I or Group II metal. In

one more preferred embodiment, calcium may be included in the base, and a calcium promoter used. After being treated with the calcium promoter to form a modified γ -alumina catalyst, in a further preferred embodiment, the modified γ -alumina catalyst is then calcined using varying calcination techniques but at temperatures which are preferably much lower than used in standard calcination methods to provide a calcined γ -alumina catalyst. The initial treatment provides a modified γ -alumina catalyst that is then calcined to be ready for use for varying processes including in the dehydration step of the processes herein for making bio-1-alkenes and their subsequent conversion to bio-1,2-alkandriols.

[0078] When employing a calcium promoter, it may be used in the treatment noted above in amounts of about 0.01 weight percent to about 4 weight percent, based on the amount of CaO determined after calcination. In preferred embodiments, about 1 weight percent to about 2 weight percent of the calcium promoter is used based on the amount of CaO determined after calcination.

[0079] In another embodiment, if desired, the alumina-based treated catalyst may be further organosilanized with an organosilane by treatment with, for example, diethoxydiphenylsilane to form an organosilanized base-treated γ -alumina catalyst. The organosilanized base may be, for example, diethoxydiphenylsilane, dichlorodiphenylsilane and similar materials.

[0080] In one embodiment a catalyst support may comprise ZnAl_2O_4 and may also be modified by a base, e.g., by reaction with a promoter and similar catalysts and modified catalyst materials known or to be developed that are capable of carrying out the process as noted herein in a manner similar to the catalysts noted herein that can create a high level of regioselectivity could also be used.

[0081] The catalysts as noted above in addition to being suitable if treated with a base, may alternatively or also be treated with an organosilane or organosilane-modified material to create a promoter-modified catalyst. This promoted catalyst may be further organosilanized with an organosilane by treatment with diethoxydiphenylsilane to create a third, organosilanized and promoter-modified γ -alumina catalyst. The organosilane used to modify the catalyst may be, for example, diethoxydiphenylsilane, dichlorodiphenylsilane and similar materials. As seen in EXAMPLE 10 herein, silanization of the catalyst leads to a decrease in bio-1-octene selectivity, once again showing a difference from previous art and the direct and proven differences in the dehydration catalyst makeup necessary for a highly regioselective dehydration of 1-butanol or 1-octanol.

[0082] In other treatment techniques herein, the γ -alumina catalyst may be modified by the technique of incipient wetting impregnation. A solution of the base is used to modify a solid support in a manner so as to avoid excess moisture that can result in support damage and chemical change. In one embodiment, the incipient wetting impregnation solution (IWS) is about 40% to about 100% the weight of the solid support, which may be, for example an untreated γ -alumina catalyst. In one embodiment, the untreated γ -alumina catalyst is selected from the commercially available, Porocel® CatGuard®. Preferably, the IWS is about 50% to about 60% of the catalyst support weight.

[0083] The γ -alumina may also be provided in a powder form having a surface area of about 50 to about 400 m²/g. The γ -alumina in one embodiment is shaped by a suitable extrusion process, as are known to those skilled in this art of solid phase catalysts. In one example, the γ -alumina is in the form of 1/16" to 1/8" cylindrical rods with a length to diameter ratio of about 20:1, preferably about a ratio of about 5:1. The extrudate can be in the shape of spheres, star-shaped, hollow cylinders or any three-dimensional shape that can ultimately deliver a γ -alumina with sufficient surface area pore volume, mechanical strength, and physical size to be used in a continuous flow reactor system.

[0084] Once prepared, *e.g.*, a base-treated, preferably a promoter treated, γ -alumina catalyst, as noted above is preferably calcined with care taken in regulating the temperature. This is done at an elevated temperature, preferably in a suitable chamber such as an oven, and the temperature range, while elevated to heat the materials, is not as high as calcination treatments typically used in prior catalyst processes. Instead, the temperature for calcination is kept at about 400°C to about 500°C, and preferably about 420°C to about 480°C, and most preferably about 440°C to about 460°C. Typically, prior standard calcination treatments occur at temperatures 500°C or higher with no limits established or specified for effectiveness. However, applicants discovered that by controlling this temperature and in the specific catalyst treatment process noted herein, the regioselectivity can be unexpectedly controlled to disproportionately favor formation of the bio-1-alkene when the bio-1-alcohol is dehydrated using the resulting calcined catalyst derived from a combination of catalyst treatment and a carefully controlled calcination process.

[0085] In the dehydration step herein, the bio-1-alcohol may be fed to a reactor undiluted or in water through the reactor. Optional an inert gas (*e.g.*, nitrogen) may be used as a purge gas to retain consistency and avoid contaminants in the process. The bio-1-alcohol is preferably

fed, such as by a pump (such as an HPLC pump) or pressurized gas source at a temperature of about 200°C to about 400°C, although temperatures may be adjusted for different bio-1-alcohols depending on the reaction time and flow rate, the catalyst selected and the desired outcome. As the product is removed from the reactor, it is preferably monitored to determine content, identification of product and the ratio of bio-1-alkene conversion as well as the regioselectivity. In a preferred embodiment, the bio-1-alkene has a regioselectivity of at least about 80%, and more preferably about 92% to about 99% and even more preferably about 95% to about 99%.

[0086] In one embodiment, the dehydration process as described in Fig. 1 using the invention catalyst, i.e., the catalyst resulting from the preferred treatment and calcination process noted above, can be stopped and the catalyst maintained under inert gas flow for extended periods of time. This shutdown period can be hours, days or weeks, with heating or no heating applied during this period. The invention catalyst can be re-heated and dehydration process resumed without any detrimental effect on catalyst activity or regioselectivity. Thus, the invention catalysts are not only robust in continuous operation, but they can withstand periods of rest (inactivity) without negative effect on catalyst performance when brought back on line.

[0087] The bio-1-alkene may also be formed using a process in which the bio-1-alcohol in water is dehydrated by heating the bio-1-alcohol with a catalyst under a purge gas as noted above in a bulk process or other continuous reactor. Base and optional organosilane treatments may also be used as well as catalysts and reaction conditions such as those noted above, and most preferably, through use of a calcined γ -alumina catalyst formed by the process described above.

[0088] The bio-1-alcohol may also be formed using a process in which the bio-1-alcohol in water is dehydrated by heating the bio-1-alcohol with a catalyst under a purge, but as noted above, in bulk process or some other continuous reactor. Base and optional organosilane treatments may also be used as well as catalysts and reaction conditions as noted above.

[0089] Once the bio-1-alcohol is dehydrated to form the highly regioselective terminal, bio-1-alkene, that material is then converted to a bio-1,2-alkandiol having a carbon chain length of about 5 to about 20 carbon atoms. Prior to conversion, the bio-1-alkene may optionally be further refined such as by a distillation, vacuum distillation, fractionation or similar refining step to further purify the bio-alkenes to remove trace impurities and minor undesired fractions.

For example, in forming a bio-1-octene, a C8 olefin content of about 90 weight percent to about 99 weight percent can be achieved, and at least about 95 weight percent and preferably about 97 weight percent or greater C8 olefin in the form of the *n*- α -olefin (*i.e.*, 1-octene) can be achieved. In addition, in forming a bio-1-hexene, a C6 content of about 95 weight percent to about 99.8 weight percent can be achieved, with at least about 96 weight percent to about 99 weight percent thereof having a 1-hexene structure.

[0090] Various chemical reactions may be used for this conversion as are known for use in standard alkene to alkanediol conversions using petrochemically derived starting materials and/or that are used for smaller chain bio-alkanes. For example, the bio-1-alkene is reacted in the presence of at least one of formic acid or acetic acid, and a peroxide such as hydrogen peroxide to form an intermediate solution including a bio-1,2-epoxyalkane, bio-1,2-alkanediol, and other components. This is then further contacted with a base solution, such as a sodium hydroxide or another suitable base solution, to complete formation of the bio-1,2-alkanediol. The process noted above preferably yields about 60% to about 99%, and more preferably about 70% to about 99% or about 75% to about 99% of bio-1,2-alkanediol.

[0091] A bio-1-alkanol may also be converted to bio-1-alkene for use in this process by dehydrating the bio-1-alkanol using heat and an acid catalyst in accordance with other previous techniques.

[0092] Bio-1,2-alkanediols, having a chain length of about 5 to about 20 carbon atoms and synthesized by conversion of a first bio-alkene having a carbon chain of about 5 to about 20 carbon atoms and a bio-1-alkene regioselectivity of at least about 80%, more preferably 92% to about 99% and most preferably about 95% to about 99%. In one embodiment, a bio-1-alkanol having a carbon chain of about 5 to about 20 carbon atoms is preferably first converted to a bio-alkene regioselectively such that the resulting bio-alkene contains a bio-1-alkene content of at least about 80% or higher as noted above. Then the bio-1-alkene is converted to the 1,2-alkanediol by any known method known in the art. The resulting bio-1,2-alkanediol after conversion may be further refined such as by distillation, vacuum distillation, fractionation or other similar steps as are noted above for refining the bio-1-alkene to provide a refined, final bio-1,2-alkanediol.

[0093] Resulting bio-1,2-alkanediols, having a chain length of about 5 to about 20 carbon atoms are preferably synthesized by first dehydrating a bio-1-alkanol having a carbon chain of about 5 to about 20 carbon atoms to a bio-1-alkene having a regioselectivity of at least about

80%, more preferably about 92% to about 99% and most preferably about 95% to about 99% of bio-1-alkene is formed, then treating the bio-1-alkene with formic or acetic acid in the presence of hydrogen peroxide, and further with an aqueous base solution. The bio-1,2-alkanediol may then be separated from the aqueous solution by any suitable technique known in the art of making dihydroxyalkanes in general, and more specifically 1,2-alkanediols. In a preferred embodiment, a distillation step is included for this purpose.

[0094] The bio-1,2-alkanediols as described above, may be used in a variety of compositions, whether used alone or in combination with other different bio-1,2-alkandiols according to the present invention. Such compositions may incorporate one, two or more different bio-1,2-alkanediols according to the invention herein that may act within an antimicrobial system. Such bio-1,2-alkanediol(s), may be used alone as an antimicrobial additive or in an antimicrobial system incorporating other bio-compounds (*i.e.*, any suitable naturally derived, and preferably authentic natural product as tested using mass spectroscopy, gas chromatography and/or the ASTM standard noted above) such as bio-organic acids, bio-diols such as 1,3-propanediol, bio-1,2-butanediol, and 1,2-pentanediol that are extracts from fermentation products of bio-based starting materials and/or other antimicrobial materials, alternative preservatives, traditional preservatives or hurdle technology components as are known in the art or to be developed. An example of a preferred source of bio-compounds for use within the scope of the invention are triglycerides. In yet a further example, another chemical group of bio-compounds that can be used in preparing alternative preservatives is commonly described as terpenoids. These natural terpenoids can have from 5 to 20 carbon atoms and can be readily obtained through sustainable farming practices and may be used within the scope of "bio-compounds" as that term is used herein for us in combination with the bio-1,2-alkanediols herein.

[0095] When used in a composition, the bio-1,2-alkanediols of the invention are preferably incorporated in an amount of about 0.1 to about 10 weight percent, and preferably 0.3 to about 2 weight percent, of the total composition; which amount may be varied depending on whether they are used alone for antimicrobial effect or with other components in an antimicrobial system. In the latter instance, the bio-1,2-alkanediols are preferably present in a ratio of the bio-1,2, alkanediol(s) to any other antimicrobial component(s) of about 99:1 to about 1:99, and preferably about 75:25 to about 25:75 in the antimicrobial system (wherein the system would

include the bio-1,2-alkanediol(s) herein and/or any other antimicrobial, traditional preservative, alternative preservation and/or hurdle technology component(s) in the composition).

[0096] When used in certain compositions that are themselves viewed as “antimicrobial products” for providing to other formulators in various industries, the 1,2-bio-alkanediol(s) of the invention may be prepared initially as antimicrobial products that include one or more of the 1,2-bio-alkanediol materials made in accordance with the invention as described above and that incorporate one or more of the compositions as noted above, wherein such antimicrobial products may include also other bio-compounds, known antimicrobials, preservatives, alternative preservation materials or hurdle technology materials.

[0097] Examples of known preservatives and alternative preservative materials or compounds used in alternative preservation systems that may be used with the bio-1,2-alkanediols of the invention, include those suitable for use by various industries in which the present invention may be beneficial. For example, in the cosmetic and personal care industry, the bio-1,2-alkanediol(s) formed according to the present invention can be used alone, in combinations of two or more such materials and/or with other biocompounds and/or with known cosmetic preservatives and alternative preservation materials and/or hurdle technology components. Examples of preservative materials are listed by the FDA in the U.S. as including: (i) traditional preservatives, such as parabens (methyl, ethyl, propyl, and butyl), Quaternium 15 (aka “Dowicil”), diazolidinyl urea, imidazolidinyl urea, DMDM hydantoin, 2-bromo-2-nitropropane-1,3-diol (aka “Bronopol”), sodium hydroxyglycinate, phenoxyethanol, sorbic acid, potassium sorbate, methylisothiazolinone (aka “MI”), methylchloroisothiazoline (aka “CMI” often in combination with MI as Kathon CG), sodium benzoate, caprylyl glycol, sodium dehydroacetate, and formaldehyde; (ii) non-traditional or alternative preservatives: such as extracts of botanicals, organic acids, alcohols and glycerols, fermentation products, glyceryl caprylate, levulinic acid, p-anisic acid, eucalyptus globulus, glycyrrhiza, glabra (licorice) root extract, salvia officinalis, citrus grandis (organic grapefruit) extract, arnica montana (organic arnica) extract, boraxitrus seed extracts, leuconostoc/radish root ferment filtrate. goldseal (hydrastis canadensis root extract), citrus medica, limonum (Lemon) peel extract, caprylhydroxamic acid; and (iii) so-called “self-preserving” materials such as ethanol (when present at > 15%), butylene glycol (when present at >10%), propylene glycol (when present at > 20%); as well as (iv) other components used in alternative or traditional preservation systems in cosmetics such as MDM hydantoin, sodium hydroxymethylglycinate, benzisothiazolinone,

benzyl alcohol, dehydroacetic acid, benzoic acid, salicylic acid, iodopropynyl butylcarbamate chloroxylenol, methyldibromo glutaronitrile, chlorphenesin, triclosan, benzalkonium chloride, chlorhexidine, polyaminopropyl biguanide, 5-bromo-5-nitro-1,3-dioxane (bronidox), hexamidine diisethionate, pentyleneglycol, ethylhexylglycerin, triclocarban, glyceryl caprylate, o-cymen-5-ol, chlorphenesin, and glyceryl monolaurate, and traditional petrochemically-derived 1,2-alkanediols such as 1,2-hexanediol, 1,2-octanediol.

[0098] Other countries have similar lists with variations on the nature and type of preservatives, alternative preservatives or preservative system or hurdle technology additives that may be used in those countries. However, the present bio-1,2-alkanediols may be used in such other materials as well. In each of the above-noted systems and compositions, the preferred bio-alkene used in the invention is a bio-octene and the at least one first bio-1,2-alkanediol is bio-1,2-octanediol.

[0099] Examples of compositions that may benefit from an antimicrobial system incorporating one or more of the bio-1,2-alkanediols formed according to the process noted above and/or in compositions as noted above include personal care compositions, such as hair care, oral care, skin care or cosmetic compositions; household product compositions, such as fabric care or cleaning products; industrial compositions; and pharmaceutical, vitamin, nutraceutical or other health care compositions, any of which could benefit from an antimicrobial system, component or antimicrobial product derived from an authentic, natural, bio-based material.

[0100] The bio-1,2-alkanediols are preferably incorporated into a cosmetic or personal care composition (on a wet-basis or total weight basis) so as to make up about 0.001% by weight to about 25% by weight of the composition, and more preferably about 0.01% by weight to about 10% by weight of the composition. The amount used may vary depending on whether other hurdle technology components or other preservatives are also being used in the composition.

