IN THE UNITED STATES DISTRICT COURT

FOR THE DISTRICT OF DELAWARE

GEVO, INC.,	)	
	)	
Plaintiff,	)	
	)	
v.	)	Civ. No. 13-576-SLR
	)	
BUTAMAX™ ADVANCED BIOFUELS LLC and E.I. DUPONT DE NEMOURS AND COMPANY,	)	
	)	
Defendants.	)	

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MEMORANDUM OPINION

Dated: July 30, 2013
Wilmington, Delaware

ROBINSON, District Judge

I. INTRODUCTION

On January 14, 2011, plaintiff Butamax™ Advanced Biofuels LLC ("Butamax") filed suit against defendant Gevo, Inc. ("Gevo") alleging infringement of U.S. Patent No. 7,851,188, amended on August 11, 2011, to include U.S. Patent No. 7,993,889.[1] (11-54 D.I. 1; 11-54 D.I. 41) Gevo answered the amended complaint on September 13, 2011 and counterclaimed against Butamax and E.I. DuPont De Nemours and Company ("DuPont") alleging infringement of U.S. Patent Nos. 8,017,375 ("the '375 patent") and 8,017,376 ("the '376 patent") (collectively, "the patents-in-suit"), related to the production of isobutanol from recombinant microorganisms. (D.I. 4) Butamax and DuPont answered the counterclaims on November 18, 2011 and counter-counterclaimed against Gevo seeking a declaratory judgment of non-infringement and invalidity of the '375 patent and the '376 patent. (D.I. 5) On December 9, 2011, Gevo answered the counter-counterclaims. (D.I. 6) On February 24, 2012, Butamax and DuPont filed a motion to sever Gevo's counterclaims, which was granted. (11-54 D.I. 213, 11-54 D.I. 371) On June 21, 2012, upon the grant of its timely motion to amend, Butamax and DuPont amended its answer to the counterclaims and the counter-counterclaims adding affirmative defenses and counter-counterclaims of inequitable conduct. (D.I. 7) Gevo's untimely motion, filed June 29, 2012, seeking to amend its answer and counterclaims to include an affirmative defense and counterclaim of inequitable conduct was denied. (11-54 D.I. 388; 11-54 D.I. 693)

[1]All D.I. #s relating to the original Civ. No. 11-54-SLR are indicated by (11-54 D.I. #). All other D.I. #'s relate to the severed action, Civ. No. 13-576.

On April 10, 2013, at the request of the parties, all claims and defenses relating to the '375 and '376 patents were severed into the above captioned action. (D.I. 1) Presently before the court are several motions for summary judgment: Gevo's summary judgment motion of validity of the '376 patent (D.I. 19), as well as Butamax's motions for summary judgment of invalidity and non-infringement of the '375 and '376 patents. (D.I. 15; D.I. 17) Butamax and DuPont also filed a motion to exclude testimony by Gevo's expert.[2] (D.I. 21) The court has jurisdiction pursuant to 28 U.S.C. §§ 1331 and 1338(a).

II. BACKGROUND

A. The Parties

Gevo is a corporation organized and existing under the laws of the State of Delaware, with its principal place of business in Englewood, Colorado. (D.I. 5 at 9 ¶ 3) Butamax is a limited liability corporation organized and existing under the laws of the State of Delaware, with its principal place of business in Wilmington, Delaware. (D.I. 5 at 9 ¶ 1) DuPont is a corporation organized and existing under the laws of the State of Delaware, with its principal place of business in Wilmington, Delaware. (D.I. 5 at 9 ¶ 2) Both Gevo and Butamax develop biological methods of producing isobutanol from recombinant microorganisms. (D.I. 5 at 10 ¶ 9)

B. Technology

Motivated by economics, politics and environmental reasons, biomass-derived biofuels have been researched as a substitution for petroleum-derived fuels. ('375

[2]The court herein addresses this motion as it relates to the '376 patent.

