

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SYMRISE AG and SYMRISE INC.,
Petitioners,

v.

INOLEX INVESTMENT CORP.,
Patent Owner.

Case IPR2023-01035
U.S. Patent No. 10,995,048

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

**PATENT OWNER'S NON-CONTINGENT MOTION TO AMEND AND
REQUEST FOR PRELIMINARY GUIDANCE**

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35 U.S.C. § 316(d)	1, 4
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LIST OF EXHIBITS

Exhibit No.	Description
Ex. 2001	Declaration of Michael E. Wright, Ph.D.
Ex. 2002	J. Ross, “Heterogeneous Catalysis,” Elsevier B.V. (2012)
Ex. 2003	Kim <i>et al.</i> , “Dual-bed catalytic system comprising Al ₂ O ₃ and Ba/Al ₂ O ₃ with enhanced 1-octene productivity in 1-octanol dehydration for linear α -olefin production,” <i>J. Ind. Eng. Chem.</i> 119:376-85 (2023)
Ex. 2004	Experimental data for Comparative Example 10 of U.S. Patent No. 10,995,048 for the conversion of 1-octanol to octenes
Ex. 2005	Deposition Testimony of Douglass F. Taber, January 23, 2024

I. INTRODUCTION

Patent Owner Inolex Investment Corp. (“Inolex” or “Patent Owner”) moves under 35 U.S.C. § 316(d) and 37 C.F.R. § 42.121 to amend U.S. Pat. No. 10,995,048 (“the ’048 Patent”) to more narrowly define the invention and address the invalidity grounds set forth by Petitioners. Inolex respectfully requests that the Board grant this Non-Contingent Motion to Amend (the “Motion to Amend”) and issue the corresponding substitute claims presented herein. Specifically, Inolex proposes cancelling challenged claims 1-6, 8-10, and 22-28,¹ and substituting claims 29-44, respectively. *See* Appendix A (showing amendments). This one-to-one substitution creates a presumption that the number of amended claims is reasonable.²

II. OVERVIEW OF THE EXISTING ’048 CLAIMS AND NARROWING AMENDMENTS

As the Board found in its institution decision, the ’048 patent is directed to “natural and renewable antimicrobial compounds for use in alternative preservation

¹ Claims 7 and 11-21 were not challenged in the Petition and are therefore ineligible for amendment. *See Apple Inc. v. Uniloc 2017 LLC*, IPR2018-01092, Paper 25 at 45 (P.T.A.B. Dec 13, 2019).

² Inolex will not be filing a Response to the Institution Decision (Paper 7) and is instead filing this Non-Contingent Motion to Amend.

systems for consumer products, such as personal care products.” Paper 7 at 3.

The Board held that Petitioners demonstrated a reasonable likelihood that they would prevail on the assertion that claims 1-6, 8-10, 22, 23, and 26-28 would have been obvious over: Le (US 2011/0196114 A1, Ex. 1007), De Bruyn (US 2005/0065389 A1, Ex. 1008) and Le, or Wright (US 2012/0238788 A1, Ex. 1009), and that claims 24 and 25 would have been obvious over Le and Cheng (US 6,528,665 B1, Ex. 1010), De Bruyn, Le and Cheng, or Wright and Cheng.

The proposed substitute claims narrow the challenged claims by incorporating limitations from unchallenged claims 11 and 14, thereby requiring a specific catalyst for the claimed method. Specifically, substitute independent claim 29 requires:

- “dehydrating a bio-1-alcohol by heating the bio-1-alcohol in a reactor with a base-treated and calcined γ -alumina catalyst”; and
- that the “catalyst has not been silanized.”

Substitute independent claim 29 also requires that:

- “the resulting bio-alkene has a carbon chain of 6 to 14 carbon atoms and is produced in a conversion of at least 95%”; and
- “has a bio-1-alkene regioselectivity of 92% to about 99%.”

These limitations are not taught or suggested by Le, De Bruyn, or Wright, or any other prior art of record. What is more, as discussed in the Declaration of

Michael E. Wright, Ph.D. (the “Wright Decl.,” Ex. 2001), the methods of substitute claim 29, as well as dependent claims 34, 37, 40, and 43, provide unexpected results over the closest prior art.

Dependent claims 30-44, among other features, are also narrowed to require that the heating is performed in a “reactor at about 240 °C to about 360 °C” (claims 33, 36, 39, and 42); that “the catalyst has been calcined at a temperature of about 400 °C to about 480 °C” (claims 34, 37, 40, and 43); and that “the bio-alkene has a bio-1-alkene regioselectivity of 95% to about 99%” (claims 35, 38, 41, and 44). These limitations, including those added to the independent claim, are supported by the disclosure and distinguish the substitute claims from the prior art of record.

In support of the patentability of substitute claims 29-44, Inolex relies upon the Wright Declaration (Ex. 2001), the sworn testimony of Petitioners’ expert, Dr. Douglass Taber (Ex. 2005), as well as Ex. 2002, Ex. 2003, and Ex. 2004.