[0101] Such bio-1,2-alkanediols alone, in combinations of two or more different bio-1,2-alkandiols, and/or in antimicrobial systems incorporating the bio-1,2-alkanediol(s) alone or with other bio-compounds and/or other preservative, alternative preservative or hurdle technology components, may also be used in a method to provide an antimicrobial effect to a composition, wherein the compositions may be any of the variety of types of compositions as noted above. It is preferred that the bio-1,2-alkanediols herein provide an antimicrobial effect and efficacy to a composition into which the bio-1,2-alkanediols are incorporated, whether into

a personal care, household, industrial, pharmaceutical, vitamin, nutraceutical or other health care composition. Such an antimicrobial effect may be demonstrated by using a variety of suitable antimicrobial effectiveness tests (AET). Such tests include, for example, a compendial test performed during formulation development and stability testing in parenteral drug products intended as a multi-dose product. Suitable test procedures and acceptance criteria are described in the *U.S. Pharmacopeia*, AET, the *European Pharmacopeia* (Efficacy of Antimicrobial Preservation), and the *Japanese Pharmacopeia* (Preservation Effectiveness Tests). Other suitable challenge tests may be used. The FDA also recommends suitable challenge testing.

[0102] One group of antimicrobials, some of which are in the group noted above, are other alcohols, and preferably at least one other alcohol, preferably at least one other diol, and most preferably one or more other vicinal diols that may be petrochemically derived, albeit, it is preferred that such materials are used as diluents or in smaller amounts for providing some antimicrobial effect, but are not so great as to diminish the impact of the natural, bio-based 1,2-alkane diols of the present invention. By the term, "vicinal diols," it is meant materials that have hydroxyl groups which are bonded to atoms in the molecule which are next to each other, *i.e.*, wherein two atoms each bearing a hydroxyl group are bonded to each other. Examples of vicinal diol compounds suitable for use in the invention, include, but are not limited to, ethylene glycol and propylene glycol. Such materials are used in the personal care, cosmetic and pharmaceutical arts as humectants and solvents, and as described in U.S. Publication No. 2007-0207105-A1 as having some modest antimicrobial activity.

[0103] Preferred vicinal diols for use with the bio-1,2-alkanediols herein, in compositions described for use in personal care and pharmaceutical use compositions are medium-chain length, linear vicinal diols that demonstrate some antimicrobial activity including petrochemically-derived 1,2-pentanediol, 1,2-hexanediol, 1,2-octanediol, and 1,2-decanediol. Other vicinal diols useful in the compositions described herein include molecules derived from glycerin. Glycerin can be reacted with other molecules at its 1- or 3-position, leaving two vicinal hydroxyl groups. For example, glyceryl monoethers, such as ethylhexylglycerin [3-(2-ethylhexyloxy)propane-1,2-diol], available commercially as SENSIVA®SC50 from Schulke & Mayr, are useful, traditional, liquid vicinal diols having antimicrobial properties. Glyceryl monoesters such as glyceryl monolaurate, glyceryl monocaproate, or glyceryl monocaprylate, the latter of which is commercially available from Inolex Chemical Company, Philadelphia, PA, are also useful antimicrobial vicinal diols. For the preservation of cosmetics, toiletries and

pharmaceuticals, vicinal diols are known to be effective against bacteria and yeast but weak against fungi and to date there are only limited natural choices, none of which to applicant's knowledge are bio-derived natural 1,2-alkanediols of from 5 to 20 carbon atoms.

5 **[0104]** The compositions herein preferably do not include, or include only to a minor amount any preservation materials such as parabens, or other known preservation materials that can be viewed as harmful to the user.

10 **[0105]** Such personal care and pharmaceutical compositions may optionally further include a solubilizing agent in amounts of about 1% to about 70% by weight of the combination of the solubilizing material with the bio-1,2-alkane diol(s) (or if used with other preservation component(s) by weight of the entire antimicrobial system with the solubilizing material). Suitable solubilizing agents include vicinal and other traditional diols.

15 **[0106]** Also useful in with the bio-1,2-alkanediols in any antimicrobial system are hydroxamic acid and the like which may be used in a variety of industries. Suitable hydroxamic acids include alkylhydroxamic acids and bio-alkylhydroxamic acids that include at least one alkyl group of a chain length of about two to about twenty-two carbon atoms, which may be branched or linear in structure, substituted or unsubstituted, and saturated or unsaturated as noted hereinabove. Preferred alkylhydroxamic acids contain alkyl groups of a chain length of about six to about twelve carbon atoms and most preferably linear chains of that length. Most preferred alkylhydroxamic acids are caprylohydroxamic acid, having a linear terminal chain of
20 eight carbon atoms and caprohydroxamic acid, having a linear chain of ten carbon atoms. Such alkylhydroxamic acids may be used alone or in combination and in amounts as noted above for an optional solubilizing agent.

25 **[0107]** Formulations prepared for personal care use, and pharmaceutical compositions, depending on the end use (topical or oral) may include any other colorants, fragrances, active ingredients or other additives typically used and/or to be developed in the art for use in personal care and pharmaceutical formulations, in which additives will vary depending upon the formulation in which the preferred bio-1,2-alkanediols, or antimicrobial products or systems containing the bio-1,2-alkanediols are used, for example, in topical skin toners, skin cleansers, night creams, skin creams, shaving creams, skin care lotions, or other cosmetic preparations;
30 make-up, such as foundation, liquid and powder-based make-up, mascara, lipstick, blush, gloss, eye-liner and the like; or other personal care and/or pharmaceutical compositions, such as, sunscreens, lip balms, fragrances, massage oil, shampoos, conditioners, conditioning shampoos,

hair styling gels, hair reparatives, hair tonics, hair fixatives, hair mousses, bath and shower gels, liquid soaps, moisturizing sprays, makeup, pressed powder formulations, bath additives, ophthalmic preparations, foaming soaps and body washes, sanitizing wipes, hand sanitizers, medicaments (tablets or liquid), towelettes and wipes and others. It should be understood, based on this disclosure that a wide variety of personal care and pharmaceutical compositions could benefit from the properties of the bio-1,2-alkanediols of the present invention, wherein, as used herein, pharmaceutical composition is one having at least one active pharmaceutical ingredient (API).

[0108] The personal care and pharmaceutical formulations, if liquid based (such as gels, hydrogels, lotions, shampoos, liquid pharmaceuticals and the like) will also preferably include water as part of the liquid base. The formulations and compositions may include other additives as well depending on the end formulation desired, such as without limitation, at least one humectant, at least one emulsifier and/or thickener, chelating agent(s), gelling agent(s), amino acid(s), emollient(s), various solvents, free radicals and initiators, sunscreen UVA and/or UVB blocking agents, antioxidants, other preservatives, waxes, polymers and copolymers, inorganic and organic pigments and/or one more fragrances, favoring(s), coloring agent(s), herbs, natural extracts, essential oils, pharmaceutical drug products, other APIs and other additives commonly used in such formulations.

[0109] Personal care and pharmaceutical compositions using the bio-1,2-alkanediols herein may be lotion-based, oil-in-water emulsions, water-in-oil emulsions, water-in-silicone emulsions, silicon-in-water emulsions, gels, solids, liquids, cream based, oil based, aqueous/alcoholic or glycolic solution based, dispersions, suspensions or syrups, microemulsions or a liposome-based formulations.

[0110] In water-based formulations, other than solids and thicker gels, etc., it is preferred that about 20% by weight to about 95% by weight (on a wet basis) of water is incorporated therein. The various additives aside from the water and preferred antimicrobial systems noted herein, would make up the remaining portion of various personal care and pharmaceutical compositions. Preferably, each additive is present in an amount of up to about 75 percent by weight of the entire formulation, and more preferably up to about 40 percent by weight, with a collective amount of such additives of preferably no greater than about 50 percent by weight.

[0111] In a household product, antimicrobials are also useful additives. Household product compositions can include household cleaners as well as fabric care compositions. Cleaning

compositions (whether solids or solutions) can incorporate cleaning agents that are active ingredients for cleaning (bleach, vinegar, ammonia, citric acid and the like). For liquid cleaning agents, aqueous solutions may be used as are known in the art or to be developed, such as quaternary ammonium compounds, bleach, vinegar, or basic or acidic cleansers.

5 Commercially available quaternary ammonium-based cleaning products include various antibacterial all-purpose cleaners among others which are intended and well-suited for sanitizing or disinfecting efficacy, however, such compositions still incorporate antimicrobials and other preservatives for shelf life and to prevent growth of foreign agents. Thus, such compositions also benefit from use of the natural bio-1,2-alkanediols herein.

10 **[0112]** For more natural cleaning solutions, such as citric acid-based agents or other green cleaning agents (ecologically friendly), consumers would be interested in further additives that are also natural, and in this case that are derived from a biological source. Thus, such compositions benefit from natural bio-based 1,2-alkanediols herein as well as antimicrobial systems and products incorporating the bio-1,2-alkanediols. Such natural cleaning

15 compositions as well as standard cleaning compositions as noted above may also incorporate various optional additives in varying amounts as noted below. Citric acid-based cleaning products may include lemon, orange or grapefruit-based cleaning agents. Other suitable components may include grape seed oil, vegetable oils combined with one or more of mild peroxide agents, surfactants, and the like, as well as pigment(s) or colorant additive(s) to

20 provide a visual alerts when the cleaners are present, conventional or alternative preservation compound(s), antimicrobial(s), bactericide(s) or fungicide(s) (each of which may be used along or in combination with the bio-1,2-alkanediols of the present invention in an antimicrobial system or product), thixotropic agents and rheological modifiers, pH adjusting additives or buffers, as well as fragrance additive(s) for providing a clean smell (pine scent, lemon scent,

25 orange scent, floral scent, etc.). In addition, other agents for foaming, color change or effervescence (bubbling) may be provided if desired to demonstrate cleaning action. Solid cleaners can incorporate similar additives, but can be compressed, incorporated or formed from depositing a cleaning material on a substrate (sponge, scrubber, mop head or the like), and various inactive agents for holding the solid cleaning material together (hardeners, gelling

30 agents, mineral powder and the like). Other additives for household cleaning compositions may include pH buffering agent(s), a fragrance encapsulate(s) or carrier(s), fluorescer(s), hydrotrope(s), soil-release agent(s), polyelectrolyte(s), enzyme(s), optical brightening agent(s),

anti-oxidant(s), UV absorbing compound(s), propylene glycol, dipropylene glycol, opacifier(s), pearlescent(s) and combinations of these as well as other cleaning product additives known or to be developed.

[0113] The fabric care compositions can include any active fabric cleaning component as well as various conditioning components as are known or to be developed in the art. Such compositions may include ingredients used for fabric cleaning or laundering, fabric conditioning or softening, fabric dye(s), water conditioner(s) and/or fabric care composition(s) such as spot removers or stain treatments. Such ingredients include without limitation antifoam agent(s), antideposition agent(s), fragrance(s) and their carrier(s) or encapsulate(s), traditional or conventional diols (although such diols may be omitted if the bio-1,2-alkanediols are useful in the same or an enhanced or boosted capacity for an existing diol), colorant(s) such as pigment(s) or dye(s), and co-softening agent(s). Others additives for fabric care compositions may include, without limitation, other traditional preservative(s), antimicrobial(s), bacteriocide(s), and/or fungicide(s)(each of which may be used alone or in an antimicrobial product or system as described herein), pH modifier(s) or buffering agent(s), fluorescer(s), hydrotrope(s), soil-release agent(s), polyelectrolyte(s), enzyme(s), optical brightening agent(s), anti-shrinking agent(s), anti-wrinkle agent(s), anti-spotting agent(s), anti-oxidant(s), UV absorbing compound(s), anti-corrosion agent(s), drape imparting agent(s), anti-static agent(s), ironing aid(s), odor-preventing compound(s), perfume encapsulate(s), cotton seed oil, tea tree oil, aloe vera extract, propylene glycol, dipropylene glycol, opacifier(s), pearlescent(s) and combinations of these components.

[0114] The antimicrobial bio-1,2-alkanediols herein may also be used in the treatment of the finished textile(s) and/or treatment of the fibers or yarns from which a textile is to be fabricated to achieve the desired benefit. Textiles may include woven and non-woven textiles, such as felt and tapa cloth and other bark cloths, or blends and combinations of the same. Textile fiber (whether it exists in finished textile form, yarn or fiber form) may be any known or developed in the art and include synthetic fibers, "natural" fibers, such as animal derived fibers or cellulosic/plant-derived fibers and blends or combinations of any of these.

[0115] Animal-derived fibers may include and derived from the hairs or fur of an animal. Examples are, without limitation, lambs or sheep's wool, alpaca, angora wool, azlon, byssus, camel hair, cashmere wool, chiengora, chatgora, llama, mohair wool, qiviut, rabbit, silk, vicuna, yak, pashmina wool and combinations of the same. Cellulosic or plant-derived fibers may

include, without limitation, those obtained from flax (linen fibers), cotton, ramie, jute, kenaf, beach hibiscus, roselle, urena, hemp (e.g., *Crotalaria juncea*, *Cannabis sativa*, *Apocynum cannabinum*), hoop vine, sisal, henequen, yucca, abaca, genus *Sansevieria*, New Zealand flax, cotton, coir, milkweed, kapok, floss silk, *Proboscidea parviflora*, bamboo, bast, fique, banana, modal, lyocell, pina, raffia, rayon, soy protein, acetate and combinations of the same. Synthetic fibers may include any known or to be developed, such as for example, and without limitation, acrylic, Kevlar®, modacrylic, Nomex®, nylon, polyester, lycra, spandex, rayon, and combinations of the same.

[0116] Fabric treatment compositions may be applied to the textile or fibers. The compositions may be applied as either a wet or dry composition and during a laundering cycle with water or a drying cycle. Such fabric treatment materials may be used for softening and/or conditioning a textile or fiber; reducing and/or preventing wrinkles, imparting fragrances to a textile or fiber; reducing ironing time, improving softness and the like.

[0117] The invention also incorporates use of the 1,2-bio-alkanediol materials formed according to the invention as a material for boosting the antimicrobial efficiency of existing antimicrobials, preservatives, alternative preservation materials and/or hurdle technologies.

[0118] By boosting the antimicrobial efficacy, it is meant that the antimicrobial efficacy of an existing antimicrobial and/or preservative (including alternative preservation materials or hurdle technologies) when combined with the 1,2-bio-alkandiols achieve an improvement of antimicrobial effectiveness that is more than insubstantial, *i.e.*, at least about 5%, preferably at least about 10%, and more preferably at least about 20% or more improvement, while providing a natural boosting material. Boosting effects and antimicrobial effects in a formulation are evaluated by measuring performance using a preservative efficacy test ("PET") or a challenge test. Preservatives and antimicrobials used in cosmetic, toiletry and pharmaceutical products must enable the products to successfully pass microbiological testing protocols, known as "challenge tests," established by government regulations and trade organizations. Challenge tests are performed by adding known quantities of microorganisms to a product and measuring the increase or decrease in microorganism population over time. The organisms include Gram-positive bacteria, Gram-negative bacteria, yeast and mold. The Cosmetic, Toiletries, and Fragrance Association (CTFA) has defined a challenge test that is widely accepted as the standard in the cosmetic, toiletry and pharmaceutical industry. The test requires that the quantity of bacteria be reduced by 99% in seven days, and that the quantity of yeast and fungi

(mold) be reduced by 90% in seven days. In order to pass a challenge test, the product must contain the appropriate amounts and types of preservative compounds that will enable antimicrobial efficacy against a broad spectrum of microorganisms in a short period of time.

[0119] In addition to the content noted to provide antimicrobial efficacy, if using as a boosting material to improve the effectiveness of an existing antimicrobial and the like as noted above it is preferred that the 1,2-bioalkanediol(s) are incorporated in an amount of about 0.1 to about 10 weight percent, and preferably 5.0 to about 3.0 weight percent, of the total composition; and in a ratio of about 99.999:0.001 to about 0.001:99.999, and preferably about 99.9:0.1 to about 0.1:99.9 of the total amount of existing antimicrobial, preservative, alternative preservation and/or hurdle technology components already existing in the composition.

[0120] The invention will now be described with respect to the following non-limiting examples:

EXAMPLES

[0121] Bio-1-octanol is formed from the hydrogenation of bio-octanoic acid (suitable sources of which may be derived from coconut, palm or any other renewable source or process that can produce octanoic acid). The bio-1-octanol is dehydrated regioselectively by feeding the bio-1-octanol at an elevated temperature into a fixed bed reactor containing a catalyst according to the invention herein.