patent, 1:32-37) Ethanol is the most produced fermented fuel. However, butanol is more advantageous as it may be mixed into gasoline and also used as a pure fuel in combustion engines. (*Id.* at 1:50-60) Isobutanol has the additional advantage of having a higher octane number. (*Id.* at 1:64-66)

Yeast cells have the ability to naturally produce isobutanol via a five-step pathway beginning with pyruvate and ending with isobutanol. (*See, e.g.*, D.I. 11 at 3) The five-step pathway consists of the following five chemical conversions: (1) pyruvate to acetolactate; (2) acetolactate to 2,3-dihydroxyisovalerate; (3) 2,3-dihydroxyisovalerate to -ketoisovalerate; (4) -ketoisovalerate to isobutyraldehyde; and (5) isobutyraldehyde to isobutanol. (11-54 D.I. 41 at ¶ 12; '375 patent, fig. 1) The patents-in-suit relate to improvements to the efficiency and performance of the five-step pathway via genetic modifications, which boost the production of isobutanol.

C. The Patents

The '375 patent, entitled "Yeast Organism Producing Isobutanol at a High Yield," was filed on December 23, 2008 and issued on September 13, 2011. It claims priority to provisional application No. 61/016,483, filed on December 23, 2007. The claims are directed to a method of producing isobutanol using a recombinant microorganism, achieving theoretical yields of greater than about 10%. Yeast also naturally convert pyruvate to ethanol, via a reaction catalyzed by pyruvate decarboxylase (PDC). ('375 patent, fig. 2) The invention also includes the reduction of PDC activity through the disruption, mutation or deletion of one or more PDC genes, reducing the production of ethanol and allowing the production of isobutanol to increase. ('375 patent, 2:10-48)

Independent claim 1 of the '375 patent, reproduced below, describes a method for producing isobutanol using a recombinant yeast microorganism:

> A recombinant yeast microorganism for producing isobutanol, the recombinant yeast microorganism comprising an isobutanol producing metabolic pathway, wherein said isobutanol producing metabolic pathway comprises the following substrate to product conversions:
>
> (i) pyruvate to acetolactate;
>
> (ii) acetolactate to 2,3-dihydroxyisovalerate;
>
> (iii) 2,3-dihydroxyisovalerate to α-ketoisovalerate·
>
> (iv) α-ketoisovalerate to isobutyraldehyde; and
>
> (v) isobutyraldehyde to isobutanol;
>
> wherein said recombinant yeast microorganism expresses:
>
> (a) an acetolactate synthase to catalyze the conversion of pyruvate to acetolactate;
>
> (b) a ketol-acid reductoisomerase to catalyze the conversion of acetolactate to 2,3-dihydroxyisovalerate;
>
> (c) a dihydroxy acid dehydratase to catalyze the conversion of 2,3-dihydroxyisovalerate to α-ketoisovalerate·
>
> (d) an α-ketoisovalerate decarboxylase from *Lactococcus lactis* to catalyze the conversion of α-ketoisovalerate to isobutyraldehyde; and
>
> (e) an alcohol dehydrogenase to catalyze the conversion of isobutyraldehyde to isobutanol;
>
> wherein the recombinant yeast microorganism has been engineered to disrupt, mutate, or delete one or more endogenous pyruvate decarboxylase (PDC) genes, wherein said recombinant yeast microorganism has reduced endogenous PDC activity as compared to the corresponding yeast microorganism that has not been engineered to have reduce endogenous PDC activity, and wherein said recombinant yeast microorganism produces:
>
> (A) isobutanol at a yield which is at least 10% of the theoretical yield of isobutanol from glucose; and/or
>
> (B) ethanol at a yield which is 1.8% or less of the theoretical yield of ethanol from glucose.