III. STATEMENT OF RELIEF REQUESTED

Inolex respectfully requests that the Board consider this Motion and grant entry of the following proposed amendments:

- Cancel claim 1-6, 8-10, and 22-28;
- Substitute the cancelled claims with claims 29-44 as shown below (with the claimed dependencies shown in parentheses):

Original Claim	Substitute Claim
1	29
2 (1)	30 (29)
3 (2)	31 (29)
4 (3)	32 (29)
5 (1)	33 (29)
6 (1)	34 (33)
8 (1)	35 (34)
9 (1)	36 (30)
10 (9)	37 (36)
22 (1)	38 (37)
23 (1)	39 (31)
24 (1)	40 (39)
25 (24)	41 (40)
26 (1)	42 (32)
27 (26)	43 (42)
28 (26)	44 (43)

Pursuant to the Scheduling Order of November 16, 2023 (Paper 8 at 4-5) and the Board’s January 19, 2024 Order concerning the Conduct of the Proceeding (Paper 11), Inolex hereby requests to participate in the pilot program for motions to amend and seeks preliminary guidance from the Board concerning substitute claims 29-44. *See Notice Regarding a New Pilot Program Concerning Motion to Amend Practice and Procedures in Trial Proceedings under the America Invents Act before the Patent Trial and Appeal Board*, 84 Fed. Reg. 9,497-01 (Mar. 15, 2019) (“MTA Pilot Program Notice”).

IV. PROCEDURAL REQUIREMENTS OF 37 C.F.R. § 41.121

The Board “must determine whether the motion to amend meets the statutory and regulatory requirements set forth in 35 U.S.C. § 316(d) and 37 C.F.R.

§ 42.121.” *Lectrosonics, Inc. v. Zaxcom, Inc.*, IPR2018-01129, Paper 15, at 4 (PTAB Feb. 25, 2019) (precedential). The requirements are: (1) the amendment proposes a reasonable number of substitute claims; (2) the proposed claims are supported in the original disclosure; (3) the amendment responds to a ground of unpatentability involved in the trial; and (4) the amendment does not seek to enlarge the scope of the claims of the patent or introduce new subject matter. *Id.* at 4-8. For the reasons stated below, these requirements are met.

A. The Number of Substitute Claims Is Reasonable

“There is a rebuttable presumption that a reasonable number of substitute claims per challenged claim is one (1) substitute claim.” *Id.* at 4. Inolex proposes 15 substitute claims, each of which corresponds to a challenged claim. Thus, Inolex has proposed a one-to-one substitution of claims, which is presumptively a reasonable number.

B. The Specification Provides Written Description Support for the Proposed Substitute Claims

“[T]he Board requires that a motion to amend set forth written description support in the originally filed disclosure of the subject patent for each proposed substitute claim, and also set forth support in an earlier filed disclosure for each claim for which benefit of the filing date of the earlier filed disclosure is sought.” *Id.* at 7. “[T]o meet this requirement, citation should be made to the original

disclosure of the application, as filed, rather than to the patent as issued.” *Id.* at 8.

Table 1 below provides citations to written support for each limitation of the substitute claims, as disclosed in Provisional Application No. 62/623,985 filed on January 30, 2018 (Ex. 1003 at pp. 20-52), Non-Provisional Application No. 16/262,902, as filed on January 30, 2019 (Ex. 1004 at pp. 24-80), and Non-Provisional Application No. 16/682,059, as filed on November 13, 2019 (Ex. 1005 at pp. 4-54).

Patent Owner notes that Provisional Application No. 62/623,985, filed on January 30, 2018, does not include explicit written support for the limitations of substitute claims 34, 37, 40, and 43 that require “wherein prior to the dehydrating, the catalyst has been calcined at a temperature of about 400 °C to about 480 °C.” Thus, substitute claims 34, 37, 40, and 43 have an earliest priority date of January 30, 2019 (based on the filing of Non-Provisional Application No. 16/262,902).

Table 1. Written Support for Elements of Substitute Claims

	Element(s) of Substitute Claims	Citation to Support in Provisional (Ex. 1003) and Non-Provisional (Ex. 1004) Priority Applications, and As-Filed Specification (Ex. 1005)
[29 pre]	29. A method for making a bio-alkene, comprising:	Ex. 1003 (pp. 20-52) at [0025], [0048], [0050], [0085], [0086]. Ex. 1004 (pp. 24-80) at [0030], [0032], [0050], [0055], [0071], [0072], [0125], Table 2, [0127],

	Element(s) of Substitute Claims	Citation to Support in Provisional (Ex. 1003) and Non-Provisional (Ex. 1004) Priority Applications, and As-Filed Specification (Ex. 1005)
		FIG. 1, Abstract. Ex. 1005 (pp. 4-54) at [0030], [0032], [0050], [0055], [0071], [0072], [0125], Table 2, [0127], FIG. 1, Abstract.
[29a]	dehydrating a bio-1-alcohol by heating the bio-1-alcohol in a reactor with a base-treated and calcined γ -alumina catalyst,	Ex. 1003 (pp. 20-52) at [0025], [0050], [0085], [0086], claim 6. Ex. 1004 (pp. 24-80) at [0040], [0042], [0071], [0076], Table 1, [0077], [0084], [0125], Table 2, [0126], [0127], claims 13, 16, 19, 20. Ex. 1005 (pp. 4-54) at [0040], [0042], [0071], [0076], Table 1, [0077], [0084], [0125], Table 2, [0126], [0127].
[29b]	wherein the catalyst has not been silanized, and	Ex. 1003 (pp. 20-52) at [0020], [0085]. Ex. 1004 (pp. 24-80) at [0027], [0081], [0132]. Ex. 1005 (pp. 4-54) at [0027], [0081], [0132].
[29c]	wherein the resulting bio-alkene has a carbon chain of 6 to 14 carbon atoms and	Ex. 1003 (pp. 20-52) at [0024], [0048], claim 2. Ex. 1004 (pp. 24-80) at [0031], [0066], claim 2.