[0122] Gas Chromatography (GC) was an important method used to characterize both petroleum and natural-renewable derivatives. Products (*e.g.* octenes) were characterized using a Thermo Scientific Trace 1310 Gas Chromatograph employing an FID detector and Chromeleon software (version 7.2.4.8525). For dehydration reactions products the GC employed a Restek MXT-5 column (30 m length, 0.5 μ m film, 0.53 ID), helium carry gas (3.0 mL/min), CT split injection 45 mL/min (5.0 mL/min purge flow), injector 250 °C, detector 300 °C, oven 70 °C hold for 8 min, then ramp to 300 °C (15 °C/min) with a final hold for 6.67 min. For alkanediol products GC analysis employed a Restek MXT-WAX column (30 m length, 0.5 μ m film, 0.53 ID), helium carry gas (5.0 mL/min), CT split injection 10 mL/min (5.0 mL/min purge flow), injector 220 °C, detector 250 °C, oven 70 °C hold for 0.25 min, then ramp to 250 °C (10 °C/min) with a final hold for 6.67 min.

EXAMPLE 1

[0123] γ -Alumina powder was treated with an aqueous solution of calcium acetate using the technique of incipient wetting to afford a catalyst containing 1.50% calcium (based on CaO) after calcination in air at 440°C for a period of 12 h.

5

EXAMPLE 2

[0124] γ -alumina powder was treated with an aqueous solution of calcium acetate using the technique of incipient wetting to afford a catalyst containing 1.50% calcium (based on CaO) after calcination in air at 500°C for a period of 12 h.

EXAMPLE 3

10 [0125] Catalysts prepared in EXAMPLE 1 and EXAMPLE 2 were loaded into separate 75 mL (Sigma Aldrich Part No. Z173592) reactors, each was wrapped with heating tape and covered with fiberglass insulation. The temperature was controlled by affixing a thermocouple to the outside skin of the reactor, this input was used for a temperature controller. Bio-1-octanol was fed into the reactor maintained at 315°C using an HPLC pump. The bio-1-octanol
15 feed rate was adjusted in a manner to obtain conversion more than 95%, but less than 100%. After 1 h of continuous operation a sample was collected and analyzed for analyzing chemical conversion of the bio-1-octanol and regioselectivity of bio-1-octene. The results are shown below:

Table 2

Catalyst	Calcination Temperature (°C)	1-Octene (%)	2-Octene & 3-Octenes (%)	1-Octanol (%)	1-Octene Selectivity (%)
EXAMPLE 1	440	94.0	3.2	1.6	97.4
EXAMPLE 2	500	88.9	6.6	3.5	93.1

20

EXAMPLE 4

[0126] γ -alumina in the form of 1/16" extrudate, Porocel® CatGuard® was cut to have length to diameter ratios in the range of 2 to 4. The extrudate was modified with an aqueous solution of calcium acetate. The weight of solution to alumina was 0.55 by weight and the
25 calcium acetate concentration was at level to deliver 1.50% of CaO (after calcination). This catalyst was subjected to calcination in air at 440°C for a period of 12 h.

EXAMPLE 5

[0127] The 48 g of the catalyst prepared in EXAMPLE 4 was loaded into a 75 mL (Sigma Aldrich Part No. Z173592) reactor, wrapped with heating tape, and covered with fiberglass insulation. The temperature was controlled by affixing a thermocouple to the outside skin of the reactor, this input was used for a temperature controller. Bio-1-octanol was fed at 0.2 mL/min into the reactor maintained at 315°C. After >1,400 h of TOS, that included regular shut-downs and start-ups, catalyst performance with regard 1) chemical conversion of the bio-1-octanol, 2) product selectivity, 3) and regioselectivity for bio-1-octene was unchanged. A GC chromatogram of the crude product collected from the reactor is shown in Fig. 3 with an octene selectivity of 96% and with chemical yield of bio-1-octene of 94%.

EXAMPLE 6

[0128] The product in EXAMPLE 5 was subjected to simple distillation at atmospheric pressure. The product obtained was analyzed by GC and the chromatogram is shown in Fig. 4. The product from the distillation was 99.9% bio-octenes with a 96.7% content of bio-1-octene.

EXAMPLE 7

[0129] The product in EXAMPLE 6 was converted to the bio-1,2-octanediol by treatment with formic acid and peroxides, then a base hydrolysis, and finally purified by fractional distillation. The GC chromatogram is shown in Fig. 5. The bio-1,2-octanediol obtained in this example has a chemical purity 98.7% by GC analysis. A typical GC chromatogram of the petro-1,2-octanediol currently used in commercial cosmetic applications is displayed in Fig. 6.

EXAMPLE 8

[0130] Stable isotope analyses were carried out on petroleum-based and those prepared from the natural and renewable feedstocks prepared in EXAMPLES 6 and 7. The values are shown below:

Table 3

Compound	$\delta^{13}\text{C}$	$\delta^2\text{H}$
Bio-1-Octanol	32.3	-273
1-Octanol (petro-based)	30.3	-87
Bio-1-Octene	32.0	-288
1-Octene (petro-based)	31.8	Not tested
Bio-1,2-Octanediol	32.2	-245
1,2-Octanediol (petro-based)	31.5	-50

EXAMPLE 9

- 5 **[0131]** The bio-1,2-octanediol prepared in EXAMPLE 7 was subjected to testing that is currently used to qualify the petroleum, non-renewable, non-natural equivalent. The bio-1,2-octanediol prepared in EXAMPLE 7 was found to meet all the batch analytical testing requirements:

Table 4

Analysis	Natural 1,2-octanediol	Petroleum 1,2-octanediol	Specification
Odor	Conforming	conforming	mild
Color, Lovibond (yellow)	0.1	0.1	≤ 1.5
Color, Lovibond (red)	0.0	0.0	≤ 0.3
Sediment	Conforming	Conforming	No discoloration
Color, APHA 142	8	1	≤ 100
COLOR, APHA 142-01	8	1	≤ 30
Infrared Spectrum	Conforming	Conforming	Matches Std.
Hydroxyl value Mg KOH/g	761	740	740 to 770
Moisture % w/w	0	0	≤ 2
Appearance	Conforming	Conforming	Clear liquid above 35 °C
Assay, %	98.7	99.5	≥ 98.0
% 1,2-octane oxide	0.1	0.1	Report result
Color 999-03	Conforming	Conforming	Matches Standard

EXAMPLE 10

[0132] In a comparative example, bio-1-octanol was fed into a 75 mL reactor packed with a catalyst prepared as follows: gamma-alumina powder was modified with a sodium hydroxide solution (5 wt-% NaOH) to create a second catalyst, the second catalyst was dried in an oven and then treated with diethoxydiphenylsilane (1 wt-% based on alumina) dissolved in ethanol. The solvent was removed, the catalyst washed with ethanol, and dried in an oven to create a

third catalyst. This third catalyst was calcined at 400°C for 12 h. The catalyst was loaded into a 75 mL reactor, heated to a target temperature of 325°C and bio-1-octanol feed rates were adjusted to optimize both conversion and regioselectivity.

5

EXAMPLE 11

[0133] Petro-1-hexanol was fed into a 75 mL reactor packed with the catalyst prepared in EXAMPLE 4. The catalyst used in this example had greater than 1,400 h of TOS used for bio-1-octanol dehydration to bio-1-octene. For this series of dehydration reaction examples, the temperature was varied from 330°C to 370°C and the feed rate was adjusted in order to achieve between 1 and 2% of hexanol passing through the reactor. The results for the hexanol dehydration are shown below:

10

Table 5

Catalyst	Reactor Temperature (°C)	1-Hexene (%)	2-Hexenes & 3-Hexene (%)	1-Hexanol (%)	1-Hexene Selectivity (%)
EXAMPLE 11A	330	92.8	3.5	1.8	95.8
EXAMPLE 11B	350	93.8	3.1	1.7	96.8
EXAMPLE 11C	370	90.1	3.2	1.6	96.6

[0134] In EXAMPLE 11C where the reactor is maintained at 370°C a new peak in the GC chromatogram appears have an area-% of 3.6; thus, indicating a lower chemical yield of 1-hexene and formation of another product.

15

EXAMPLE 12

[0135] After 1400 h of TOS for the dehydration of bio-1-octanol, some catalyst was removed at the entrance side of the tube reactor. In Fig. 7 the used catalyst is photographed next to catalyst with 0 h TOS. The used catalyst shows only a slight discoloration, and as noted herein, displays no loss in chemical conversion or loss in regioselectivity.

20

[0136] It will be appreciated by those skilled in the art that changes could be made to the embodiments described above without departing from the broad inventive concept thereof. It is

understood, therefore, that this invention is not limited to the particular embodiments disclosed, but it is intended to cover modifications within the spirit and scope of the present invention as defined by the appended claims.

CLAIMS

What is claimed is:

1. A method for making a bio-alkene, comprising:
 - 5 dehydrating a bio-1-alcohol by heating the bio-1-alcohol in a reactor with a catalyst, wherein the resulting bio-alkene has a carbon chain of about 5 to about 20 carbon atoms and a bio-1-alkene regioselectivity of at least about 80%.
 2. The method of claim 1, wherein the bio-alkene has a carbon chain of about 6 to about 14 carbon atoms.
 - 10 3. The method according to claim 2, wherein the bio-alkene has a carbon chain length of about 6 to about 10 carbon atoms.
 4. The method according to claim 3, wherein the bio-alkene has a carbon chain length of about 6 to about 8 carbon atoms.
 5. The method according to claim 1, wherein the bio-alkene is bio-octene.
 - 15 6. The method according to claim 1, wherein the reactor is a fixed bed reactor.
 7. The method according to claim 6, wherein the fixed bed reactor is a fluidized bed reactor.
 8. The method according to claim 1, wherein the catalyst is selected from ZnAl_2O_4 and a γ -alumina catalyst.
 - 20 9. The method according to claim 1, wherein the bio-alkene has a bio-1-alkene regioselectivity of about 92% to about 99%.
 10. The method according to claim 9, wherein the bio-alkene has a bio-1-alkene regioselectivity of about 95% to about 99%.
 11. The method according to claim 1, wherein the catalyst is a γ -alumina catalyst is treated with a base to form a modified γ -alumina catalyst.
 - 25 12. The method according to claim 11, wherein the base comprises a Group I or a Group II metal.
 13. The method according to claim 11, wherein the γ -alumina catalyst is treated with a calcium promoter to provide a modified γ -alumina catalyst.
 - 30 14. The method according to claim 13, wherein the modified γ -alumina catalyst is calcined to provide a calcined γ -alumina catalyst.

15. The method according to claim 13, wherein the calcium promoter is used in an amount of about 0.01 weight percent to about 4 weight percent based on the weight of CaO determined after calcination.

16. The method according to claim 15, wherein the calcium promoter is used in an amount
5 of about 1 weight percent to about 2 weight percent based on the weight of CaO determined after calcination.

17. The method according to claim 14, wherein a temperature during calcination is about 400°C to about 500°C.

18. The method according to claim 17, wherein the temperature during calcination is about
10 420°C to about 480°C.

19. The method according to claim 18, wherein the temperature during calcination is about 440°C to about 460°C.

20. The method according to claim 14, wherein calcination is carried out in an oven.

21. The method according to claim 14, wherein the calcination is carried out in an
15 atmosphere of air or inert gas.

22. The method according to claim 1, wherein the method comprises a distillation step to refine the bio-alkene.

23. The method according to claim 1, wherein the bio-alkene results from a process wherein the bio-1-alcohol in water is dehydrated by heating the bio-1-alcohol with a catalyst under a
20 purge gas.

24. The method according to claim 1, wherein the bio-alkene is further reacted to form a bio-based compound different from the bio-alkene or a bio-based polymer.

25. The method according to claim 24, wherein the bio-alkene is further reacted by a free radical or a catalytic polymerization process to form a bio-based polymer.

26. A bio-alkene made by the method of claim 1.

27. The bio-alkene according to claim 28, wherein the bio-alkene is selected from straight or branched chain bio-alkenes.

28. The bio-alkene according to claim 28, wherein the resulting bio-1-alkene is selected from bio-1-pentene, bio-1-iso-pentene, bio-1-hexene, bio-1-heptene, bio-1-octene, bio-1-
30 nonene, bio-1-decene, and bio-1-dodecene.

ABSTRACT OF THE DISCLOSURE

A process is incorporated herein for the synthesis of bio-1,2-alkanediols, comprising: providing a bio-alkene having a carbon chain of about 5 to about 20 carbon atoms and a bio-1-alkene regioselectivity of at least about 80%, at least about 92% and/or at least
5 about 95%; and converting the bio-alkene to a bio-1,2-alkanediol having a carbon chain length of about 5 to about 20 carbon atoms. Methods for treating catalysts which may be incorporated in the process for the synthesis of bio-1,2-alkanediols are also included herein. Such bio-1,2-alkanediols are used in compositions and products alone as antimicrobial materials, or with
10 existing bio-compounds and/or antimicrobials, preservatives, alternative preservation systems and/or hurdle technology components. The bio-1,2-alkanediols incorporate a natural and bio-based pathway for antimicrobial effects in various compositions such as cosmetic, pharmaceutical, industrial and household products.



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
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www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
16/682,059	11/13/2019	Rocco V. Burgo	I0113-198U3

CONFIRMATION NO. 6533

INFORMAL NOTICE



OC000000115240463

159443
Calderone Bullock LLC
Two Greentree Centre, Suite 301
9000 Lincoln Drive East
Marlton, NJ 08053

Date Mailed: 03/09/2020

INFORMATIONAL NOTICE TO APPLICANT

Applicant is notified that the above-identified application contains the deficiencies noted below. No period for reply is set forth in this notice for correction of these deficiencies. However, if a deficiency relates to the inventor's oath or declaration, the applicant must file an oath or declaration in compliance with 37 CFR 1.63, or a substitute statement in compliance with 37 CFR 1.64, executed by or with respect to each actual inventor no later than the expiration of the time period set in the "Notice of Allowability" to avoid abandonment. See 37 CFR 1.53(f).

The item(s) indicated below are also required and should be submitted with any reply to this notice to avoid further processing delays.

- A properly executed inventor's oath or declaration has not been received for the following inventor(s):
Rocco V. Burgo
Michael E. Wright
Gary B. Mosser
Michael J. Fevola

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at (571) 272-4000 or (571) 272-4200 or 1-888-786-0101.

/nbekele/

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875						Application or Docket Number 16/682,059	
APPLICATION AS FILED - PART I							
(Column 1)		(Column 2)		SMALL ENTITY		OTHER THAN SMALL ENTITY	
FOR	NUMBER FILED	NUMBER EXTRA	RATE(\$)	FEE(\$)		RATE(\$)	FEE(\$)
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	300
SEARCH FEE (37 CFR 1.16(k), (l), or (m))	N/A	N/A	N/A			N/A	660
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	760
TOTAL CLAIMS (37 CFR 1.16(j))	28	minus 20 = * 8			OR	x 100 =	800
INDEPENDENT CLAIMS (37 CFR 1.16(h))	1	minus 3 = *				x 460 =	0.00
APPLICATION SIZE FEE (37 CFR 1.16(s)) If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$310 (\$155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).							0.00
							0.00
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							0.00
			TOTAL			TOTAL	2520
* If the difference in column 1 is less than zero, enter "0" in column 2.							
APPLICATION AS AMENDED - PART II							
(Column 1)		(Column 2)		(Column 3)		SMALL ENTITY	
AMENDMENT A	CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE(\$)	ADDITIONAL FEE(\$)		RATE(\$)
	Total (37 CFR 1.16(i))	*	Minus **	=	x =	OR	x =
	Independent (37 CFR 1.16(h))	*	Minus ***	=	x =	OR	x =
	Application Size Fee (37 CFR 1.16(s))					OR	
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))					OR	
			TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	
(Column 1)		(Column 2)		(Column 3)		SMALL ENTITY	
AMENDMENT B	CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE(\$)	ADDITIONAL FEE(\$)		RATE(\$)
	Total (37 CFR 1.16(i))	*	Minus **	=	x =	OR	x =
	Independent (37 CFR 1.16(h))	*	Minus ***	=	x =	OR	x =
	Application Size Fee (37 CFR 1.16(s))					OR	
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))					OR	
			TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	
* If the entry in column 1 is less than the entry in column 2, write "0" in column 3. ** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20". *** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3". The "Highest Number Previously Paid For" (Total or Independent) is the highest found in the appropriate box in column 1.							



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APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY. DOCKET NO	TOT CLAIMS	IND CLAIMS
16/682,059	11/13/2019		2680	I0113-198U3	28	1

CONFIRMATION NO. 6533

UPDATED FILING RECEIPT

159443

Calderone Bullock LLC

Two Greentree Centre, Suite 301

9000 Lincoln Drive East

Marlton, NJ 08053



0000000115240462

Date Mailed: 03/09/2020

Receipt is acknowledged of this non-provisional utility patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF FIRST INVENTOR, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection.