('375 patent, 223:36-224:38)

The '376 patent, entitled "Methods of Increasing Dihydroxy Acid Dehydratase Activity to Improve Production of Fuels, Chemicals, and Amino Acids," was filed on

November 24, 2010 and issued on September 13, 2011. The third step in the five-step pathway converts 2,3-dihydroxyisovalerate to α-ketoisovalerate, catalyzed by dihydroxy acid dehydratase (DHAD). The '376 patent discloses an improvement in the performance of this third pathway enzyme, DHAD, by increasing its activity as DHAD tends to be a rate-limiting component of the pathway. ('376 patent, 15:37-46) The increase in DHAD activity then contributes to increased production of isobutanol. (*Id.*, 15:39-46) The patent also discloses an increase in DHAD activity achieved by: increasing the availability of (1) the DHAD enzyme and (2) activator of ferrous transport (Aft) proteins.[3] (*Id.*, 2:7-22) The inventors theorize that DHAD activity is generally limited by the availability of cellular iron and the increased Aft availability increases the intake of iron, resulting in an increase in DHAD activity. (Id., 16:37-41, 20:60-62, 21:1-5)

Independent claim 1 of the '376 patent, reproduced below, describes a particular recombinant yeast organism, which encodes for and seeks to increase the DHAD:

> A recombinant yeast microorganism comprising a recombinantly overexpressed polynucleotide encoding a dihydroxy acid dehydratase (DHAD), and recombinantly overexpressed one or more polynucleotides encoding one or more activator of ferrous transport (Aft) proteins which increase the dehydratase activity of DHAD.

(*Id.*, 89:55-60)

III. CLAIM CONSTRUCTION

A. Legal Principles

Claim construction is a matter of law. *Phillips v. AWH Corp.*, 415 F.3d 1303,

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[3]"Aft" refers to the protein, "AFT" refers to the gene.

1330 (Fed. Cir. 2005) (en banc). Claim construction focuses on intrinsic evidence - the claims, specification and prosecution history - because intrinsic evidence is "the most significant source of the legally operative meaning of disputed claim language." *Vitronics Corp. v. Conceptronic, Inc.*, 90 F.3d 1576, 1582 (Fed. Cir. 1996); *Markman v. Westview Instruments, Inc.*, 52 F.3d 967, 979 (Fed. Cir. 1995) (en banc), *aff'd*, 517 U.S. 370 (1996). Claims must be interpreted from the perspective of one of ordinary skill in the relevant art at the time of the invention. *Phillips*, 415 F.3d at 1313.

Claim construction starts with the claims, *id.* at 1312, and remains centered on the words of the claims throughout. *Interactive Gift Express, Inc. v. Compuserve, Inc.*, 256 F.3d 1323, 1331 (Fed. Cir. 2001). In the absence of an express intent to impart different meaning to claim terms, the terms are presumed to have their ordinary meaning. *Id.* Claims, however, must be read in view of the specification and prosecution history. Indeed, the specification is often "the single best guide to the meaning of a disputed term." *Phillips*, 415 F.3d at 1315.

B. Limitations of the '375 Patent

1. "[A] ketol-acid reductoisomerase"

The court construes this term to mean "a naturally-occurring or engineered enzyme that catalyzes the reaction of acetolactate (AL) to dihydroxyisovalerate (DHIV)." The court understands that the parties have agreed that the ketol-acid reductoisomerase ("KARI") described in the patents-in-suit may use either NADH or NADPH as a cofactor. As KARI catalyzed reactions necessarily require cofactors, the court concludes that the claim construction does not necessitate the recitation of the

cofactors. (D.I. 11 at 15; D.I. 29 at 15) The court declines to introduce ambiguity into the claim by adopting Butamax's limitation to "structurally similar to known" KARIs.