	Element(s) of Substitute Claims	Citation to Support in Provisional (Ex. 1003) and Non-Provisional (Ex. 1004) Priority Applications, and As-Filed Specification (Ex. 1005)
		Ex. 1005 (pp. 4-54) at [0031], [0066].
[29d]	is produced in a conversion of at least 95%,	Ex. 1003 (pp. 20-52) at [0086]. Ex. 1004 (pp. 24-80) at [0074], [0125], claim 2. Ex. 1005 (pp. 4-54) at [0031], [0066].
[29e]	and has a bio-1-alkene regioselectivity of 92% to about 99%	Ex. 1003 (pp. 20-52) at [0025], [0041], [0052], claim 7. Ex. 1004 (pp. 24-80) at [0033], [0066], claim 10. Ex. 1005 (pp. 4-54) at [0033], [0066].
[30a]	30. The method according to claim 29, wherein the bio-alkene has a carbon chain length of 6 to 10 carbon atoms.	Ex. 1003 (pp. 20-52) at [0024], [0048], claim 3. Ex. 1004 (pp. 24-80) at [0031], [0066], claim 3. Ex. 1005 (pp. 4-54) at [0031], [0066].
[31a]	31. The method according to claim 29, wherein the bio-alkene has a carbon chain length of 6 to 8 carbon atoms.	Ex. 1003 (pp. 20-52) at [0024], [0048], claims 3-4. Ex. 1004 (pp. 24-80) at [0031], claim 4. Ex. 1005 (pp. 4-54) at [0031].

	Element(s) of Substitute Claims	Citation to Support in Provisional (Ex. 1003) and Non-Provisional (Ex. 1004) Priority Applications, and As-Filed Specification (Ex. 1005)
[32a]	32. The method according to claim 29, wherein the bio-alkene is bio-octene.	Ex. 1003 (pp. 20-52) at [0024], [0048], claim 4. Ex. 1004 (pp. 24-80) at [0031], [0058], [0066], [0067], [0076], Table 1, [0081], [0121], [0122], [0125], [0127], Table 2, claim 5, Fig. 4. Ex. 1005 (pp. 4-54) at [0031], [0058], [0066], [0067], [0076], Table 1, [0081], [0121], [0122], [0125], [0127], Table 2, Fig. 4.
[33a]	33. The method according to claim 29, wherein the reactor is heated at about 240 °C to about 360 °C.	Ex. 1003 (pp. 20-52) at [0050], [0052], [0085], [0086]. Ex. 1004 (pp. 24-80) at [0074], [0075], [0133], Table 5, [0134]. Ex. 1005 (pp. 4-54) at [0074], [0075], [0133], Table 5, [0134].
[34a]	34. The method according to claim 33, wherein prior to the dehydrating, the catalyst has been calcined at a temperature of about 400 °C to about 480 °C.	Ex. 1004 (pp. 24-80) at [0035], [0076], Table 1, [0084]. Ex. 1005 (pp. 4-54) at [0035], [0076], Table 1, [0084].
[35a]	35. The method according to claim 34, wherein the bio-alkene has a bio-1-alkene regioselectivity of 95% to about 99%.	Ex. 1003 (pp. 20-52) at [0025], [0041], [0052], [0086]. Ex. 1004 (pp. 24-80) at [0033], [0066], claim 11. Ex. 1005 (pp. 4-54) at [0033],

	Element(s) of Substitute Claims	Citation to Support in Provisional (Ex. 1003) and Non-Provisional (Ex. 1004) Priority Applications, and As-Filed Specification (Ex. 1005)
		[0066].
[36a]	36. The method according to claim 30, wherein the reactor is heated at about 240 °C to about 360 °C.	See limitation 33a, <i>supra</i> .
[37a]	37. The method according to claim 36, wherein prior to the dehydrating, the catalyst has been calcined at a temperature of about 400 °C to about 480 °C.	See limitation 34a, <i>supra</i> .
[38a]	The method according to claim 37, wherein the bio-alkene has a bio-1-alkene regioselectivity of 95% to about 99%.	See limitation 35a, <i>supra</i> .
[39a]	39. The method according to claim 31, wherein the reactor is heated at about 240 °C to about 360 °C.	See limitation 33a, <i>supra</i> .
[40a]	40. The method according to claim 39, wherein prior to the dehydrating, the catalyst has been calcined at a temperature of about 400 °C to about 480 °C.	See limitation 34a, <i>supra</i> .
[41a]	The method according to claim 39, wherein the bio-alkene has a bio-1-alkene regioselectivity of 95% to about 99%.	See limitation 35a, <i>supra</i> .
[42a]	42. The method according to	See limitation 33a, <i>supra</i> .

	Element(s) of Substitute Claims	Citation to Support in Provisional (Ex. 1003) and Non-Provisional (Ex. 1004) Priority Applications, and As-Filed Specification (Ex. 1005)
	claim 32, wherein the reactor is heated at about 240 °C to about 360 °C.	
[43a]	43. The method according to claim 42, wherein prior to the dehydrating, the catalyst has been calcined at a temperature of about 400 °C to about 480 °C.	See limitation 34a, <i>supra</i> .
[44a]	The method according to claim 43, wherein the bio-alkene has a bio-1-alkene regioselectivity of 95% to about 99%.	See limitation 35a, <i>supra</i> .