Please verify the accuracy of the data presented on this receipt. If an error is noted on this Filing Receipt, please submit a written request for a corrected Filing Receipt, including a properly marked-up ADS showing the changes with strike-through for deletions and underlining for additions. If you received a "Notice to File Missing Parts" or other Notice requiring a response for this application, please submit any request for correction to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections provided that the request is grantable.

Inventor(s)

Rocco V. Burgo, Mullica Hill, NJ;
Michael E. Wright, Hurricane, UT;
Gary B. Mosser, Tabernacle, NJ;
Michael J. Fevola, Belle Mead, NJ;

Applicant(s)

Inlex Investment Corporation, Wilmington, DE;

Assignment For Published Patent Application

Inlex Investment Corporation

Power of Attorney: None

Domestic Priority data as claimed by applicant

This application is a CON of 16/262,902 01/30/2019
which claims benefit of 62/623,985 01/30/2018

Foreign Applications for which priority is claimed (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see <http://www.uspto.gov> for more information.) - None.

Foreign application information must be provided in an Application Data Sheet in order to constitute a claim to foreign priority. See 37 CFR 1.55 and 1.76.

Permission to Access Application via Priority Document Exchange: Yes

Permission to Access Search Results: Yes

Applicant may provide or rescind an authorization for access using Form PTO/SB/39 or Form PTO/SB/69 as appropriate.

If Required, Foreign Filing License Granted: 12/02/2019

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 16/682,059**

Projected Publication Date: 06/18/2020

Non-Publication Request: No

Early Publication Request: No

Title

Natural 1,2-Alkanediols, Compositions Having Natural 1,2-Alkanediols and Processes for Making the Same

Preliminary Class

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications: No

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at <http://www.uspto.gov/web/offices/pac/doc/general/index.html>.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, <http://www.stopfakes.gov>. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific

countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4258).

LICENSE FOR FOREIGN FILING UNDER
Title 35, United States Code, Section 184
Title 37, Code of Federal Regulations, 5.11 & 5.15

GRANTED

The applicant has been granted a license under 35 U.S.C. 184, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" followed by a date appears on this form. Such licenses are issued in all applications where the conditions for issuance of a license have been met, regardless of whether or not a license may be required as set forth in 37 CFR 5.15. The scope and limitations of this license are set forth in 37 CFR 5.15(a) unless an earlier license has been issued under 37 CFR 5.15(b). The license is subject to revocation upon written notification. The date indicated is the effective date of the license, unless an earlier license of similar scope has been granted under 37 CFR 5.13 or 5.14.

This license is to be retained by the licensee and may be used at any time on or after the effective date thereof unless it is revoked. This license is automatically transferred to any related applications(s) filed under 37 CFR 1.53(d). This license is not retroactive.

The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data. Licensees should apprise themselves of current regulations especially with respect to certain countries, of other agencies, particularly the Office of Defense Trade Controls, Department of State (with respect to Arms, Munitions and Implements of War (22 CFR 121-128)); the Bureau of Industry and Security, Department of Commerce (15 CFR parts 730-774); the Office of Foreign Assets Control, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

NOT GRANTED

No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).

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In Re Patent Applications of: :
Inolex Investment Corporation :
103 Springer Building :
411 Silverside Road :
Wilmington, DE 19810 :

POWER OF ATTORNEY TO PROSECUTE APPLICATIONS BEFORE THE U.S.
PATENT AND TRADEMARK OFFICE

Inolex Investment Corporation, assignee of the above application, by its undersigned representative, hereby revokes all previous powers of attorney given in the application identified in the enclosed Statement Under 37 C.F.R. §3.73(c).

Inolex Investment Corporation, by its undersigned representative, hereby appoints the registered attorneys and agents associated with Customer No. 159443, Calderone Bullock LLC, as its attorneys or agents to represent the assignee before the United States Patent and Trademark Office (U.S. PTO) in connection with any and all patent applications assigned only to the undersigned according to the U.S. PTO assignment records or assignment documents attached to this form and/or to the enclosed Statement Under 37 C.F.R. §3.73(c) and in accordance therewith, with full power of substitution and revocation, to prosecute the application identified in the enclosed Statement Under 37 C.F.R. § 3.73(c) and to transact all business in the U.S. PTO connected therewith.

Please change the correspondence address for the application identified in the enclosed Statement Under 3.73(c) to the address associated with **Customer No. 159443, namely, CALDERONE BULLOCK LLC**, Two Greentree Centre, 9000 Lincoln Drive East, Marlton New Jersey 08053. Please direct all communications and telephone calls to Lynda Calderone at (856) 446-6045 (telephone) or (856) 267-5370 (facsimile).

The undersigned states that he/she is authorized to sign the document on behalf of the assignee of the above application, and he/she certifies that, to the best of assignee's knowledge

and belief, title to the above application is in assignee by virtue of the documents provided and/or referenced in the enclosed Statement Under 37 C.F.R. §3.73(c).

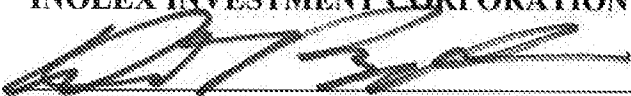
Respectfully submitted,

INOLEX INVESTMENT CORPORATION

February 6, 2019

Date

By:



Name: David C. A. Plimpton

Title: CEO

Telephone: 215-320-1507

Electronic Acknowledgement Receipt

EFS ID:	38968055
Application Number:	16682059
International Application Number:	
Confirmation Number:	6533
Title of Invention:	Natural 1,2-Alkanediols, Compositions Having Natural 1,2-Alkanediols and Processes for Making the Same
First Named Inventor/Applicant Name:	Rocco V. Burgo
Customer Number:	159443
Filer:	lynda Leigh Calderone
Filer Authorized By:	
Attorney Docket Number:	I0113-198U3
Receipt Date:	30-MAR-2020
Filing Date:	13-NOV-2019
Time Stamp:	18:16:26
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no
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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Transmittal Letter	transmittalofdec.pdf	238550	no	3
			3c9f5161a4dde645b72d53f3f1f1dc99a70161d7		

Warnings:

Information:					
2	Oath or Declaration filed	198u3dec.pdf	130259	no	3
			81028ad8d433ab9b167d488c81bec630e6c4379		
Warnings:					
Information:					
3	Assignee showing of ownership per 37 CFR 3.73	198U3373c.pdf	135177	no	2
			0098500c32100c160a2664644cf4552b1aaeadd6		
Warnings:					
Information:					
4	Power of Attorney	POA.pdf	244247	no	2
			183e9e56fe34e63561b7626aafae3f5370927726		
Warnings:					
Information:					
Total Files Size (in bytes):			748233		
This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503. <u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application. <u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course. <u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.					

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In Re Patent Application of: :
Inolex Investment Corporation :
 :
 : Group Art Unit: 1612
Conf. No.: 6533 :
 :
 :
Appln. No.: 16/682,059 : Examiner: Nannette Holloman
 :
 :
Filing Date: November 13, 2019 : Attorney Docket No.: I0113-198U3
 :
 :
Title: Natural 1,2-Alkanediols, Compositions Having Natural 1,2-Alkanediols and Processes
for Making the Same

TRANSMITTAL OF DOCUMENTS

Enclosed are the following documents:

- ☐ ☐ Inventor Declaration; ☐ Inventor(s) Declaration and Power of Attorney; ☐
☐ Inventor(s) Oath; ☐ Substitute Statement
- ☒ Copy of ☒ Declaration; ☐ Declaration and Power of Attorney from prior application.
- ☐ Appointment of Attorney by Applicant/Assignee.
- ☒ General Power of Attorney and 3.73(c) Statement
- ☐ Revocation and Appointment of Attorney and Change of Correspondence Address.
- ☐ Replacement Drawings.
- ☐ Substitute Application Data Sheet.
- ☐ Verified English translation of application as filed.
- ☐ Priority document(s): Certified copy(ies) of ___ patent application No(s). ___, filed in ___
on ___ from which priority is claimed under 35 U.S.C. § 119.
- ☐ Microfiche computer program (Appendix).
- ☐ Nucleotide and/or Amino Acid Sequence Submission, including:
☐ Computer readable copy; ☐ Paper Copy; ☐ Verified Statement.
- ☐ ☐ Formal drawings: ___ sheets; ☐ Replacement drawings: ___ sheets

- ☐ Information Disclosure Statement, PTO/SB/08A or B and cited references.
- ☐ Request for Refund.
- ☐ Request for Corrected Filing Receipt. Attached is a marked-up copy of the Filing Receipt showing corrections.
- ☐ Applicant(s), by its/their undersigned attorney, claim(s) Small Entity Status under 37 C.F.R. §1.27 as ☐ an Independent Inventor, or ☐ a Small Business Concern, or ☐ a Non-Profit Organization.
- ☐ Micro Entity Status ☐ is hereby claimed by Applicant(s) and Micro Entity Certification is enclosed; ☐ has previously been claimed/established.
- ☐ Preliminary Amendment. ☐ The application filing fees were paid upon filing and additional claim fees resulting from the Preliminary Amendment are calculated as follows:

				MICRO ENTITY		SMALL ENTITY		LARGE ENTITY	
	NO. OF CLAIMS AFTER AMEND.	HIGHEST NO. PREVIOUSLY PAID FOR	EXTRA	RATE	ADDIT. FEE	RATE	ADDIT. FEE	RATE	ADDIT. FEE
TOTAL				X \$25	\$	X \$50	\$	X \$100	
INDEP.				X \$115	\$	X \$230	\$	X \$460	
[] 1 st PRESENTATION OF MULTIPLE DEPENDENT CLAIMS				\$205		\$410		\$820	
				TOTAL	\$	TOTAL	\$	TOTAL	

- ☐ Utility Non-Provisional Patent Application Filing Fees. The application filing fees were not paid at filing and are being paid herewith and are calculated as follows:

			MICRO ENTITY			SMALL ENTITY			LARGE ENTITY	
CLAIMS	NO. FILED	NO. EXTRA	BASIC FILING, SEARCH, AND EXAMINATION FEES:			BASIC FILING, SEARCH, AND EXAMINATION FEES:			BASIC FILING, SEARCH, AND EXAMINATION FEES:	
			\$430			\$ 785			\$1,720	
Total	@% -20 =	@%	X \$ 25	\$	OR	X \$ 50	\$	OR	X \$100	\$
Independent	@% - 3=	@%	X \$115	\$	OR	X \$230	\$	OR	X \$460	\$
[@%] Multiple Dependent Claims			X \$205	\$	OR	X \$410	\$	OR	X \$820	\$
[] Application Size Fee (if specification and drawings exceed 100 sheets)										
Total sheets		Add'l sheets	# of sets of 50 (round up to whole number)							
-100	=		/50 =	X \$100 =	\$	OR	X \$200 =	\$	OR	X \$400

Late Fee For Filing Fees, Inventor Oath or Declaration	\$ 40	\$	OR	\$ 80	\$	OR	\$160	\$
Late Fee For Non-English Specification	\$ 35	\$	OR	\$ 70	\$	OR	\$140	\$
	TOTAL	\$	OR	TOTAL	\$	OR	TOTAL	\$

☐ Other:

☐ Applicant(s) herewith charge the following fees in the total amount of \$ _____ as calculated above to the credit card account, Calderone Bullock _____ (Billing No. @%.@%):

☐ Additional Claim Fees After Preliminary Amendment \$ _____.

☐ Non-Provisional Utility Patent Application Filing Fees \$ _____.

☒ The Commissioner is hereby authorized to charge and/or credit Deposit Account No. 60-2689 (Billing No. I0113.0251) as noted below.

☐ Any overpayments or deficiencies in the above-calculated fees.

☒ Any additional fees required under 37 C.F.R. § 1.16 and § 1.17.

☒ In the event that a Petition for Extension of Time is required during the prosecution of this application, but not submitted, please charge any extension fee under 37 C.F.R. § 1.136(a) to our Deposit Account noted above.

☒ Applicant believes there are no additional fees required with this submission. Should a fee be necessary, the Commissioner is hereby authorized to charge any fee or deficiency, or credit any overpayment to Deposit Account No. 60-2689 (Billing No. I0113.0251).

INOLEX INVESTMENT CORPORATION

3/13/20
(Date)

By:

LYNDAL CALDERONE

Registration No. 35,837

CALDERONE BULLOCK LLC

Two Greentree Centre

9000 Lincoln Drive East, Suite 301

Marlton, NJ 08053

Telephone: 856-446-6047

Direct Dial: 856-446-6045

Facsimile: 856-267-5370

E-Mail: lcalderone@calderonebullock.com

☒ Customer Number or Bar Code Label: **000159443**

LLC:smc

Enclosures: Inventor's Declaration

COPY

Attorney Docket No. I0113-198U2

DECLARATION
(Original application)

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

I believe I am an original sole inventor (if only one name is listed below) or an original joint inventor (if plural names are listed below) of the subject matter that is claimed and for which a patent is sought on the invention entitled:

**NATURAL 1,2-ALKANEDIOLS, COMPOSITIONS HAVING NATURAL 1,2-
ALKANEDIOLS AND PROCESSES FOR MAKING THE SAME.**

the specification of which is attached hereto and/or was filed on January 30, 2019 as Application No. 16/262,902.

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to herein.

The above-identified application was made or was authorized to be made by me.

I hereby claim foreign priority benefits under 35 U.S.C. §119(a)-(d), of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

FOREIGN PRIORITY APPLICATION(S)

(Number)	(Country)	(Day/month/year filed)

Priority Claimed
☐ Yes ☐ No

☐ Yes ☐ No

COPY

I hereby claim the benefit under 35 U.S.C. §119(e) of any United States provisional patent application(s) listed below:

PROVISIONAL PRIORITY PATENT APPLICATION(S)

62/623,985
(Application No.)

January 30, 2018
(Filing Date)

Priority Claimed
☒ Yes ☐ No

(Application No.)

(Filing Date)

☐ Yes ☐ No

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements made in this Declaration are punishable under 18 U.S.C. §1001 by fine or imprisonment of not more than five (5) years.

Full name of first or
sole inventor

Rocco V. Buren

Inventor's Signature

Date

2/5/20

Residence

Mullica Hill, New Jersey

Citizenship

United States

Post Office Address

604 Widgeon Court, Mullica Hill, New Jersey 08062

Full name of second
inventor

Michael E. Wright

Inventor's Signature

Date

2/10/2020

Residence

Hurricane, Utah

Citizenship

United States

Post Office Address

-4175 S. 1200 W., Hurricane, Utah 84737

COPY

Full name of third

inventor

Gary B. Mosser

Inventor's Signature

Gary B. Mosser

Date

2/10/20

Residence

Tabernacle, New Jersey

Citizenship

United States

Post Office Address

5 Colonial Court, Tabernacle, New Jersey 08088

Full name of fourth

inventor

Michael J. Fevola

Inventor's Signature

Michael J. Fevola

Date

5 Feb 2020

Residence

Belle Mead, New Jersey

Citizenship

United States

Post Office Address

409 Township Line Road, Belle Mead, New Jersey 08502

ELECTRONICALLY FILED

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In Re Patent Application of:	:		
Inolex Investment Corporation	:		
	:		
	:	Group Art Unit:	1612
Conf. No.: 6533	:		
	:		
Appln. No.: 16/682,059	:	Examiner:	Nannette Holloman
	:		
Filing Date: November 13, 2019	:	Attorney Docket No.:	I0113-198U3
	:		
Title: Natural 1,2-Alkanediols, Compositions Having Natural 1,2-Alkanediols and Processes for Making the Same	:		

STATEMENT UNDER 37 C.F.R. § 3.73(c)

3.73 (c) Statement:

Assignee, Inolex Investment Corporation, is owner of the entire right, title and interest in and to the above-referenced application and its related applications by virtue of: (a) the chain of title noted below wherein the documents are recorded as noted under 37 C.F.R. 3.73(c)(1)(ii) and in the Appointment of Attorney filed simultaneously herewith; or (b) the enclosed copies of the documentary evidence of the chain of title set forth below and in the Appointment of Attorney that, as required under 3.73(c)(1)(i), were submitted for recordation or are being concurrently submitted for recordation pursuant to 37 C.F.R. 11.