2. "[A]n α-ketoisovalerate decarboxylase from *Lactococcus lactis*"

The court adopts Gevo's construction, "an enzyme that has the amino acid sequence of an α-ketoisovalerate decarboxylase found in *Lactococcus lactis*." While Butamax argues that the construction should be limited to those α-ketoisovalerate decarboxylases ("KIVD") "known at the time of filing" and that Gevo is impermissibly broadening the claim term, Butamax's reliance on *Schering Corp. v. Amgen Inc.*, 222 F.3d 1347, 1352 (Fed. Cir. 2000) for these arguments is misplaced. In *Schering*, the inventor expressly included a claim limitation of "IFN-α," which encompassed only the single protein described by the patent application. *Schering*, 222 F.3d at 1353. At the time of litigation, however, scientists further understood the term to refer to several families of proteins. *Id.* at 1353-54. The Federal Circuit held that the use of the term in the patent "did not and could not enlarge the scope of the patent to embrace technology arising after its filing." *Id.* at 1353. In contrast, Gevo has not placed any limitations on the meaning of the term KIVD, instead using the term as it was known in the art at the time of filing. The court's construction properly limits the term to KIVDs from *Lactococcus lactis* ("*L. Lactis*").

3. "[W]herein said recombinant yeast microorganism has reduced endogenous PDC activity as compared to the corresponding yeast microorganism that has not been engineered to have reduced endogenous PDC activity"

Although Butamax raises the issue that the claim "requires comparing the recombinant yeast whose PDC activity was altered against 'the corresponding' (a/k/a control) yeast, which is the same organism, without altered PDC activity," neither party addresses this issue in a way that would be helpful to a jury. (D.I. 29 at 19; D.I. 11 at 12; D.I. 13 at 7) Resolving this issue, the court construes the term to mean "wherein said recombinant yeast microorganism has less endogenous PDC activity than the same yeast microorganism that does not have a disruption, mutation or deletion of a PDC gene." This construction finds support in the claim as the previous clause reads "wherein the recombinant yeast microorganism has been engineered to disrupt, mutate, or delete one or more endogenous pyruvate decarboxylase (PDC) genes." ('375 patent, 223:59-61) The specification also supports the construction, namely, the "recombinant microorganism [is] engineered to include reduced pyruvate decarboxylase (PDC) activity as compared to [the] parental microorganism," where the recombinant microorganism includes "a mutation… a partial deletion…a complete deletion…[or] a modification of…at least one [PDC] gene resulting in a reduction of [PDC] activity." ('375 patent, 2:23-48)

4. "[I]s further engineered or selected to grow on glucose independently of C2-compounds at a growth rate substantially equivalent to the growth rate of the corresponding yeast microorganism that has not been engineered to have reduced endogenous PDC activity"

Similarly to the previous term, the court construes this term to mean "[i]s further engineered or selected to grow on glucose independently of C2-compounds at a growth

rate substantially equivalent to the growth rate of the same yeast microorganism that does not have a disruption, mutation or deletion of a PDC gene."

C. Limitations of the '376 Patent

1. "[A] ketol-acid reductoisomerase"

The parties agree that this term should have the same meaning for both patents-in-suit. As explained above, the court construes this term to mean "a naturally-occurring or engineered enzyme that catalyzes the reaction of acetolactate (AL) to dihydroxyisovalerate (DHIV)."

2. "[A] recombinantly overexpressed polynucleotide encoding a dihydroxy acid dehydratase (DHAD)"

The court adopts the parties' construction "the claimed yeast has been genetically modified to include a DNA or RNA that causes an elevated level (e.g., aberrant level) of mRNAs encoding for a DHAD protein, and/or an elevated level of DHAD protein in cells as compared to similar corresponding unmodified cells expressing basal levels of mRNAs encoding a DHAD protein or having basal levels of DHAD protein." (D.I. 11 at 13 n.4; D.I. 29 at 21 n.25)

3. "[R]ecombinantly overexpressed one or more polynucleotides encoding one or more activator of ferrous transport (Aft) proteins"

The court adopts the parties' proposed construction "the claimed yeast has been genetically modified to include a DNA or RNA that causes an elevated level (e.g., aberrant level) of mRNAs encoding for an Aft protein, and/or an elevated level of Aft protein in cells as compared to similar corresponding unmodified cells expressing basal

levels of mRNAs encoding an Aft protein or having basal levels of Aft protein." (D.I. 11 at 13 n.4; D.I. 29 at 21 n.25)