C. The Substitute Claims Are Responsive to the Instituted Grounds

The proposed substitute claims are responsive to the grounds for institution because they distinguish from the prior art of record, and in particular from Le, De Bruyn, and Wright. More specifically, substitute claim 29 recites a specific catalyst and the production of C₆ to C₁₄ bio-alkenes with a conversion of at least 95% and a bio-1-alkene regioselectivity of 92% to about 99%, which are not disclosed or suggested by Le, De Bruyn, and/or Wright, or any combination thereof in view of the prior art of record. *See also* Section V below.

What is more, substitute claim 29 is sought to be amended with limitations

from claims 11 and 14 of the '048 patent that were unchallenged in this proceeding. Since Petitioners have not challenged these specific limitations, so long as the Board finds written support for these limitations in the as-filed specification and priority documents, these amendments should resolve this *inter partes* review proceeding.

As further explained below and in the Wright Declaration (Ex. 2001), the substitute claims are patentable over the instituted grounds. *See* 37 C.F.R. § 42.121(a)(2)(i).

D. The Substitute Claims Do Not Enlarge the Scope of the Original Claims

The substitute claims do not broaden the original claims in any manner. Instead, they are narrower, as reflected in Appendix A attached hereto, which reflects the amendments to the claims (underlined text reflects added limitations, while strikethrough text indicates portions being removed). Substitute claim 29, for example, adds the limitations that the bio-1-alcohol is dehydrated “by heating ... in a reactor with a base-treated and calcined γ -alumina catalyst, wherein the catalyst has not been silanized,” and “wherein the resulting bio-alkene has a carbon chain of 6 to 14 carbon atoms and is produced in a conversion of at least 95%, and has a bio-1-alkene regioselectivity of 92% to about 99%.” Each and every one of substitute claims 30-44 depends directly or indirectly from substitute claim 29, and

thereby incorporates these limitations by reference. Because the independent claim is narrower than the original independent claims, the dependent claims are necessarily narrower than the original claims.

In addition, certain dependent claims have been further narrowed. For example, substitute claims 30 and 31 delete the modifier “about” before the carbon chain limitations, thereby narrowing these claims and removing any ambiguity as to the scope of what is claimed. Further, original claims 26-28, which recited a product-by-process, have been cancelled and all substitute claims are directed to methods.

V. THE SUBSTITUTE CLAIMS ARE PATENTABLE OVER THE INSTITUTED GROUNDS

Substitute claim 29 requires “dehydrating a bio-1-alcohol by heating the bio-1-alcohol in a reactor with a base-treated and calcined γ -alumina catalyst, wherein the catalyst has not been silanized.” The limitations “base-treated and calcined γ -alumina catalyst” are recited in claims 11 and 14 of the '048 patent, the validity of which was not challenged by Petitioners. See Pet. at 5 (challenging validity of only claims 1-6, 8-10 and 22-28). Substitute claim 29 also requires that “the catalyst has not been silanized” and “wherein the resulting bio-alkene has a carbon chain of 6 to 14 carbon atoms and is produced in a conversion of at least 95%, and has a bio-1-alkene regioselectivity of 92% to about 99%.”

As discussed herein, Inolex submits that these non-contingent amendments distinguish substitute claim 29 (and dependent claims 30-44) as non-obvious over the prior art of record, and more particularly each of Petitioners' Grounds 1-6.

A. Substitute Claim 29 Is Patentable Over Le and Cheng (Petition Grounds 1 and 2)

The Board found that Le discloses “a dehydration step that can be carried out in the presence of a dehydration catalyst, such as a γ -alumina-based catalyst, in the presence of the alcohols obtained from renewable sources at temperatures ranging from 250 to 400 °C.” Paper 7 at p. 11 (citing Ex. 1007 at [0063, [0065]]).

Patent Owner notes that Le discloses the “dehydration step can be carried out in the presence of a dehydration catalyst, for example a γ -alumina-based catalyst, which may be acidic or basic,” with the former providing improved conversion and the latter providing improved regioselectivity. Ex. 1007, [0064]; Ex. 2001, ¶ 40. In particular, Le identifies two commercially available γ -alumina catalysts “suitable for the dehydration of these alcohols,” the first of which is sold by the company Eurosupport under the trade name ESM 110[®], “which is an undoped trilobed alumina containing little residual Na₂O (usually 0.04%).” Ex. 1007, [0064], [0171]; Ex. 2001, ¶ 40. Le also identifies “the Pural[®] KR1 catalyst produced by Sasol.” Ex. 1007, [0066], Ex. 2001, ¶ 40.

A person of ordinary skill in the art (“POSITA”) reading Le would have

been motivated to use one of the commercially available γ -alumina catalysts disclosed therein—namely, the ESM 110[®] catalyst from Eurosupport or the Pural[®] KR1 catalyst from Sasol. *See* Ex. 2001, ¶ 56; Ex. 2005 at p. 101, l. 21 – p. 103, l. 15. However, a POSITA would not know anything about how those commercially available catalysts were prepared—for example, whether either commercial alumina catalyst disclosed in Le was chemically modified or calcined. *See* Ex. 2001, ¶ 40, ¶ 55, ¶ 64; Ex. 2005 at p. 97, l. 21 – p. 99, l. 20; p. 101, ll. 6-20.

Further, Le provides no details concerning the conversion or 1-alkene regioselectivity obtained in Le's exemplary embodiment (*see* Ex. 1007 at [0171]-[0172]), which would have been important information to a POSITA. *See* Ex. 2001, ¶ 45; Ex. 2005, p. 104, l. 14 – p. 105, l. 1; p. 106, l. 14 – p. 107, l. 9.