Inolex Investment Corporation is the owner by virtue of and as set forth in the Appointment of Attorney by Assignee filed simultaneously herewith:

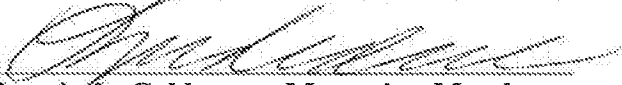
An assignment from the inventors of the parent of the above-identified patent application dated February 17, 2020, February 20, 2020 and February 23, 2020 of which this application is a continuation. The assignment was recorded in the United States Patent and Trademark Office (PTO) on March 2, 2020 at Reel 051981, beginning at Frame 0661.

The undersigned (whose title appears below) is authorized to act on behalf of assignee in this application as set forth in the Power of Attorney by Assignee filed herewith.

Respectfully submitted,

INOLEX INVESTMENT CORPORATION

3/13/20

By: 

**Lynda L. Calderone, Managing Member
and Attorney for Assignee**

Registration No. 35,837

Two Greentree Centre

9000 Lincoln Drive East, Suite 301

Marlton, NJ 08053

Telephone: 856-446-6047

Direct Dial: 856-446-6045

Facsimile: 856-267-5370

E-Mail: lcalderone@calderonebullock.com

LLC:smc

Enclosures

☒ Customer Number or Bar Code Label: 159443



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
16/682,059	11/13/2019	Rocco V. Burgo	I0113-198U3

CONFIRMATION NO. 6533

POA ACCEPTANCE LETTER



159443
Calderone Bullock LLC
Two Greentree Centre, Suite 301
9000 Lincoln Drive East
Marlton, NJ 08053

Date Mailed: 04/02/2020

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 03/30/2020.

The Power of Attorney in this application is accepted. Correspondence in this application will be mailed to the above address as provided by 37 CFR 1.33.

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at (571) 272-4000 or (571) 272-4200 or 1-888-786-0101.

/byemane/



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UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
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P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
16/682,059	11/13/2019	Rocco V. Burgo	I0113-198U3

CONFIRMATION NO. 6533

PUBLICATION NOTICE



OC000000117852728

159443
Calderone Bullock LLC
Two Greentree Centre, Suite 301
9000 Lincoln Drive East
Marlton, NJ 08053

Title: Natural 1,2-Alkanediols, Compositions Having Natural 1,2-Alkanediols and Processes for Making the Same

Publication No. US-2020-0189995-A1

Publication Date: 06/18/2020

NOTICE OF PUBLICATION OF APPLICATION

The above-identified application will be electronically published as a patent application publication pursuant to 37 CFR 1.211, et seq. The patent application publication number and publication date are set forth above.

The publication may be accessed through the USPTO's publically available Searchable Databases via the Internet at www.uspto.gov. The direct link to access the publication is currently <http://www.uspto.gov/patft/>.

The publication process established by the Office does not provide for mailing a copy of the publication to applicant. A copy of the publication may be obtained from the Office upon payment of the appropriate fee set forth in 37 CFR 1.19(a)(1). Orders for copies of patent application publications are handled by the USPTO's Public Records Division. The Public Records Division can be reached by telephone at (571) 272-3150 or (800) 972-6382, by facsimile at (571) 273-3250, by mail addressed to the United States Patent and Trademark Office, Public Records Division, Alexandria, VA 22313-1450 or via the Internet.

In addition, information on the status of the application, including the mailing date of Office actions and the dates of receipt of correspondence filed in the Office, may also be accessed via the Internet through the Patent Electronic Business Center at www.uspto.gov using the public side of the Patent Application Information and Retrieval (PAIR) system. The direct link to access this status information is currently <https://portal.uspto.gov/pair/PublicPair>. Prior to publication, such status information is confidential and may only be obtained by applicant using the private side of PAIR.

Further assistance in electronically accessing the publication, or about PAIR, is available by calling the Patent Electronic Business Center at 1-866-217-9197.

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

TRANSMITTAL FOR POWER OF ATTORNEY TO ONE OR MORE REGISTERED PRACTITIONERS

NOTE: This form is to be submitted with the Power of Attorney by Applicant form (PTO/AIA/82B) to identify the application to which the Power of Attorney is directed, in accordance with 37 CFR 1.5, unless the application number and filing date are identified in the Power of Attorney by Applicant form. If neither form PTO/AIA/82A nor form PTO/AIA82B identifies the application to which the Power of Attorney is directed, the Power of Attorney will not be recognized in the application.

Application Number	16/682,059
Filing Date	November 13, 2019
First Named Inventor	Rocco Burgo
Title	Natural 1,2-Alkanediols, Compositions Having Natural 1,2-Alkanediols and Processes for Making the Same
Art Unit	1612
Examiner Name	HOLLOMAN, NANNETTE
Attorney Docket Number	I0113-198U3

SIGNATURE of Applicant or Patent Practitioner

Signature	/Eric J. Choi/		Date (Optional)	
Name	Eric J. Choi	Registration Number	71,160	
Title (if Applicant is a juristic entity)	Attorney			
Applicant Name (if Applicant is a juristic entity)	Inolex Investment Corporation			

NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4(d) for signature requirements and certifications. If more than one applicant, use multiple forms.



*Total of 1 forms are submitted.

This collection of information is required by 37 CFR 1.131, 1.32, and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

POWER OF ATTORNEY BY APPLICANT

I hereby revoke all previous powers of attorney given in the application identified in either the attached transmittal letter or the boxes below.

Application Number	Filing Date

(Note: The boxes above may be left blank if information is provided on form PTO/AIA/82A.)

- ☒ I hereby appoint the Patent Practitioner(s) associated with the following Customer Number as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the application referenced in the attached transmittal letter (form PTO/AIA/82A) or identified above: 171052
- OR
- ☐ I hereby appoint Practitioner(s) named in the attached list (form PTO/AIA/82C) as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the patent application referenced in the attached transmittal letter (form PTO/AIA/82A) or identified above. (Note: Complete form PTO/AIA/82C.)

Please recognize or change the correspondence address for the application identified in the attached transmittal letter or the boxes above to:

- ☒ The address associated with the above-mentioned Customer Number
- OR
- ☐ The address associated with Customer Number:
- OR

☐ Firm or Individual Name				
Address				
City	State	Zip		
Country				
Telephone	Email			

I am the Applicant (if the Applicant is a juristic entity, list the Applicant name in the box):

INOLEX Investment Corporation

- ☐ Inventor or Joint Inventor (title not required below)
- ☐ Legal Representative of a Deceased or Legally Incapacitated Inventor (title not required below)
- ☒ Assignee or Person to Whom the Inventor is Under an Obligation to Assign (provide signer's title if applicant is a juristic entity)
- ☐ Person Who Otherwise Shows Sufficient Proprietary Interest (e.g., a petition under 37 CFR 1.46(b)(2) was granted in the application or is concurrently being filed with this document) (provide signer's title if applicant is a juristic entity)

SIGNATURE of Applicant for Patent

The undersigned (whose title is entered below) is authorized to act on behalf of the applicant (e.g., where the applicant is a juristic entity).

Signature	<u>DAVID C.A. PLIMPTON</u>	Date (Optional)	<u>5-22-2020</u>
Name	<u>DAVID C.A. PLIMPTON</u>		
Title	<u>CEO + PRESIDENT</u>		

NOTE: Signature - This form must be signed by the applicant in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications. If more than one applicant, use multiple forms.

☐ Total of _____ forms are submitted.

This collection of information is required by 37 CFR 1.131, 1.132, and 1.133. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 36 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

POWER OF ATTORNEY BY APPLICANT

No more than ten (10) patent practitioners total may be appointed as set forth below by name and registration number. This page need not be submitted if appointing the Patent Practitioner(s) associated with a Customer Number (see form PTO/AIA/82B):

Name	Registration Number

Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these records.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Electronic Acknowledgement Receipt

EFS ID:	40284456
Application Number:	16682059
International Application Number:	
Confirmation Number:	6533
Title of Invention:	Natural 1,2-Alkanediols, Compositions Having Natural 1,2-Alkanediols and Processes for Making the Same
First Named Inventor/Applicant Name:	Rocco V. Burgo
Customer Number:	159443
Filer:	Eric J. Choi/Valerie Dotson
Filer Authorized By:	Eric J. Choi
Attorney Docket Number:	I0113-198U3
Receipt Date:	14-AUG-2020
Filing Date:	13-NOV-2019
Time Stamp:	10:29:23
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no
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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Power of Attorney	INLX_0198U3_484800_I0113-198U3_PowerOfAttorney.pdf	331168 908b3756789bd325ea67c6e4d48f9b0aad534085	no	4

Warnings:

Information:	
Total Files Size (in bytes):	331168
This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503. <u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application. <u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course. <u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.	



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UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
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Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
16/682,059	11/13/2019	Rocco V. Burgo	I0113-198U3

171052
Cozen O'Connor - Inolex
1200 19th St. NW
Washington, DC 20036

CONFIRMATION NO. 6533
POA ACCEPTANCE LETTER



Date Mailed: 08/19/2020

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 08/14/2020.

The Power of Attorney in this application is accepted. Correspondence in this application will be mailed to the above address as provided by 37 CFR 1.33.

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at (571) 272-4000 or (571) 272-4200 or 1-888-786-0101.

/thaile/



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
16/682,059	11/13/2019	Rocco V. Burgo	I0113-198U3

CONFIRMATION NO. 6533

POWER OF ATTORNEY NOTICE



OC000000119284841

159443
Calderone Bullock LLC
Two Greentree Centre, Suite 301
9000 Lincoln Drive East
Marlton, NJ 08053

Date Mailed: 08/19/2020

NOTICE REGARDING CHANGE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 08/14/2020.

- The Power of Attorney to you in this application has been revoked by the applicant. Future correspondence will be mailed to the new address of record(37 CFR 1.33).

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at (571) 272-4000 or (571) 272-4200 or 1-888-786-0101.

/thaile/

Third Party Submission

U.S. Serial No. 16/262,902 (US2019/0289848)

Cite No.	Reference	Concise Description of Relevance
1	Fortman et al., US9856461B2 (March 10, 2016)	Fortman et al. describe a polyketide synthase (PKS) capable of synthesizing an α -olefin, such as 1-hexene or butadiene. See summary. Fortman et al. specifically disclose 1-alkenes such as 1-hexene, 1-pentene, 1-butene, and propylene (column 14, lines 49-52). Precursor molecules are said to be biosynthesized (column 22, lines 12-18), so synthesized α -olefins can also be interpreted to be non-petrochemically-derived, i.e. they cover "bio"-1-alkenes according to pending claim 42 of US2019/0289848. See paragraph [0012] of US2019/0289848. The "bio"- α -olefins according to Fortman et al. can serve as starting materials for forming "bio"-1,2-alkanediols according to pending claim 42 of US2019/0289848.
2	Klug et al., <i>Degradation of Hydrocarbons by Members of the Genus Candida, II. Oxidation of n-Alkanes and 1-Alkenes by Candida lipolytica</i> , Journal of Bacteriology, Vol. 93, No. 6, pp 1847-1852 (1967)	Klug et al. describe Pseudomonas-mediated epoxidation of an 1-octene double bond followed by nonenzymatic rupture of the epoxide bond to yield 1,2-octanediol (page 1851, right column, lines 14-28). Klug et al. do not describe that the 1-octene is petrochemically-derived. Klug et al. are thus considered to disclose a "bio"-1,2-alkanediol formed by conversion of a "bio"-1-alkene, according to pending claim 42 of US2019/0289848.
3	Liu et al., <i>Hydrogen peroxide-independent production of α-alkenes by OleT_{JE} P450 fatty acid decarboxylase</i> , Biotechnology for Biofuels, 7:28 (2014)	Liu et al. describe a Jeotgalicoccus sp.-mediated decarboxylation of C12-C20 fatty acids to α -olefins. See Results section of Abstract. Also it is described that the α -olefins are biogenic α -alkenes, which are renewable and more environmentally friendly than petroleum-derived equivalents. See Background section of Abstract. Liu et al. thus describe "bio"- α -alkenes that can serve as starting materials for forming "bio"-1,2-alkanediols according to pending claim 42 of US2019/0289848.
4	Wright, US8912373B2 (September 20, 2012)	Wright describes the dehydration of bio-1-alcohols to bio-1-alkenes with high selectivity. See column 3, line 54-column 4, line 26. Fig. 1 illustrates a general overview of creating renewable and sustainable biodiesel, biojet, and biolubricants based on a feed stream of bio-1-alcohols. It is clear that this are non-petrochemically-derived products, as is evidenced by the starting materials, e.g. cellulosic and hemi-cellulosic biomass, in Fig. 1. Wright thus covers "bio"-1-alkenes according to pending claim 42 of US2019/0289848. The "bio"-1-alkenes according to wright can serve as starting materials for forming "bio"-1,2-alkanediols according to pending claim 42 of US2019/0289848.

THIRD-PARTY SUBMISSION UNDER 37 CFR 1.290 CONCISE DESCRIPTION OF RELEVANCE		
Application Number		16682059
U.S. PATENTS		
Cite No	Patent Number	Concise Description of Relevance
1	4234752	See attached statement
2	8450543	See attached statement
3	8912373	See attached statement

176 of 236

4	9242226	See attached statement

U.S. PATENT APPLICATION PUBLICATION		
Cite No	Publication Number	Concise Description of Relevance
1	20050006538	See attached statement

2	20030006523	See attached statement
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FOREIGN PATENT DOCUMENTS		
CiteNo	Foreign Document Number	Concise Description of Relevance

NON-PATENT PUBLICATIONS		
Cite No	Reference	Concise Description of Relevance

1	Klug et al., Degradation of Hydrocarbons by Members of the Genus <i>Candida</i> , II. Oxidation of n-Alkanes and 1-Alkenes by <i>Candida lipolytica</i> , Journal of Bacteriology, Vol. 93, No. 6, pp 1847-1852 (1967)	See attached statement
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Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

THIRD-PARTY SUBMISSION UNDER 37 CFR 1.290	Application Number	16682059

U.S. PATENTS				
Cite No	Patent Number	Kind Code ¹	Issue Date (YYYY-MM-DD)	First Named Inventor
1	9242226	B2	2016-01-26	Michael Wright
2	8912373	B2	2014-12-16	Michael Wright
3	8450543	B2	2013-05-28	Matthew PETERS
4	4234752		1980-11-18	YULIN WU
U.S. PATENT APPLICATION PUBLICATIONS				
Cite No	Publication Number	Kind Code ¹	Publication Date (YYYY-MM-DD)	First Named Inventor
1	20030006523	A1	2003-04-03	Fuji
2	20050006538	A1	2005-03-24	De Bruyn
FOREIGN PATENTS AND PUBLISHED FOREIGN PATENT APPLICATIONS				

THIRD-PARTY SUBMISSION UNDER 37 CFR 1.290	Application Number	16682059

Cite No	Foreign Document Number ³	Country Code ²	Kind Code ¹	Publication Date (YYYY-MM-DD)	Applicant, Patentee or First Named Inventor	T ⁵
						☐

NON-PATENT PUBLICATIONS (e.g., journal article, Office action)

Cite No	Author (if any), title of the publication, page(s) being submitted, publication date, publisher (where available), place of publication (where available).	T ⁵	E ⁶
1	Klug et al., Degradation of Hydrocarbons by Members of the Genus Candida, II. Oxidation of n-Alkanes and 1-Alkenes by Candida lipolytica, Journal of Bacteriology, Vol. 93, No. 6, pp 1847-1852 (1967)	☐	☐

STATEMENTS

The party making the submission is not an individual who has a duty to disclose information with respect to the above-identified application under 37 CFR 1.56.

This submission complies with the requirements of 35 U.S.C. 122(e) and 37 CFR 1.290.

☒ The fee set forth in 37 CFR 1.290(f) has been submitted herewith.

☐ The fee set forth in 37 CFR 1.290(f) is not required because this submission lists three or fewer total items and, to the knowledge of the person signing the statement after making reasonable inquiry, this submission is the first and the only submission under 35 U.S.C. 122(e) filed in the above-identified application by the party making the submission or by a party in privity with the party.

☐ This resubmission is being made responsive to a notification of non-compliance issued for an earlier filed third-party submission. The corrections in this resubmission are limited to addressing the non-compliance. As such, the party making this resubmission: (1) requests that the Office apply the previously-paid fee set forth in 37 CFR 1.290(f), or (2) states that no fee is required to accompany this resubmission as the undersigned is again making the fee exemption statement set forth in 37 CFR 1.290(g).