4. "[A]ctivator of ferrous transport (Aft) proteins"

The court construes this term to mean "protein transcription factors that regulate the genes associated with iron transport (known as iron regulon genes)."[4] This construction is consistent with the scientific literature cited by the parties and with Gevo's expert, Dr. Winge, describing the Aft1 protein as "involved in the regulation of iron uptake and transport" and "activating transcription of these genes."[5] (11-54 D.I. 646 at ¶ 61)

5. "[W]hich increase the dehydratase activity of DHAD"

The specification refers to increased DHAD activity and does not necessarily limit the increase to activity of recombinantly overexpressed DHAD. ('376 patent, 15:35-46) Therefore, the court adopts Gevo's construction "causing the enzymatic activity of the DHAD to be increased."

6. "[W]herein said ketol-acid reductoisomerase is an

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[4]Butamax argues that the claim should be limited to "a protein transcription factor disclosed in the '376 patent specification (but not an undisclosed homolog thereof)," citing to the examiner's amendment deleting "or homologs thereof" from the claims. (D.I. 29 at 24; 11-54 D.I. 517 at GJA4395) There is no explanation in the prosecution history for the deletion. (11-54 D.I. 517 at GJA4398-99) The specification is replete with references to homologs of the Aft protein. (*See e.g.*, '376 patent, 2:9-64, 3:1-65) As Butamax's construction would add ambiguity to the claim, the court declines to add such a limitation.

[5]*See*, Yuko Yamaguchi-Iwai et al., *AFT1: a mediator of iron regulated transcriptional control in* Saccharomyces cervisiae, 14 The EMBO Journal 1231, 1231 (1995) (describing the protein as a mediator and regulator); Julian C. Rutherford et al., *A second iron-regulatory system in yeast independent of Aft1p*, 98 Proc. Natl. Acad. Sci. USA 98, 14322, 14322 (2001) (describing the protein as regulating and activating).

NADH-dependant ketol-acid reductoisomerase"

Consistent with the specification language of "utiliz[ing] NADH (rather than NADPH) as a co-factor" and the application language "preferentially us[ing] NADH as the redox cofactor," the court construes this term to mean "the KARI enzyme which preferentially uses NADH as a cofactor." ('376 patent, 52:33-45; 11-54 D.I. 518 at GJA4746-47)

7. [A] constitutively active Aft protein

The parties agree that "constitutively active" means "irrespective of iron concentrations." (D.I. 11 at 19-20; D.I. 29 at 23-24) The specification describes a constitutive promoter which controls the protein, negating Butamax's argument that the protein must necessarily be altered. ('376 patent, 19:34-37, 20:12-15, 24:1-30) Therefore, the court construes this term to mean "an Aft protein that activates expression of the iron regulon genes, irrespective of iron concentrations."

IV. STANDARD OF REVIEW

"The court shall grant summary judgment if the movant shows that there is no genuine dispute as to any material fact and the movant is entitled to judgment as a matter of law." Fed. R. Civ. P. 56(a). The moving party bears the burden of demonstrating the absence of a genuine issue of material fact. *Matsushita Elec. Indus. Co. v. Zenith Radio Corp.*, 415 U.S. 574, 586 n.10 (1986). A party asserting that a fact cannot be—or, alternatively, is—genuinely disputed must support the assertion either by citing to "particular parts of materials in the record, including depositions, documents, electronically stored information, affidavits or declarations, stipulations (including those

made for the purposes of the motions only), admissions, interrogatory answers, or other materials," or by "showing that the materials cited do not establish the absence or presence of a genuine dispute, or that an adverse party cannot produce admissible evidence to support the fact." Fed. R. Civ. P. 56(c)(1)(A) & (B). If the moving party has carried its burden, the nonmovant must then "come forward with specific facts showing that there is a genuine issue for trial." *Matsushita*, 415 U.S. at 587 (internal quotation marks omitted). The court will "draw all reasonable inferences in favor of the nonmoving party, and it may not make credibility determinations or weigh the evidence." *Reeves v. Sanderson Plumbing Prods., Inc.*, 530 U.S. 133, 150 (2000).