In contrast to Le, the specification of the '048 patent discloses that base-treatment and calcination were important to obtain both the claimed conversion and bio-1-alkene regioselectivity. *See* Ex. 1005 at 14-15 [0034], [0042], 24-25 [0076]-[0077]; Ex. 2001, ¶ 21-¶ 22. Nothing in *Le* would provide a POSITA any reasonable expectation that a base-treated and calcined γ -alumina catalyst could be used to dehydrate a C₆ to C₁₄ bio-1-alcohol, wherein the resulting bio-alkene is produced in a conversion of at least 95%, and has a bio-1-alkene regioselectivity of 92% to about 99%. *See* Ex. 2001, ¶ 45, ¶ 55-¶ 56. For at least these reasons, the method of substitute claim 29 is non-obvious over Le (i.e., Petition Ground 1).

Cheng is relied upon by Petitioners for its teaching that a 1-alkene (i.e., 1-hexene) can be converted to 1,2-epoxyhexane, which is then converted to 1,2-hexanediol (Paper 7 at 17), but Cheng does not teach or suggest the use of any specific catalysts to prepare bio-1-alkenes with high alcohol conversion and bio-1-alkene regioselectivity. *See* Ex. 2001, ¶ 57, Ex. 2005, p. 122, l. 9 – p. 123, l. 12. Thus, Cheng lacks any teaching or suggestion that, in combination with Le, would render substitute claim 29 and its dependent claims obvious. Ex. 2001, ¶ 57, ¶ 63. For at least these reasons, substitute claim 29 is non-obvious over Le in view of Cheng (i.e., Petition Ground 2).

B. Substitute Claim 29 Is Patentable Over De Bruyn in View of Le and Cheng (Petition Grounds 3 and 4)

The Board found that Examples 4 and 5 of De Bruyn disclose dehydrating 1-hexanol and 1-octanol, respectively, to provide corresponding 1-alkenes having 97% regioselectivity. *See* Paper 7 at 15. However, De Bruyn, like Le, is wholly silent as to whether any catalyst used for the dehydration process (*see* Ex. 1008 at [0037], [0053], [0081]) was chemically modified or calcined. *See* Ex. 2001, ¶ 44, ¶ 56; Ex. 2005, p. 79, l. 9 – p. 80, l. 6. De Bruyn also teaches that the purity of the alcohol starting material largely controls the purity of the resulting alpha-olefin. *See id.* at [0033]; Ex. 2001, ¶ 17, ¶ 44. A POSITA reading De Bruyn, optionally in view of Le would understand that a commercially available γ -alumina catalyst

could be used to dehydrate a C₆ to C₈ alcohol to provide a 1-alkene regioselectivity of 96-97% at a conversion of about 60% to 77%. (See Ex. 1008, ¶ [0067]-¶ [0068], Table 10, ¶ [0080]-¶ [0083], Figure 2, Table 14; Ex. 2001, ¶ 42-¶ 43, ¶ 45-¶ 47.) And a POSITA reviewing De Bruyn, optionally in view of Le would have been motivated to use the commercially available γ -alumina catalysts disclosed in De Bruyn and/or Le as a starting point for further investigation. Ex. 2001, ¶ 43.

As noted above, the specification of the '048 patent discloses that base-treatment of an alumina catalyst, followed by calcination were important to improve both yield and regioselectivity. See Ex. 1005 at 14-15, [0034], [0042], 24-25 at [0076]-[0077]; Ex. 2001, ¶ 21-¶ 22. Nothing in *De Bruyn* in view of *Le* would provide a POSITA any reasonable expectation that a base-treated and calcined γ -alumina catalyst could be used to dehydrate a C₆ to C₁₄ bio-1-alcohol, wherein the resulting bio-alkene is produced in a conversion of at least 95%, and has a bio-1-alkene regioselectivity of 92% to about 99%. See Ex. 2001, ¶ 55-¶ 56. Thus, the requirement in substitute claim 29 that the claimed method utilize “a base-treated and calcined γ -alumina catalyst” (i.e., element 29a, *supra*) renders the substitute claims non-obvious over De Bruyn in view of Le (i.e., Petition Ground 3). See *id.*

As noted above, Cheng is relied upon by Petitioners for its teaching that a 1-alkene (i.e., 1-hexene) can be converted to 1,2-epoxyhexane, which is then

converted to 1,2-hexanediol. *See* Paper 7 at 17. Cheng does not teach or suggest the use of any specific catalysts to prepare bio-1-alkenes with high conversion and bio-1-alkene regioselectivity. *See* Ex. 2001, ¶ 57, Ex. 2005, p. 122, l. 9 – p. 123, l. 12. Thus, Cheng lacks any teaching or suggestion that, in combination with Le and De Bruyn, would render substitute claim 29 and its dependent claims obvious. Ex. 2001, ¶ 57, ¶ 63. For at least this reason, substitute claim 29 is non-obvious over De Bruyn in view of Le and Cheng (i.e., Petition Ground 4).

C. Substitute Claim 29 Is Patentable Over Wright in View of Cheng (Petition Grounds 5 and 6)

The Board found that Wright discloses dehydrating 1-butanol, 1-pentanol, and 1-hexanol to provide corresponding 1-alkenes. Paper 7 at 21-22. Wright teaches that the preferred catalyst used for this conversion is an “alumina-based catalyst that has been treated with an aqueous base solution, washed with water, dried, reacted with at least one chlorosilane in the amount of 0.1-20 wt-%, washed with a hydrocarbon solvent, and air dried.” *See* Ex. 1009, [0020], [0034], Table 1; Ex. 2001, ¶ 50, ¶ 58.