THIRD-PARTY SUBMISSION UNDER 37 CFR 1.290	Application Number	16682059

Signature	/daniel altman/		
Name/Print	Daniel Altman	Registration Number (if applicable)	34115

Examiner Signature		Date Considered	
--------------------	--	-----------------	--

*EXAMINER: Signature indicates all documents listed above have been considered, except for citations through which a line is drawn. Draw line through citation if not considered. Include a copy of this form with next communication to applicant. 1. If known, enter kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16. See MPEP 901.04(a). 2. Enter the country or patent office that issued the document, by two-letter code under WIPO standard ST.3. See MPEP 1851. 3. For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. 4. If known, enter the kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16. See MPEP 901.04(a). 5. Check mark indicates translation attached. 6. Check mark indicates evidence of publication attached.

Electronic Patent Application Fee Transmittal

Application Number:	16682059			
Filing Date:				
Title of Invention:				
First Named Inventor/Applicant Name:				
Filer:	Daniel E. Altman			
Attorney Docket Number:				
Filed as Large Entity				
Filing Fees for				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
DOCUMENT FEE FOR THIRD-PARTY SUBMISSIONS	1818	1	180	180
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Extension-of-Time:				
Miscellaneous:				
Total in USD (\$)				180

Electronic Acknowledgement Receipt	
EFS ID:	40492267
Application Number:	16682059
International Application Number:	
Confirmation Number:	6533
Title of Invention:	
First Named Inventor/Applicant Name:	
Correspondence Address:	- - - - - - -
Filer:	Daniel E. Altman
Filer Authorized By:	
Attorney Docket Number:	
Receipt Date:	08-SEP-2020
Filing Date:	
Time Stamp:	14:33:03
Application Type:	

Payment information:	
Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	\$ 180

RAM confirmation Number		E202098E33005541			
Deposit Account					
Authorized User					
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:					
File Listing:					
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Non Patent Literature	Klug_et_al.pdf	939292	no	6
			79d244c869bc25b6a5f0032db7f72cdc991c368		
Warnings:					
Information:					
2	Concise Description of Relevance	Concise_Statement_of_Relevance.pdf	134079	no	1
			f167931213dff763264913579743d626734e264e		
Warnings:					
Information:					
3	Concise Description of Relevance	Concise-description-generated.pdf	35169	no	4
			a031e70bc02eba291a4fd97466366fcc42d6006e		
Warnings:					
Information:					
4	Third-Party Submission Under 37 CFR 1.290	Third-party-preissuance-submission.pdf	49530	no	3
			9349a1f6b47b87fd2af7ab54dab489b726aed4b		
Warnings:					
Information:					
5	Request for Notification of Non-compliant Third-Party Submission	Third-party-notification-request.pdf	19633	no	1
			f86d19b12bec008caacbb14950d9c30571c5628e		
Warnings:					
Information:					

6	Fee Worksheet (SB06)	fee-info.pdf	29268 21fde7c632f09826327292eaae390166e6c2d7dc	no	2
Warnings:					
Information:					
Total Files Size (in bytes):			1206971		
This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503. <u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application. <u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course. <u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.					



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/682,059	11/13/2019	Rocco V. Burgo	INLX.0198U3/484800	6533
171052	7590	09/10/2020	EXAMINER	
Cozen O'Connor - Inolex			HOLLOMAN, NANNETTE	
1200 19th St. NW			ART UNIT	PAPER NUMBER
Washington, DC 20036			1612	
			NOTIFICATION DATE	DELIVERY MODE
			09/10/2020	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

echoi@cozen.com
nyipdocketing@cozen.com
vdotson@cozen.com

**UNITED STATES DEPARTMENT OF COMMERCE****U.S. Patent and Trademark Office**

Address: COMMISSIONER FOR PATENTS

P.O. Box 1450

Alexandria, Virginia 22313-1450

APPLICATION NO./ CONTROL NO.	FILING DATE	FIRST NAMED INVENTOR/ PATENT IN REEXAMINATION	ATTORNEY DOCKET NO.
16/682,059	11/13/2019	Burgo et al.	INLX.0198U3/48480

Cozen O'Connor - Inolex 1200 19th St. NW Washington, DC 20036		EXAMINER	
		MARIANNE C SEIDEL	
		ART UNIT	PAPER
		1600	20200909

DATE MAILED: _____

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner for Patents

The third-party submission under 37 CFR 1.290 filed on 9/8/2020 for the instant application has been determined to be compliant with 35 U.S.C. 122(e) and 37 CFR 1.290 and is being entered in the application. Please allow a few days for the submission to be visible in the Patent Application Information Retrieval (PAIR) system.

/MARIANNE C SEIDEL/
Quality Assurance Specialist, Art Unit 1600

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number	16682059
	Filing Date	2019-11-13
	First Named Inventor	Rocco V. Burgo
	Art Unit	1612
	Examiner Name	Nannette Holloman
	Attorney Docket Number	INLX.0198U3/484800

U.S.PATENTS						Remove
Examiner Initial*	Cite No	Patent Number	Kind Code ¹	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	9856461	B2	2018-01-02	Jeffrey Fortman	

If you wish to add additional U.S. Patent citation information please click the Add button. Add

U.S.PATENT APPLICATION PUBLICATIONS						Remove
Examiner Initial*	Cite No	Publication Number	Kind Code ¹	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20120282207	A1	2012-11-01	LUTZ, Patrick Jay	
	2	20060161025	A1	2006-07-20	OSTERHOLT, Clemens	
	3	20140066666	A1	2014-03-06	Oskar Koch	
	4	20060161025	A1	2008-06-10	Swern	

If you wish to add additional U.S. Published Application citation information please click the Add button. Add

FOREIGN PATENT DOCUMENTS								Remove
Examiner Initial*	Cite No	Foreign Document Number ³	Country Code ²	Kind Code ⁴	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T ⁵

**INFORMATION DISCLOSURE
STATEMENT BY APPLICANT**
(Not for submission under 37 CFR 1.99)

Application Number	16682059
Filing Date	2019-11-13
First Named Inventor	Rocco V. Burgo
Art Unit	1612
Examiner Name	Nannette Holloman
Attorney Docket Number	INLX.0198U3/484800

1	2016007196	WO	A1	2016-01-14	WRIGHT, Michael E.
2	1876162	EP	A1	2008-01-09	FURUYA, Masaki

If you wish to add additional Foreign Patent Document citation information please click the Add button

NON-PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T ⁵
	1	U.S. Appl. Ser. No. 16/262,902: Non-Final Office Action dated September 17, 2020	
	2	Liu et al., "Hydrogen peroxide-independent production of α-alkenes by OleTJE P450 fatty acid decarboxylase," Biotechnology for Biofuels 7:28 (2014)	
	3	Swern et al., "Hydroxylation and epoxidation of some 1-olefins with per-acids," JACS 68:1504-1507 (1946)	
	4	Wang et al., Efficient conversion of microcrystalline cellulose to 1,2-alkanediols over supported Ni catalysts, GREEN CHEM., 14:758-765 (2012)	
	5	Jong & Birmingham, Mushrooms as a Source of Natural Flavor and AromaCompounds", Chapter 37 (pp. 345-366) in MUSHROOM BIOLOGY AND MUSHROOM PRODUCTS (Chinese University Press 1993)	

If you wish to add additional non-patent literature document citation information please click the Add button

EXAMINER SIGNATURE

Examiner Signature		Date Considered	
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*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

**INFORMATION DISCLOSURE
STATEMENT BY APPLICANT**
(Not for submission under 37 CFR 1.99)

Application Number	16682059
Filing Date	2019-11-13
First Named Inventor	Rocco V. Burgo
Art Unit	1612
Examiner Name	Nannette Holloman
Attorney Docket Number	INLX.0198U3/484800

¹ See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. ² Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). ³ For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. ⁴ Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. ⁵ Applicant is to place a check mark here if English language translation is attached.

**INFORMATION DISCLOSURE
STATEMENT BY APPLICANT**
(Not for submission under 37 CFR 1.99)

Application Number	16682059
Filing Date	2019-11-13
First Named Inventor	Rocco V. Burgo
Art Unit	1612
Examiner Name	Nannette Holloman
Attorney Docket Number	INLX.0198U3/484800

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

See attached certification statement.

The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Aaron Lukas, Reg.# 59,443/	Date (YYYY-MM-DD)	2020-12-17
Name/Print	Aaron Lukas	Registration Number	59443

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these records.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In Re Application of: **Rocco V. Burgo et al.**Confirmation No.: **6533**Serial No.: **16/682,059**Group Art Unit: **1612**Filing Date: **November 13, 2019**Examiner: **Nannette Holloman**For: **Natural 1,2-Alkanediols, Compositions Having Natural 1,2-Alkanediols and Processes for Making the Same**Docket No.: **INLX.0198U3/484800**Customer No.: **171052**

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

INFORMATION DISCLOSURE STATEMENT TRANSMITTAL

Commissioner for Patents:

In accordance with 37 CFR §§ 1.56, 1.97 and 1.98, Applicant wishes to make known to the U.S. Patent and Trademark Office the reference(s) set forth on the enclosed Information Disclosure Statement. Please acknowledge receipt by initialing and returning a copy of the Information Disclosure Statement and kindly make the cited reference(s) of record in the above-identified application.

Because copies of cited U.S. patents and published patent applications are not required, they have not been provided. Copies of cited unpublished U.S. patent applications are not provided based upon the good faith belief that such applications are available in the USPTO's Image File Wrapper system. Copies of all other reference(s) are provided except as noted.

☒ I. This Information Disclosure Statement is being submitted pursuant to 37 CFR § 1.97(b) during one of the following time periods:

- Within three months of the filing date of a national application other than a Continued Prosecution Application under 37 CFR § 1.53(d);
- Within three months of the date of entry of the national stage as set forth in 37 CFR § 1.491 in an international application;

- Before the mailing of a first Office Action on the merits;
- Before the mailing of a first Office Action after the filing of a Request for Continued Examination under 37 CFR § 1.114; or
- Within three months of the date of publication of the international registration under Hague Agreement Article 10(3) in an international design application.

This Information Disclosure Statement is not to be construed as a representation that a search has been made or an admission that any cited reference is considered to be prior art under 35 U.S.C. §§ 101, 102 or 103, or material to patentability under 37 CFR § 1.56. The reference(s) being cited in this Information Disclosure Statement are being made known to the USPTO for compliance with Applicant's duty to disclose.

The Director is authorized to charge any other fees due by way of the Information Disclosure Statement, or credit any overpayment to Deposit Account No. 50-3111.

Date: December 17, 2020

Respectfully submitted,

/Aaron Lukas, Reg# 59,443/

Attorney Name: Aaron S. Lukas, Ph.D.

Registration No. 59,443

COZEN O'CONNOR

1200 19th Street, N.W.

Washington, DC 20036

Phone: (202) 912-4823

AL:vjd

Enclosures:

PTO/SB/08a Form & five (5) references

Electronic Acknowledgement Receipt

EFS ID:	41420960
Application Number:	16682059
International Application Number:	
Confirmation Number:	6533
Title of Invention:	Natural 1,2-Alkanediols, Compositions Having Natural 1,2-Alkanediols and Processes for Making the Same
First Named Inventor/Applicant Name:	Rocco V. Burgo
Customer Number:	171052
Filer:	Aaron Scott Lukas/Valerie Dotson
Filer Authorized By:	Aaron Scott Lukas
Attorney Docket Number:	INLX.0198U3/484800
Receipt Date:	17-DEC-2020
Filing Date:	13-NOV-2019
Time Stamp:	16:19:12
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no
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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Information Disclosure Statement (IDS) Form (SB08)	INLX_0198U3_484800_InformationDisclosureStatement.PDF	1042749 f676b56628610689db9bfd9c37b3ab5573dffc07	no	5

Warnings:

Information:					
2	Transmittal Letter	INLX_0198U3_484800_Transmittal.pdf	184162	no	2
			14d9b8273a96aa541fdb7d31ad1e6f0415195da5		
Warnings:					
Information:					
3	Non Patent Literature	INLX_0198U3_484800_Jong_Birmingham.pdf	862458	no	13
			e09dc52f12084c73566ac3030eaf130cdc7d5ea4		
Warnings:					
Information:					
4	Non Patent Literature	INLX_0198U3_484800_Liu.pdf	1345881	no	12
			e97706f9f46bfc80965a261fca6fe3560928c3fc		
Warnings:					
Information:					
5	Non Patent Literature	INLX_0198U3_484800_Office_Action.pdf	315829	no	10
			1578ad00665bd2a8839818e491ddb4acef7a31c		
Warnings:					
Information:					
6	Non Patent Literature	INLX_0198U3_484800_Swern.pdf	1386374	no	5
			5c4f13b845a4bdbad6f8ef12be95ffd1fe8f347e		
Warnings:					
Information:					
7	Non Patent Literature	INLX_0198U3_484800_Wang.pdf	1441041	no	8
			5dda41e55c2d1ea2cd6628ccf03434e5a86beaf6		
Warnings:					
Information:					
Total Files Size (in bytes):			6578494		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
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NOTICE OF ALLOWANCE AND FEE(S) DUE

171052 7590 01/04/2021
Cozen O'Connor - Inolex
1200 19th St. NW
Washington, DC 20036

EXAMINER	
HOLLOMAN, NANNETTE	
ART UNIT	PAPER NUMBER

1612

DATE MAILED: 01/04/2021

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/682,059	11/13/2019	Rocco V. Burgo	INLX.0198U3/484800	6533

TITLE OF INVENTION: NATURAL 1,2-ALKANEDIOLS, COMPOSITIONS HAVING NATURAL 1,2-ALKANEDIOLS AND PROCESSES FOR MAKING THE SAME

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	\$1200	\$0.00	\$0.00	\$1200	04/05/2021

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

HOW TO REPLY TO THIS NOTICE:

I. Review the ENTITY STATUS shown above. If the ENTITY STATUS is shown as SMALL or MICRO, verify whether entitlement to that entity status still applies.

If the ENTITY STATUS is the same as shown above, pay the TOTAL FEE(S) DUE shown above.

If the ENTITY STATUS is changed from that shown above, on PART B - FEE(S) TRANSMITTAL, complete section number 5 titled "Change in Entity Status (from status indicated above)".

For purposes of this notice, small entity fees are 1/2 the amount of undiscounted fees, and micro entity fees are 1/2 the amount of small entity fees.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Maintenance fees are due in utility patents issuing on applications filed on or after Dec. 12, 1980. It is patentee's responsibility to ensure timely payment of maintenance fees when due. More information is available at www.uspto.gov/PatentMaintenanceFees.

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), by mail or fax, or via EFS-Web.

By mail, send to: Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

By fax, send to: (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

171052 7590 01/04/2021
Cozen O'Connor - Inolex
1200 19th St. NW
Washington, DC 20036

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being transmitted to the USPTO via EFS-Web or by facsimile to (571) 273-2885, on the date below.

(Typed or printed name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/682,059	11/13/2019	Rocco V. Burgo	INLX.0198U3/484800	6533

TITLE OF INVENTION: NATURAL 1,2-ALKANEDIOLS, COMPOSITIONS HAVING NATURAL 1,2-ALKANEDIOLS AND PROCESSES FOR MAKING THE SAME

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	\$1200	\$0.00	\$0.00	\$1200	04/05/2021

EXAMINER	ART UNIT	CLASS-SUBCLASS
HOLLOMAN, NANNETTE	1612	424-049000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.

☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-09 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list

(1) The names of up to 3 registered patent attorneys or agents OR, alternatively,

1 _____

(2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

2 _____

3 _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document must have been previously recorded, or filed for recordation, as set forth in 37 CFR 3.11 and 37 CFR 3.81(a). Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE

(B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent) : ☐ Individual ☐ Corporation or other private group entity ☐ Government

4a. Fees submitted: ☐ Issue Fee ☐ Publication Fee (if required) ☐ Advance Order - # of Copies _____

4b. Method of Payment: (Please first reapply any previously paid fee shown above)

☐ Electronic Payment via EFS-Web ☐ Enclosed check ☐ Non-electronic payment by credit card (Attach form PTO-2038)

☐ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment to Deposit Account No. _____

5. Change in Entity Status (from status indicated above)

☐ Applicant certifying micro entity status. See 37 CFR 1.29

☐ Applicant asserting small entity status. See 37 CFR 1.27

☐ Applicant changing to regular undiscounted fee status.

NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.

NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.

NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature _____

Date _____

Typed or printed name _____

Registration No. _____



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/682,059	11/13/2019	Rocco V. Burgo	INLX.0198U3/484800	6533
171052	7590	01/04/2021	EXAMINER	
Cozen O'Connor - Inolex			HOLLOMAN, NANNETTE	
1200 19th St. NW			ART UNIT	
Washington, DC 20036			PAPER NUMBER	
			1612	
DATE MAILED: 01/04/2021				

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b) (Applications filed on or after May 29, 2000)

The Office has discontinued providing a Patent Term Adjustment (PTA) calculation with the Notice of Allowance.

Section 1(h)(2) of the AIA Technical Corrections Act amended 35 U.S.C. 154(b)(3)(B)(i) to eliminate the requirement that the Office provide a patent term adjustment determination with the notice of allowance. See Revisions to Patent Term Adjustment, 78 Fed. Reg. 19416, 19417 (Apr. 1, 2013). Therefore, the Office is no longer providing an initial patent term adjustment determination with the notice of allowance. The Office will continue to provide a patent term adjustment determination with the Issue Notification Letter that is mailed to applicant approximately three weeks prior to the issue date of the patent, and will include the patent term adjustment on the patent. Any request for reconsideration of the patent term adjustment determination (or reinstatement of patent term adjustment) should follow the process outlined in 37 CFR 1.705.

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

<i>Notice Requiring Inventor's Oath or Declaration</i>	Application No. 16/682,059	Applicant(s) Rocco V. Burgo	
	Examiner HOLLOMAN, NANNETTE	Art Unit 1612	

This notice is an attachment to the Notice of Allowability (PTOL-37), or the Notice of Allowability For A Design Application (PTOL-37D).

An inventor's oath or declaration in compliance with 37 CFR 1.63 or 1.64 executed by or with respect to each inventor has not yet been submitted.

An oath or declaration in compliance with 37 CFR 1.63, or a substitute statement in compliance with 37 CFR 1.64, executed by or with respect to each inventor (for any inventor for which a compliant oath, declaration, or substitute statement has not yet been submitted) **MUST** be filed no later than the date on which the issue fee is paid. See 35 U.S.C. 115(f). Failure to timely comply will result in ABANDONMENT of this application.

A properly executed inventor's oath to declaration has not been received for the following inventor(s):

If applicant previously filed one or more oaths, declarations, or substitute statements, applicant may have received an informational notice regarding deficiencies therein.

The following deficiencies are noted:

INFORMAL ACTION PROBLEMS

- A properly executed inventor's oath or declaration has not been received for the following inventor(s): **Rocco V. Burgo, Michael E. Wright, Gary B. Mosser, and Michael J. Fevola.**

Applicant may submit the inventor's oath or declaration at any time before the Notice of Allowance and Fee(s) Due, PTOL-85, is mailed.

Questions relating to this Notice should be directed to the Application Assistance Unit at 571-272-4200.

OMB Clearance and PRA Burden Statement for PTOL-85 Part B

The Paperwork Reduction Act (PRA) of 1995 requires Federal agencies to obtain Office of Management and Budget approval before requesting most types of information from the public. When OMB approves an agency request to collect information from the public, OMB (i) provides a valid OMB Control Number and expiration date for the agency to display on the instrument that will be used to collect the information and (ii) requires the agency to inform the public about the OMB Control Number's legal significance in accordance with 5 CFR 1320.5(b).

The information collected by PTOL-85 Part B is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 30 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450. Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.

Notice of Allowability	Application No. 16/682,059	Applicant(s) Burgo et al.	
	Examiner NANNETTE HOLLOMAN	Art Unit 1612	AIA (FITF) Status Yes

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to 11/13/2020.
☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

3. ☒ The allowed claim(s) is/are 1-28. As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.

4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

a) ☐ All b) ☐ Some *c) ☐ None of the:

1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

* Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892) 2. ☒ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____. 3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material _____. 4. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____.	5. ☒ Examiner's Amendment/Comment 6. ☒ Examiner's Statement of Reasons for Allowance 7. ☐ Other _____.
--	---

/NANNETTE HOLLOMAN/
Primary Examiner, Art Unit 1612

Notice of Pre-AIA or AIA Status

The present application, filed on or after March 16, 2013, is being examined under the first inventor to file provisions of the AIA.

EXAMINER'S AMENDMENT

An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

The application has been amended as follows:

Claim 27 line 1, the term "28" is replaced with --- 26 ---.

Claim 28 line 1, the term "28" is replaced with --- 26 ---.

Reasons for Allowance

The following is an examiner's statement of reasons for allowance: Osterholt et al. (US 7,385,092, disclosed by applicant) appears to be the closest prior art and discloses a process for the synthesis of diols comprising providing an alkene having a carbon chain of about 5 to about 20 carbon atoms and converting the alkene to a 1,2-alkanediol having a carbon chain length of about 5 to about 20 carbon atoms (Abstract, column 10, Example 4). Osterholt et al. are silent in regard to dehydrating an alcohol by heating.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to NANNETTE HOLLOMAN whose telephone number is (571)270-5231. The examiner can normally be reached on Monday-Friday 9am-6pm.

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at <http://www.uspto.gov/interviewpractice>.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Frederick Krass can be reached on (571)272-0580. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <https://ppair-my.uspto.gov/pair/PrivatePair>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/NANNETTE HOLLOMAN/
Primary Examiner, Art Unit 1612

<i>Search Notes</i> 	Application/Control No. 16/682,059	Applicant(s)/Patent Under Reexamination Burgo et al.
	Examiner NANNETTE HOLLOMAN	Art Unit 1612

CPC - Searched*		
Symbol	Date	Examiner
A61K	12/19/2020	NH
A01N	12/19/2020	NH

CPC Combination Sets - Searched*		
Symbol	Date	Examiner

US Classification - Searched*			
Class	Subclass	Date	Examiner

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

Search Notes		
Search Notes	Date	Examiner
PALM Inventor Search	12/19/2020	NH
NPL Search	12/19/2020	NH
EAST Search	12/19/2020	NH

/NANNETTE HOLLOMAN/ Primary Examiner, Art Unit 1612	
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<i>Search Notes</i> 	Application/Control No. 16/682,059	Applicant(s)/Patent Under Reexamination Burgo et al.
	Examiner NANNETTE HOLLOMAN	Art Unit 1612

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner
A61K	8/062, 2300/00, 8/046, 8/92, 8/34, 8/345, 2800/592, 47/14, 47/44, 8/068/, 8/922, 8/33, 2800/596	12/19/2020	NH
A01N	37/36, 37/44, 25/04, 25/30, 37/02, 37/10 25/10, 2300/00, 25/02, 33/04, 33/12, 3/06	12/19/2020	NH

/NANNETTE HOLLOMAN/ Primary Examiner, Art Unit 1612	
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Issue Classification 	Application/Control No. 16/682,059	Applicant(s)/Patent Under Reexamination Burgo et al.	
	Examiner NANNETTE HOLLOMAN	Art Unit 1612	

CPC						
Symbol					Type	Version
C07C	/	29	/	04	F	2013-01-01
C07C	/	31	/	20	I	2013-01-01
C07C	/	29	/	80	I	2013-01-01
B01J	/	23	/	06	I	2013-01-01
B01J	/	37	/	08	I	2013-01-01
B01J	/	21	/	04	I	2013-01-01
C11D	/	3	/	2044	I	2013-01-01
C07C	/	1	/	24	I	2013-01-01
C07C	/	29	/	48	I	2013-01-01
C07C	/	11	/	02	I	2013-01-01
C07C	/	11	/	107	I	2013-01-01
B01J	/	2523	/	27	A	2013-01-01
C07B	/	41	/	02	A	2013-01-01
C07B	/	63	/	00	A	2013-01-01
B01J	/	2523	/	31	A	2013-01-01
A61L	/	2	/	18	A	2013-01-01
A01N	/	31	/	02	A	2013-01-01
A61K	/	8	/	345	A	2013-01-01
A61Q	/	5	/	00	A	2013-01-01
A61Q	/	11	/	00	A	2013-01-01
A61Q	/	19	/	00	A	2013-01-01
C11D	/	3	/	48	A	2013-01-01
C07C	/	2521	/	04	A	2013-01-01

CPC Combination Sets								
Symbol					Type	Set	Ranking	Version
C07C	/	1	/	24	I	1	1	2013-01-01
C07C	/	11	/	02	I	1	2	2013-01-01
C07C	/	29	/	48	I	2	1	2013-01-01
C07C	/	31	/	20	I	2	2	2013-01-01

NONE (Assistant Examiner) _____ (Date) _____		Total Claims Allowed: 28	
/NANNETTE HOLLOMAN/ Primary Examiner, Art Unit 1612 (Primary Examiner) _____ (Date) 19 December 2020		O.G. Print Claim(s) 1	O.G. Print Figure NONE

<i>Issue Classification</i> 	Application/Control No. 16/682,059	Applicant(s)/Patent Under Reexamination Burgo et al.
	Examiner NANNETTE HOLLOMAN	Art Unit 1612

CPC Combination Sets								
Symbol					Type	Set	Ranking	Version
C07C	/	29	/	80	I	3	1	2013-01-01
C07C	/	31	/	20	I	3	2	2013-01-01

NONE (Assistant Examiner) _____ (Date) _____		Total Claims Allowed: 28	
/NANNETTE HOLLOMAN/ Primary Examiner, Art Unit 1612 (Primary Examiner) _____ (Date) 19 December 2020		O.G. Print Claim(s) 1	O.G. Print Figure NONE

Issue Classification 	Application/Control No. 16/682,059	Applicant(s)/Patent Under Reexamination Burgo et al.
	Examiner NANNETTE HOLLOMAN	Art Unit 1612

INTERNATIONAL CLASSIFICATION			
CLAIMED			
C07C29/04	/	29	/ 04

NON-CLAIMED			
/		/	

US ORIGINAL CLASSIFICATION	
CLASS	SUBCLASS

CROSS REFERENCES(S)						
CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)					

NONE		Total Claims Allowed:	
(Assistant Examiner)	(Date)	28	
/NANNETTE HOLLOMAN/ Primary Examiner, Art Unit 1612	19 December 2020	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	NONE

<i>Issue Classification</i> 	Application/Control No. 16/682,059	Applicant(s)/Patent Under Reexamination Burgo et al.
	Examiner NANNETTE HOLLOMAN	Art Unit 1612

☒ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47
--

CLAIMS															
Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
1	1	10	10	19	19	28	28								
2	2	11	11	20	20										
3	3	12	12	21	21										
4	4	13	13	22	22										
5	5	14	14	23	23										
6	6	15	15	24	24										
7	7	16	16	25	25										
8	8	17	17	26	26										
9	9	18	18	27	27										

NONE (Assistant Examiner) _____ (Date) _____		Total Claims Allowed: 28	
/NANNETTE HOLLOMAN/ Primary Examiner, Art Unit 1612 (Primary Examiner) _____ (Date) 19 December 2020		O.G. Print Claim(s) 1	O.G. Print Figure NONE

Bibliographic Data

Application No: 16/682,059

Foreign Priority claimed: ☐ Yes ☒ No

35 USC 119 (a-d) conditions met: ☐ Yes ☒ No ☐ Met After Allowance

Verified and Acknowledged:

/NANNETTE HOLLOMAN/

Examiner's Signature

Initials

Title:

Natural 1,2-Alkanediols, Compositions Having Natural 1,2-Alkanediols and Processes for Making the Same

FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
11/13/2019	424	1612	INLX.0198U3/484800
RULE			

APPLICANTS

Inolex Investment Corporation, Wilmington, DE, UNITED STATES

INVENTORS

Rocco V. Burgo, Mullica Hill, NJ, UNITED STATES

Michael E. Wright, Hurricane, UT, UNITED STATES

Gary B. Mosser, Tabernacle, NJ, UNITED STATES

Michael J. Fevola, Belle Mead, NJ, UNITED STATES

CONTINUING DATA

This application is a CON of 16262902 01/30/2019

16262902 has PRO of 62623985 01/30/2018

FOREIGN APPLICATIONS

IF REQUIRED, FOREIGN LICENSE GRANTED**

12/02/2019

STATE OR COUNTRY

UNITED STATES

ADDRESS

Cozen O'Connor - Inolex

1200 19th St. NW

Washington, DC 20036

UNITED STATES

FILING FEE RECEIVED

\$2,680

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	12	((household and pharmaceutical and cosmetic) and (octanediol or ((caprylyl or hexylene or decylene) adj glycol) or alkanediol)).clm.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT	OR	ON	2020/12/19 20:03
L2	431,023	((A61K8/062 OR A61K2300/00 OR A61K8/046 OR A61K8/92 OR A61K8/34 OR A61K8/345 OR A61K2800/592 OR A61K47/14 OR A61K47/44 OR A61K8/068 OR A61K8/922 OR A61K8/33 OR A61K2800/596 OR A61K47/10 OR A61K47/46 OR A61K8/37 OR A61K8/39 OR A61K8/466 OR A61K8/4973 OR A61K9/0014 OR A61K9/107 OR A61K9/122 OR A61K2800/5922 OR A61K8/361 OR A61K2800/21 OR A61K47/12 OR A61K47/16 OR A61K47/18 OR A61K47/20 OR A61K47/26 OR A61K47/34 OR A61K8/00 OR A61K8/064 OR A61K8/368 OR A61K8/375 OR A61K8/40 OR A61K8/46 OR A61K8/60 OR A61K8/602 OR A61K8/891 OR A61K8/925 OR A61K9/1075 OR A61K2800/10 OR A61K31/045 OR A61K31/047 OR A61K31/05 OR A61K31/055 OR A61K31/137 OR A61K31/19 OR A61K31/191 OR A61K31/192 OR A61K31/194 OR A61K31/198 OR A61K45/06 OR A61K8/342 OR A61K8/365 OR A61K8/44 OR A01N31/04 OR A01N31/02 OR A01N37/36 OR A01N37/44 OR A01N25/04 OR A01N25/30 OR A01N37/02 OR A01N37/10 OR A01N25/10 OR A01N2300/00 OR A01N25/02 OR A01N33/04 OR A01N33/12 OR A01N37/06 OR A01N43/36).CPC.)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT	OR	ON	2020/12/19 20:05
L3	13,713	I2 and (octanediol or ((caprylyl or hexylene or decylene) adj glycol) or alkanediol)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT	OR	ON	2020/12/19 20:06
L4	11	I3 and regioselectivity	US-PGPUB; USPAT;	OR	ON	2020/12/19 20:07

			USOCR; EPO; JPO; DERWENT			
S1	937	((("BURGO") near3 ("Rocco")) OR (("WRIGHT") near3 ("Michael")) OR (("MOSSER") near3 ("Gary")) OR (("FEVOLA") near3 ("Michael"))).INV.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT	OR	OFF	2020/07/07 19:12
S2	378	(bio with alkene) bioalkene	US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT	OR	ON	2020/07/07 19:19
S3	6,577	regioselectivity	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT	OR	ON	2020/09/09 14:30
S4	13	regioselectivity same alkanediol	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT	OR	ON	2020/09/09 14:30
S5	7	regioselectivity same (octanediol or (caprylyl adj glycol))	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT	OR	ON	2020/09/09 14:47
S6	1	("7385092").PN.	USPAT; USOCR	OR	OFF	2020/09/09 14:53
S7	2	wo-2016007196-\$.did.	US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT	OR	OFF	2020/09/11 11:19
S8	6	alkanediol same (household and pharmaceutical and cosmetic)	US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT	OR	ON	2020/09/11 17:25
S9	3	(household and pharmaceutical and cosmetic) same (octanediol or (caprylyl adj glycol))	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT	OR	ON	2020/09/11 17:26
S10	336	(household and pharmaceutical and cosmetic) and (octanediol or (caprylyl adj glycol))	US-PGPUB; USPAT; USOCR;	OR	ON	2020/09/11 17:26

			EPO; JPO; DERWENT			
S11	6	((household and pharmaceutical and cosmetic) and (octanediol or (caprylyl adj glycol))).clm.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT	OR	ON	2020/09/11 17:26
S13	946	((("BURGO") near3 ("Rocco")) OR ("WRIGHT") near3 ("Michael")) OR ("MOSSER") near3 ("Gary")) OR ("FEVOLA") near3 ("Michael"))).INV.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT	OR	OFF	2020/09/11 19:14
S14	3	S13 and alkanediol	US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT	OR	ON	2020/09/11 19:18
S15	7	((("8912373") or ("9856461") or ("4234752") or ("20050065389") or ("20030065233") or ("20060161025") or ("20140066666")).PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2020/09/13 13:37