To defeat a motion for summary judgment, the non-moving party must "do more than simply show that there is some metaphysical doubt as to the material facts." *Matsushita*, 475 U.S. at 586-87; *see also Podohnik v. U.S. Postal Service*, 409 F.3d 584, 594 (3d Cir. 2005) (stating party opposing summary judgment "must present more than just bare assertions, conclusory allegations or suspicions to show the existence of a genuine issue") (internal quotation marks omitted). Although the "mere existence of some alleged factual dispute between the parties will not defeat an otherwise properly supported motion for summary judgment," a factual dispute is genuine where "the evidence is such that a reasonable jury could return a verdict for the nonmoving party." *Anderson v. Liberty Lobby, Inc.*, 411 U.S. 242, 247-48 (1986). "If the evidence is merely colorable, or is not significantly probative, summary judgment may be granted." *Id.* at 249-50 (internal citations omitted); *see also Celotex Corp. v. Catrett*, 411 U.S. 317, 322 (1986) (stating entry of summary judgment is mandated "against a party who fails to make a showing sufficient to establish the existence of an element essential to

that party's case, and on which that party will bear the burden of proof at trial").

V. DISCUSSION

A. Infringement

1. Standard

A patent is infringed when a person "without authority makes, uses or sells any patented invention, within the United States . . . during the term of the patent." 35 U.S.C. § 271(a). A two-step analysis is employed in making an infringement determination. *See Markman v. Westview Instruments, Inc.*, 52 F.3d 967, 976 (Fed. Cir. 1995). First, the court must construe the asserted claims to ascertain their meaning and scope. *See id.* Construction of the claims is a question of law subject to de novo review. *See Cybor Corp. v. FAS Techs.*, 138 F.3d 1448, 1454 (Fed. Cir. 1998). The trier of fact must then compare the properly construed claims with the accused infringing product. *See Markman*, 52 F.3d at 976. This second step is a question of fact. *See Bai v. L & L Wings, Inc.*, 160 F.3d 1350, 1353 (Fed. Cir. 1998).

"Direct infringement requires a party to perform each and every step or element of a claimed method or product." *BMC Res., Inc. v. Paymentech, L.P.*, 498 F.3d 1373, 1378 (Fed. Cir. 2007), *overruled on other grounds by* 692 F.3d 1301 (Fed. Cir. 2012). "If any claim limitation is absent from the accused device, there is no literal infringement as a matter of law." *Bayer AG v. Elan Pharm. Research Corp.*, 212 F.3d 1241, 1247 (Fed. Cir. 2000). If an accused product does not infringe an independent claim, it also does not infringe any claim depending thereon. *See Wahpeton Canvas Co. v. Frontier, Inc.*, 870 F.2d 1546, 1553 (Fed. Cir. 1989). However, "[o]ne may infringe an

independent claim and not infringe a claim dependent on that claim." *Monsanto Co. v. Syngenta Seeds, Inc.*, 503 F.3d 1352, 1359 (Fed. Cir. 2007) (quoting *Wahpeton Canvas*, 870 F.2d at 1552) (internal quotations omitted). A product that does not literally infringe a patent claim may still infringe under the doctrine of equivalents if the differences between an individual limitation of the claimed invention and an element of the accused product are insubstantial. *See Warner-Jenkinson Co. v. Hilton Davis Chem. Co.*, 520 U.S. 17, 24 (1997). The patent owner has the burden of proving infringement and must meet its burden by a preponderance of the evidence. *See SmithKline Diagnostics, Inc. v. Helena Lab. Corp.*, 859 F.2d 878, 889 (Fed. Cir. 1988) (citations omitted).