Wright also teaches that “[p]ossible alternatives would be silica and alumina solid phase catalysts as well as standard mineral acid catalysts. These all give complicated mixtures of products.” *Id.* at [0025]. Further, Wright teaches that “[c]urrent methods for dehydrating alcohol leads to a variety of regiosiomers [sic]”

and that the dehydration of 1-butanol using a “typical solid phase catalyst” such as γ -alumina provides “a mixture of 1-butene (~70%) and 2-butene (~30%).” *Id.* at [0027]. Thus, Wright teaches that silanized catalysts can improve the regioselectivity for the dehydration of 1-alkanols (and preferably 1-butanol) to 1-alkenes. Ex. 2001, ¶ 50.

Wright’s exemplary embodiment discloses that bio-1-butene was produced with a conversion of 96% to 98% and a 1-butene regioselectivity of 94% to 95%, which remained steady for a period of 123 days time on stream. Ex. 1009, ¶ [0034], Table 1; Ex. 2001, ¶ 50, ¶ 58. Notably, Wright discloses a significantly higher yield of biobutenes (96-98%) compared the yield of octenes disclosed by De Bruyn (about 20-40%). *Compare* Ex. 1009, Table 1 *with* Ex. 1008, Figure 2; *see* Ex. 2001, ¶ 50; Ex. 2005, p. 119, l. 4 – p. 120, l. 14. A POSITA reviewing Wright would reasonably expect that the same catalyst could be used for the dehydration of C₅ to C₂₃ 1-alkanols, and would have been motivated to do so. *See* Ex. 1009, ¶ [0017], ¶ [0022]; Ex. 2001, ¶ 48, ¶ 56, ¶ 57; Ex. 2005, p. 120, l. 15 – p. 121, l. 19. Based on the high 1-alkene regioselectivity, constant high-alcohol conversion, high alkene yield, and ability to maintain catalytic activity for an extended period of time on stream, a POSITA would view Wright as the closest prior art to the substitute claims. *See* Ex. 2001, ¶ 51, ¶ 58.

The specification of the ’048 patent distinguishes the silanized catalysts

taught by Wright as providing lower regioselectivity for the conversion of 1-octanol to 1-octene. *See* Ex. 1005 at [0027], [0132]. Experiments reported in the '048 patent as Example 10 were conducted in which 1-octanol was dehydrated using a γ -alumina catalyst that was first treated with a base, dried, silanized, and then calcined at 400 °C. *See* Ex. 1001 at p. 23, col. 28, ll. 51-67; Ex. 1004 at pp. 62-63 of 617; Ex. 1005 at pp. 42-43 of 236. The results of these experiments are provided in Ex. 2004, and show that the claimed combination of 1-alkene regioselectivity and alcohol conversion to alkenes could not be achieved with a γ -alumina catalyst that was first treated with a base, dried, silanized, and then calcined at 400 °C. *See* Ex. 2004; Ex. 2001, ¶ 59. Referring to Ex. 2004, a series of 16 experiments were conducted in which the catalyst remained the same, while the pump rate (mL/min) was varied. *See id.* The data show that, under certain conditions, the base-treated and silanized γ -alumina catalyst of Wright could provide a bio-1-octene regioselectivity of 92% or higher, but with a conversion of at most 89%. *See* Ex. 2004, Run 4; Ex. 2001, ¶ 59. Modification of the reactor conditions improved the octene conversion to at least 95%, but with a loss in bio-1-octene regioselectivity to between 61% and 85%. *See* Ex. 2004, Runs 1-3; Ex. 2001, ¶ 59. Patent Owner submits that a POSITA would view these results as unexpected, as a POSITA would have expected that a promoted and silanized γ -alumina catalyst would retain the high regioselectivity and conversion for 1-

butanol disclosed by Wright for the dehydration of longer alcohols, such as 1-octanol. with which the base-treated and silanized γ -alumina catalyst of Wright dehydrated 1-butanol. Ex. 2001, ¶ 59. Indeed, a POSITA would have reasonably expected in view of Wright and the prior art as a whole that a silanized γ -alumina catalyst would be required in order to obtain high conversion and high 1-alkene regioselectivity. Ex. 2001, ¶ 59. Reflective of this unexpected finding, the limitation “wherein the catalyst has not been silanized” (element 29b) has been added to substitute claim 29, which distinguishes it (and dependent claims 30-44) from Wright. Ex. 2001, ¶ 60.

Further, substitute claim 29 requires a “base-treated and calcined γ -alumina catalyst,” which *Wright* also does not teach or suggest. Ex. 2001, ¶ 57. Because Wright is silent as to whether base-treatment and calcination can improve regioselectivity and yield for the dehydration of C₆ to C₁₄ alcohols, a POSITA reviewing Wright would not have been motivated to use the claimed catalysts with any reasonable expectation of success. Ex. 2001, ¶ 60-¶ 61. Indeed, as Petitioners’ expert admitted numerous times, the only way a POSITA would understand if a particular catalyst would provide improved conversion, 1-alkene regioselectivity, and/or yield would be to test it experimentally. See Ex. 2005, p. 44, l. 18 – p. 45, l. 11; p. 54, l. 13 – p. 55, l. 7; p. 71, ll. 2-14; p. 91, l. 22 – p. 92, l. 21; p. 103, l. 10 – p. 104, l. 1. And the fact that a base-treated and silanized γ -alumina catalyst similar

to that disclosed by Wright does not provide the claimed bio-1-alkene regioselectivity or conversion for longer-chain 1-alcohols is unexpected. Ex. 2001, ¶ 59. Therefore, the specific γ -alumina catalyst required by substitute claim 29 would not have been obvious to a POSITA based on *Wright*'s disclosure. For at least these reasons, substitute claim 29 is non-obvious over Wright (i.e., Petition Ground 5).