EAST Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L5	97,290	((A61K8/062 OR A61K2300/00 OR A61K8/046 OR A61K8/92 OR A61K8/34 OR A61K8/345 OR A61K2800/592 OR A61K47/14 OR A61K47/44 OR A61K8/068 OR A61K8/922 OR A61K8/33 OR A61K2800/596 OR A61K47/10 OR A61K47/46 OR A61K8/37 OR A61K8/39 OR A61K8/466 OR A61K8/4973 OR A61K9/0014 OR A61K9/107 OR A61K9/122 OR A61K2800/5922 OR A61K8/361 OR A61K2800/21 OR A61K47/12 OR A61K47/16 OR A61K47/18 OR A61K47/20 OR A61K47/26 OR A61K47/34 OR A61K8/00 OR A61K8/064 OR A61K8/368 OR A61K8/375 OR A61K8/40 OR A61K8/46 OR A61K8/60 OR A61K8/602 OR A61K8/891 OR A61K8/925 OR A61K9/1075 OR A61K2800/10 OR A61K31/045 OR A61K31/047 OR A61K31/05 OR A61K31/055 OR A61K31/137 OR A61K31/19 OR A61K31/191 OR A61K31/192 OR A61K31/194 OR A61K31/198 OR A61K45/06 OR A61K8/342 OR A61K8/365 OR A61K8/44 OR A01N31/04 OR A01N31/02 OR A01N37/36 OR A01N37/44 OR A01N25/04 OR A01N25/30 OR A01N37/02 OR A01N37/10 OR A01N25/10 OR A01N2300/00	USPAT	OR	ON	2020/12/19 20:08

		OR A01N25/02 OR A01N33/04 OR A01N33/12 OR A01N37/06 OR A01N43/36).CPC.)				
L6	4	I5 and (octanediol or ((caprylyl or hexylene or decylene) adj glycol) or alkanediol) and regioselectivity	USPAT	OR	ON	2020/12/19 20:08

12/19/2020 8:58:25 PM

C:\Users\nholloman\Documents\EAST\Workspaces\16682059.wsp

Doc Code:IDS.3P

PTO/SB/429(08-12)

Document Description: Third-Party Submission Under 37 CFR 1.290

Approved for use through 07/31/2015. OMB 0651-0031

U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

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THIRD-PARTY SUBMISSION UNDER 37 CFR 1.290	Application Number	16682059

U.S. PATENTS				
Cite No	Patent Number	Kind Code ¹	Issue Date (YYYY-MM-DD)	First Named Inventor
1	9242226	B2	2016-01-26	Michael Wright
2	8912373	B2	2014-12-16	Michael Wright
3	8450543	B2	2013-05-28	Matthew PETERS
4	4234752		1980-11-18	YULIN WU

U.S. PATENT APPLICATION PUBLICATIONS				
Cite No	Publication Number	Kind Code ¹	Publication Date (YYYY-MM-DD)	First Named Inventor
1	20030006523	A1	2003-04-03	Fuji
2	20050006538	A1	2005-03-24	De Bruyn

FOREIGN PATENTS AND PUBLISHED FOREIGN PATENT APPLICATIONS				
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THIRD-PARTY SUBMISSION UNDER 37 CFR 1.290	Application Number	16682059

Cite No	Foreign Document Number ³	Country Code ²	Kind Code ¹	Publication Date (YYYY-MM-DD)	Applicant, Patentee or First Named Inventor	T ⁵
						☐

NON-PATENT PUBLICATIONS (e.g., journal article, Office action)

Cite No	Author (if any), title of the publication, page(s) being submitted, publication date, publisher (where available), place of publication (where available).	T ⁵	E ⁶
1	Klug et al., Degradation of Hydrocarbons by Members of the Genus Candida, II. Oxidation of n-Alkanes and 1-Alkenes by Candida lipolytica, Journal of Bacteriology, Vol. 93, No. 6, pp 1847-1852 (1967)	☐	☐

STATEMENTS

The party making the submission is not an individual who has a duty to disclose information with respect to the above-identified application under 37 CFR 1.56.

This submission complies with the requirements of 35 U.S.C. 122(e) and 37 CFR 1.290.

☒ The fee set forth in 37 CFR 1.290(f) has been submitted herewith.

☐ The fee set forth in 37 CFR 1.290(f) is not required because this submission lists three or fewer total items and, to the knowledge of the person signing the statement after making reasonable inquiry, this submission is the first and the only submission under 35 U.S.C. 122(e) filed in the above-identified application by the party making the submission or by a party in privity with the party.

☐ This resubmission is being made responsive to a notification of non-compliance issued for an earlier filed third-party submission. The corrections in this resubmission are limited to addressing the non-compliance. As such, the party making this resubmission: (1) requests that the Office apply the previously-paid fee set forth in 37 CFR 1.290(f), or (2) states that no fee is required to accompany this resubmission as the undersigned is again making the fee exemption statement set forth in 37 CFR 1.290(g).

THIRD-PARTY SUBMISSION UNDER 37 CFR 1.290	Application Number	16682059

Signature	/daniel altman/		
Name/Print	Daniel Altman	Registration Number (if applicable)	34115

Examiner Signature	/NANNETTE HOLLOMAN/	Date Considered	12/19/2020
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*EXAMINER: Signature indicates all documents listed above have been considered, except for citations through which a line is drawn. Draw line through citation if not considered. Include a copy of this form with next communication to applicant. 1. If known, enter kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16. See MPEP 901.04(a). 2. Enter the country or patent office that issued the document, by two-letter code under WIPO standard ST.3. See MPEP 1851. 3. For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. 4. If known, enter the kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16. See MPEP 901.04(a). 5. Check mark indicates translation attached. 6. Check mark indicates evidence of publication attached.

Web Search History

date, time	web site	search string
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12/19/2020 8:10:05 PM	Google Scholar	octandiol regioselectivity
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Doc code: IDS

PTO/SB/08a (02-18)

Doc description: Information Disclosure Statement (IDS) Filed

Approved for use through 11/30/2020. OMB 0651-0031

U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		16682059	
	Filing Date		2019-11-13	
	First Named Inventor		Rocco V. Burgo	
	Art Unit		1612	
	Examiner Name		Nannette Holloman	
	Attorney Docket Number		INLX.0198U3/484800	

U.S.PATENTS						Remove
Examiner Initial*	Cite No	Patent Number	Kind Code ¹	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	9856461	B2	2018-01-02	Jeffrey Fortman	

If you wish to add additional U.S. Patent citation information please click the Add button. Add

U.S.PATENT APPLICATION PUBLICATIONS						Remove
Examiner Initial*	Cite No	Publication Number	Kind Code ¹	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20120282207	A1	2012-11-01	LUTZ, Patrick Jay	
	2	20060161025	A1	2006-07-20	OSTERHOLT, Clemens	
	3	20140066666	A1	2014-03-06	Oskar Koch	
	4	20060161025	A1	2008-06-10	Swern	

If you wish to add additional U.S. Published Application citation information please click the Add button. Add

FOREIGN PATENT DOCUMENTS								Remove
Examiner Initial*	Cite No	Foreign Document Number ³	Country Code ²ⁱ	Kind Code ⁴	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T ⁵

**INFORMATION DISCLOSURE
STATEMENT BY APPLICANT**
(Not for submission under 37 CFR 1.99)

Application Number	16682059
Filing Date	2019-11-13
First Named Inventor	Rocco V. Burgo
Art Unit	1612
Examiner Name	Nannette Holloman
Attorney Docket Number	INLX.0198U3/484800

1	2016007196	WO	A1	2016-01-14	WRIGHT, Michael E.
2	1876162	EP	A1	2008-01-09	FURUYA, Masaki

If you wish to add additional Foreign Patent Document citation information please click the Add button

NON-PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T ⁵
	1	U.S. Appl. Ser. No. 16/262,902: Non-Final Office Action dated September 17, 2020	
	2	Liu et al., "Hydrogen peroxide-independent production of α-alkenes by OleTJE P450 fatty acid decarboxylase," Biotechnology for Biofuels 7:28 (2014)	
	3	Swern et al., "Hydroxylation and epoxidation of some 1-olefins with per-acids," JACS 68:1504-1507 (1946)	
	4	Wang et al., Efficient conversion of microcrystalline cellulose to 1,2-alkanediols over supported Ni catalysts, GREEN CHEM., 14:758-765 (2012)	
	5	Jong & Birmingham, Mushrooms as a Source of Natural Flavor and AromaCompounds", Chapter 37 (pp. 345-366) in MUSHROOM BIOLOGY AND MUSHROOM PRODUCTS (Chinese University Press 1993)	

If you wish to add additional non-patent literature document citation information please click the Add button

EXAMINER SIGNATURE

Examiner Signature	/NANNETTE HOLLOMAN/	Date Considered	12/19/2020
--------------------	---------------------	-----------------	------------

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

**INFORMATION DISCLOSURE
STATEMENT BY APPLICANT**
(Not for submission under 37 CFR 1.99)

Application Number		16682059
Filing Date		2019-11-13
First Named Inventor	Rocco V. Burgo	
Art Unit		1612
Examiner Name	Nannette Holloman	
Attorney Docket Number		INLX.0198U3/484800

¹ See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. ² Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). ³ For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. ⁴ Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. ⁵ Applicant is to place a check mark here if English language translation is attached.

**INFORMATION DISCLOSURE
STATEMENT BY APPLICANT**
(Not for submission under 37 CFR 1.99)

Application Number	16682059
Filing Date	2019-11-13
First Named Inventor	Rocco V. Burgo
Art Unit	1612
Examiner Name	Nannette Holloman
Attorney Docket Number	INLX.0198U3/484800

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

See attached certification statement.

The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Aaron Lukas, Reg.# 59,443/	Date (YYYY-MM-DD)	2020-12-17
Name/Print	Aaron Lukas	Registration Number	59443

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these records.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.



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United States Patent and Trademark Office
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Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/682,059	11/13/2019	Rocco V. Burgo	INLX.0198U3/484800	6533
171052	7590	01/06/2021	EXAMINER	
Cozen O'Connor - Inolex			HOLLOMAN, NANNETTE	
1200 19th St. NW			ART UNIT	PAPER NUMBER
Washington, DC 20036			1612	
			NOTIFICATION DATE	DELIVERY MODE
			01/06/2021	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

echoi@cozen.com
nyipdocketing@cozen.com
vdotson@cozen.com

Letter Withdrawing a Notice Requiring Inventor's Oath or Declaration	Application No. 16/682,059	Applicant(s) Burgo et al.

The Notice Requiring Inventor's Oath or Declaration mailed on 04 January 2021 was sent in error, and is hereby withdrawn. The time period set forth in the Notice of Allowance and Fee(s) Due to file a reply and pay the required fees continues to run from the mailing date of the Notice of Allowance and Fee(s) Due. Any time period set forth in the Notice of Allowability continues to run from the mailing date of the Notice of Allowability.

Questions relating to this Notice should be directed to the Application Assistance Unit at 571-272-4200.

/Brian Broadfoot/
Office of Data Management, Art Unit 3974
571-272-4200 or 1-888-786-0101
Patent Publication Branch
Office of Data Management

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), by mail or fax, or via EFS-Web.

By mail, send to: Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

By fax, send to: (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

171052 7590 01/04/2021
Cozen O'Connor - Inolex
1200 19th St. NW
Washington, DC 20036

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being transmitted to the USPTO via EFS-Web or by facsimile to (571) 273-2885, on the date below.

(Typed or printed name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/682,059	11/13/2019	Rocco V. Burgo	INLX.0198U3/484800	6533

TITLE OF INVENTION: NATURAL 1,2-ALKANEDIOLS, COMPOSITIONS HAVING NATURAL 1,2-ALKANEDIOLS AND PROCESSES FOR MAKING THE SAME

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	\$1200	\$0.00	\$0.00	\$1200	04/05/2021

EXAMINER	ART UNIT	CLASS-SUBCLASS
HOLLOMAN, NANNETTE	1612	424-049000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.

☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-09 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list

(1) The names of up to 3 registered patent attorneys or agents OR, alternatively,

(2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 COZEN O'CONNOR
2 _____
3 _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document must have been previously recorded, or filed for recordation, as set forth in 37 CFR 3.11 and 37 CFR 3.81(a). Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE

(B) RESIDENCE: (CITY and STATE OR COUNTRY)

INOLEX INVESTMENT CORPORATION

Wilmington, Delaware

Please check the appropriate assignee category or categories (will not be printed on the patent): ☐ Individual ☒ Corporation or other private group entity ☐ Government

4a. Fees submitted: ☒ Issue Fee ☐ Publication Fee (if required) ☐ Advance Order - # of Copies _____

4b. Method of Payment: (Please first reapply any previously paid fee shown above)

☒ Electronic Payment via EFS-Web ☐ Enclosed check ☐ Non-electronic payment by credit card (Attach form PTO-2038)

☒ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment to Deposit Account No. **50-3111**

5. Change in Entity Status (from status indicated above)

☐ Applicant certifying micro entity status. See 37 CFR 1.29

☐ Applicant asserting small entity status. See 37 CFR 1.27

☐ Applicant changing to regular undiscounted fee status.

NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.

NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.

NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature /Aaron S. Lukas, Reg. #59,443/

Date 03/31/2021

Typed or printed name Aaron S. Lukas, Ph.D.

Registration No. 59,443

Electronic Patent Application Fee Transmittal				
Application Number:		16682059		
Filing Date:		13-Nov-2019		
Title of Invention:		NATURAL 1,2-ALKANEDIOLS, COMPOSITIONS HAVING NATURAL 1,2-ALKANEDIOLS AND PROCESSES FOR MAKING THE SAME		
First Named Inventor/Applicant Name:		Rocco V. Burgo		
Filer:		Aaron Scott Lukas/Valerie Dotson		
Attorney Docket Number:		INLX.0198U3/484800		
Filed as Large Entity				
Filing Fees for Utility under 35 USC 111(a)				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
UTILITY APPL ISSUE FEE	1501	1	1200	1200

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Extension-of-Time:				
Miscellaneous:				
Total in USD (\$)				1200

Electronic Acknowledgement Receipt

EFS ID:	42328361
Application Number:	16682059
International Application Number:	
Confirmation Number:	6533
Title of Invention:	NATURAL 1,2-ALKANEDIOLS, COMPOSITIONS HAVING NATURAL 1,2-ALKANEDIOLS AND PROCESSES FOR MAKING THE SAME
First Named Inventor/Applicant Name:	Rocco V. Burgo
Customer Number:	171052
Filer:	Aaron Scott Lukas/Valerie Dotson
Filer Authorized By:	Aaron Scott Lukas
Attorney Docket Number:	INLX.0198U3/484800
Receipt Date:	31-MAR-2021
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Time Stamp:	09:13:33
Application Type:	Utility under 35 USC 111(a)

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Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
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			7f5ef9ca751d226a5c0997de249d9580c2b08146		
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	30636	no	2
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Doc code: IDS

PTO/SB/08a (02-18)

Doc description: Information Disclosure Statement (IDS) Filed

Approved for use through 11/30/2020. OMB 0651-0031

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)

Application Number	16682059
Filing Date	2019-11-13
First Named Inventor	Rocco V. Burgo
Art Unit	1612
Examiner Name	Nannette Holloman
Attorney Docket Number	INLX.0198U3/484800

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	2	20060161025	A1	2006-07-20	OSTERHOLT, Clemens	
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APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/682,059	05/04/2021	10995048	INLX.0198U3/484800	6533

171052 7590 04/14/2021
Cozen O'Connor - Inolex
1200 19th St. NW
Washington, DC 20036

ISSUE NOTIFICATION

The projected patent number and issue date are specified above.

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b) (application filed on or after May 29, 2000)

The Patent Term Adjustment is 0 day(s). Any patent to issue from the above-identified application will include an indication of the adjustment on the front page.

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (<http://pair.uspto.gov>).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Application Assistance Unit (AAU) of the Office of Data Management (ODM) at (571)-272-4200.

APPLICANT(s) (Please see PAIR WEB site <http://pair.uspto.gov> for additional applicants):

Rocco V. Burgo, Mullica Hill, NJ;
Inolex Investment Corporation, Wilmington, DE;
Michael E. Wright, Hurricane, UT;
Gary B. Mosser, Tabernacle, NJ;
Michael J. Fevola, Belle Mead, NJ;

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