When an accused infringer moves for summary judgment of non-infringement, such relief may be granted only if one or more limitations of the claim in question does not read on an element of the accused product, either literally or under the doctrine of equivalents. *See Chimie v. PPG Indus., Inc.*, 402 F.3d 1371, 1376 (Fed. Cir. 2005); *see also TechSearch, L.L.C. v. Intel Corp.*, 286 F.3d 1360, 1369 (Fed. Cir. 2002) ("Summary judgment of noninfringement is ... appropriate where the patent owner's proof is deficient in meeting an essential part of the legal standard for infringement, because such failure will render all other facts immaterial."). Thus, summary judgment of non-infringement can only be granted if, after viewing the facts in the light most favorable to the non-movant, there is no genuine issue as to whether the accused product is covered by the claims (as construed by the court). *See Pitney Bowes, Inc. v. Hewlett–Packard Co.*, 182 F.3d 1298, 1304 (Fed. Cir. 1999).

For there to be infringement under the doctrine of equivalents, the accused product or process must embody every limitation of a claim, either literally or by an equivalent. *Warner-Jenkinson*, 520 U.S. at 41. An element is equivalent if the differences between the element and the claim limitation are "insubstantial." *Zelinski v. Brunswick Corp.*, 185 F.3d 1311, 1316 (Fed. Cir. 1999). One test used to determine "insubstantiality" is whether the element performs substantially the same function in substantially the same way to obtain substantially the same result as the claim limitation. *See Graver Tank & Mfg. Co. v. Linde Air Products Co.*, 339 U.S. 605, 608 (1950). This test is commonly referred to as the "function-way-result" test. The mere showing that an accused device is equivalent overall to the claimed invention is insufficient to establish infringement under the doctrine of equivalents. The patent owner has the burden of proving infringement under the doctrine of equivalents and must meet its burden by a preponderance of the evidence. *See SmithKline Diagnostics, Inc. v. Helena Lab. Corp.*, 859 F.2d 878, 889 (Fed. Cir. 1988) (citations omitted).

The doctrine of equivalents is limited by the doctrine of prosecution history estoppel. In *Festo Corp. v. Shoketsu Kinzoku Kogyo Kabushiki Co., Ltd.*, 535 U.S. 722 (2002) ("*Festo VII*"), the Supreme Court stated:

> Prosecution history estoppel ensures that the doctrine of equivalents remains tied to its underlying purpose. Where the original application once embraced the purported equivalent but the patentee narrowed his claims to obtain the patent or to protect its validity, the patentee cannot assert that he lacked the words to describe the subject matter in question. The doctrine of equivalents is premised on language's inability to capture the essence of innovation,

> but a prior application describing the precise element at issue undercuts that premise. In that instance the prosecution history has established that the inventor turned his attention to the subject matter in question, knew the words for both the broader and narrower claim, and affirmatively chose the latter.

Id. at 734-735. In other words, the prosecution history of a patent, as the public record of the patent proceedings, serves the important function of identifying the boundaries of the patentee's property rights. Once a patentee has narrowed the scope of a patent claim as a condition of receiving a patent, the patentee may not recapture the subject matter surrendered. In order for prosecution history estoppel to apply, however, there must be a deliberate and express surrender of subject matter. *See Southwall Tech., Inc. v. Cardinal IG Co.*, 54 F.3d 1570, 1580 (Fed. Cir. 1995).

Once a court has determined that prosecution history estoppel applies, it must determine the scope of the estoppel. *See id.* This requires an objective examination into the reason for and nature of the surrendered subject matter. *Id.*; *see also Augustine Med., Inc. v. Gaymar Indus., Inc.*, 181 F.3d 1291, 1299 (Fed. Cir. 1999). If one of ordinary skill in the art would consider the accused product to be surrendered subject matter, then the doctrine of equivalents cannot be used to claim infringement by the accused product; i.e., prosecution history estoppel necessarily applies. *Augustine Med.*, 181 F.3d at 1298. In addition, a "patentee may not assert coverage of a 'trivial' variation of the distinguished prior art feature as an equivalent." *Id.* at 1299 (quoting *Litton Sys., Inc. v. Honeywell, Inc.*, 140 F.3d 1449, 1454 (Fed. Cir. 1998)).