As noted above, Cheng is relied upon by Petitioners for its teaching that a 1-alkene (i.e., 1-hexene) can be converted to 1,2-epoxyhexane, which is then converted to 1,2-hexanediol. See Paper 7 at 17. Cheng does not teach or suggest the use of any specific catalysts to prepare bio-1-alkenes with high conversion and bio-1-alkene regioselectivity. See Ex. 2001, ¶ 62, Ex. 2005, p. 122, l. 9 – p. 123, l. 12. Thus, Cheng lacks any teaching or suggestion that, in combination with Wright, would render substitute claim 29 and its dependent claims obvious. Ex. 2001, ¶ 62, ¶ 63. For at least this reason, substitute claim 29 is non-obvious over Wright in view of Cheng (i.e., Petition Ground 6).

D. Substitute Claims 30-44 Are Patentable Over The Prior Art

Substitute claims 30-44 depend directly or indirectly from independent substitute claim 29, and incorporate all of its limitations. 35 U.S.C. § 112(d). Thus, for the same reasons discussed above with respect to substitute claim 29, dependent claims 30-44 are also non-obvious and patentable over the prior art.

Ex. 2001, ¶ 63.

Further, substitute claims 34, 37, 40, and 43 depend indirectly from claim 29 and require that “prior to the dehydrating, the catalyst has been calcined at a temperature of about 400 °C to about 480 °C.” As discussed above, a POSITA would not know whether the commercial γ -alumina taught by *Le* and *De Bruyn* were chemically modified and/or calcined. Ex. 2001, ¶ 40-¶ 41, ¶ 44, ¶ 55-¶ 56; ¶ 64; Ex. 2005, p. 79, l. 4 – p. 80, l. 11, p. 98, l. 12 – p. 99, l. 20, p. 101, ll. 6-20. And *Le* and *De Bruyn* are wholly silent as to whether calcination of a γ -alumina catalyst (let alone a base-treated γ -alumina catalyst) can be used to improve 1-alkene regioselectivity. Ex. 2001, ¶ 46, ¶ 56, ¶ 64. *Wright* similarly does not disclose or suggest base-treatment of a γ -alumina catalyst followed by calcination. See Ex. 2001, ¶ 60, ¶ 61, ¶ 64.

As set forth in the '048 patent specification, base-treatment followed by calcination at a temperature of about 400 °C to about 480 °C, provides a bio-1-alkene regioselectivity of 97% and conversion of 97%, whereas calcination at a temperature of 500 °C reduced bio-1-alkene regioselectivity to 93% at a conversion of 95.5%. See Ex. 1004 at p. 44 of 617, [0076], Table 1; Ex. 1005 at p. 24 of 236, [0076], Table 1; Ex. 2001, ¶ 21-¶ 22, ¶ 65. A POSITA would find the fact that a calcining ceiling temperature afforded an optimum catalyst to be unexpected. Ex. 2001, ¶ 21-¶ 22, ¶ 65. Further, nothing in *Le*, *De Bruyn*, *Wright* or

the background knowledge in the art teaches or suggests that base treatment and calcination at a temperature of about 400 °C to about 480 °C can improve 1-alkene regioselectivity. Ex. 2001, ¶ 66. For this additional reason, claims 34, 37, 40, and 43 are non-obvious over the prior art of record in this proceeding, including *Le*, *De Bruyn*, *Wright*, or any combination thereof.

VI. THE LEVEL OF ORDINARY SKILL IN THE ART

The Board set forth a definition of a POSITA (see Paper 7 at 6-7) that Inolex accepts for the purposes of this proceeding.

Inolex notes that Dr. Taber testified that a POSITA would “have experience in industrial chemistry or industrial processes,” and “probably” also have experience working at a chemical company. See Ex. 2005, p. 22, ll. 4-13. Inolex’s expert, Dr. Wright, has experience working in the chemical industry, and qualifies as a POSITA under either the Board’s definition or Dr. Taber’s revised definition.

VII. CLAIM CONSTRUCTION

In its institution decision, the Board construed the term “about” (as this term appeared in original claims 1-4 of the ’048 patent) as being a term of degree that allowed for the recited number of carbon atoms, plus or minus one carbon atom. See Paper 7 at 9-10. Based on the Board’s construction, “about 5” and “about 6”, as these terms appear in original claims 1-4 of the ’048 patent, encompass carbon chain lengths of at least 4 and 5 carbon atoms, respectively. See *id.* at 9. And,

“about 20,” “about 14,” “about 10,” and “about 8,” as these terms appear in original claims 1-4 of the '048 patent, encompass carbon chain lengths of at least 21, 15, 11, and 9 carbon atoms, respectively. *See id.*

In order to remove any ambiguity from the substitute claims, Inolex has deleted the term “about” from substitute claims 29-32, as it pertains to the length of the carbon chains recited by these claims.

Inolex submits that none of the limitations added to the proposed substitute claims require construction and should instead be construed in accordance with their ordinary meaning. *See Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) (*en banc*); *see also* Ex. 2001 at ¶ 36.

VIII. CONCLUSION

For each original claim the Board finds unpatentable, Inolex respectfully requests that the Board grant this motion to amend as to the substitute claims.

Date: February 8, 2024

Respectfully submitted,

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APPENDIX A

Claim Amendments

1.-6. (Cancelled)

8.-10. (Cancelled)

22.-28. (Cancelled)

29. (Proposed Substitute for Claim 1) A method for making a bio-alkene, comprising:

dehydrating a bio-1-alcohol by heating the bio-1-alcohol in a reactor with a base-treated and calcined γ -alumina catalyst, wherein the catalyst has not been silanized, and

wherein the resulting bio-alkene has a carbon chain of 6 to 14 ~~about 5 to about 20~~ carbon atoms and is produced in a conversion of at least 95%, and has a bio-1-alkene regioselectivity of 92% to about 99% ~~at least about 80%.~~

30. (Proposed Substitute for Claim 2) The method of claim ~~1~~29, wherein the bio-alkene has a carbon chain of ~~about 6 to 14~~ 6 to 10 carbon atoms.

31. (Proposed Substitute for Claim 3) The method according to claim ~~2~~29, wherein the bio-alkene has a carbon chain ~~length of about 6 to 8~~ length of about 6 to 10 carbon atoms.

32. (Proposed Substitute for Claim 4) The method according to claim ~~3~~29, wherein the bio-alkene is bio-octene ~~has a carbon chain length of about 6 to about 8 carbon atoms.~~

33. (Proposed Substitute for Claim 5) The method according to claim ~~4~~29, wherein the reactor is heated at about 240 °C to about 360 °C ~~bio-alkene is bio-octene.~~

34. (Proposed Substitute for Claim 6) The method according to claim ~~5~~33, wherein prior to the dehydrating, the catalyst has been calcined at a temperature of about 400 °C to about 480 °C ~~reactor is a fixed bed reactor.~~

35. (Proposed Substitute for Claim 8) The method according to claim ~~7~~34,

wherein the bio-alkene has a bio-1-alkene regioselectivity of 95% to about 99%~~catalyst is selected from ZnAl_2O_4 and a γ -alumina catalyst.~~

36. (Proposed Substitute for Claim 9) The method according to claim ~~1~~30, wherein the reactor is heated at about 240 °C to about 360 °C~~bio-alkene has a bio-1-alkene regioselectivity of about 92% to about 99%.~~
37. (Proposed Substitute for Claim 10) The method according to claim ~~9~~36, wherein prior to the dehydrating, the catalyst has been calcined at a temperature of about 400 °C to about 480 °C~~bio-alkene has a bio-1-alkene regioselectivity of about 95% to about 99%.~~
38. (Proposed Substitute for Claim 22) The method according to claim ~~13~~37, wherein the bio-alkene has a bio-1-alkene regioselectivity of 95% to about 99%~~method comprises a distillation step to refine the bio-alkene.~~
39. (Proposed Substitute for Claim 23) The method according to claim ~~13~~31, wherein the reactor is heated at about 240 °C to about 360 °C~~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 purge gas.~~
40. (Proposed Substitute for Claim 24) The method according to claim ~~39~~41, wherein prior to the dehydrating, the catalyst has been calcined at a temperature of about 400 °C to about 480 °C ~~bio-alkene is further reacted to form a bio-based compound different from the bio-alkene or a bio-based polymer.~~
41. (Proposed Substitute for Claim 25) The method according to claim ~~24~~40, wherein the bio-alkene has a bio-1-alkene regioselectivity of 95% to about 99% ~~is further reacted by a free radical or a catalytic polymerization process to form a bio-based polymer.~~
42. (Proposed Substitute for Claim 26) ~~A bio-alkene made by the~~ The method of according to claim ~~13~~32, wherein the reactor is heated at about 240 °C to about 360 °C.
43. (Proposed Substitute for Claim 27) The method ~~bio-alkene~~ according to claim ~~26~~42, wherein prior to the dehydrating, the catalyst has been calcined at a temperature of about 400 °C to about 480 °C~~bio-alkene is selected from straight or branched chain bio-alkenes.~~

44. (Proposed Substitute for Claim 28) The method ~~bio-alkene~~ according to claim 2643, wherein the ~~resulting~~ bio-alkene has a bio-1-alkene regioselectivity of 95% to about 99% ~~is selected from bio-1-pentene, bio-1-iso-pentene, bio-1-hexene, bio-1-heptene, bio-1-octene, bio-1-nonene, bio-1-decene, and bio-1-dodecene.~~

CERTIFICATE OF COMPLIANCE

The undersigned certifies that this brief complies with the type-volume limitations of 37 C.F.R. § 42.24. This brief is 25 pages or less, and contains 5,529 words as calculated by the “Word Count” feature of Microsoft Word for Office 365, the word processing program used to create it.

Date: February 8, 2024

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CERTIFICATE OF SERVICE

I hereby certify that on February 8, 2024, a true and correct copy of the foregoing PATENT OWNER'S NON-CONTINGENT MOTION TO AMEND AND REQUEST FOR PRELIMINARY GUIDANCE was served on counsel of record for Petitioners by filing this document through the P-TACTS System as well as delivering a copy via electronic mail to the following addresses:

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