"[A] narrowing amendment made to satisfy any requirement of the Patent Act" creates a presumption that "the patentee surrendered all subject matter between the

broader and the narrower language" and bars any equivalents. *Festo VII.*, 535 U.S. at 736, 740; *see also Honeywell Int'l, Inc. v. Hamilton Sundstrand*, 370 F.3d 1131, 1139 (Fed. Cir. 2004) (prosecution history estoppel "bar[s] the patentee from asserting equivalents if the scope of the claims has been narrowed by an amendment during prosecution.").

Thus, a presumption of prosecution history estoppel is established by showing that the patentee made a narrowing amendment and that "the reason for that amendment was a substantial one relating to patentability." *Festo Corp. v. Shoketsu Kinzoku Kogyo Kabushiki Co.*, 344 F.3d 1359, 1366 (Fed. Cir. 2003) (en banc) (*"Festo X"*). There are three exceptions to this presumption: (1) the equivalent was "unforeseeable at the time of the narrowing amendment"; (2) the rationale for the amendment "bore no more than a tangential relation to the equivalent in question"; or (3) "some other reason suggested that the patentee could not reasonably have been expected to describe the alleged equivalent." *Festo VII.*, 535 U.S. at 740-41.

2. Analysis

The court starts with the premise that the claims and specification of a patent serve a public notice function. *See, e.g., Johnson & Johnston Associates Inc. v. R.E. Service Co., Inc.*, 285 F.3d 1046, 1052 (Fed. Cir. 2002) (citing *Mahn v. Harwood*, 112 U.S. 354, 361 (1884)) (claims give notice to the public of the scope of the patent). "Consistent with its scope definition and notice functions, the claim requirement presupposes that a patent applicant defines his invention in the claims, not in the specification. After all, the claims, not the specification, provide the measure of the

patentee's right to exclude." *Id.* (citing *Milcor Steel Co. v. George A. Fuller Co.*, 316 U.S. 143, 146 (1942) ("Out of all the possible permutations of elements which can be made from the specifications, [a patentee] reserves for himself only those contained in the claims.") (quoting *Milcor Steel Co. v. George A. Fuller Co.*, 122 F.2d 292, 294 (2d Cir. 1941)). "In making this connection, foreseeability reconciles the preeminent notice function of patent claims with the protective function of the doctrine of equivalents." *See Honeywell Int'l, Inc. v. Hamilton Sundstrand Corp.*, 523 F.3d 1304, 1313 (Fed. Cir. 2008).

Gevo initially had a broad claim covering the use of any enzyme to convert α-ketoisovalerate to isobutyraldehyde and a dependent claim specifying that the enzyme should be a 2-keto acid decarboxylase.[6] On March 28, 2011, the examiner

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[6]The amended claims are the first set presented in the record and read:

> 131. (New) A recombinant yeast microorganism for producing isobutanol, the recombinant yeast microorganism obtainable by:
> (a) engineering the microorganism to express an isobutanol producing metabolic pathway comprising at least one heterologous gene encoding an enzyme that catalyzes a pathway step in the conversion of pyruvate to isobutanol; and
> (b) engineering the microorganism to have reduced pyruvate decarboxylase (PDC) activity as compared to a parental microorganism.
> 132. (New) The recombinant yeast microorganism of claim 131, wherein said pathway step in the conversion of pyruvate to isobutanol is selected from:
> (a) pyruvate to acetolactate;
> (b) acetolactate to 2,3-dihydroxyisovalerate;
> (c) 2,3-dihydroxyisovalerate to α-ketoisovalerate;
> (d) α-ketoisovalerate to isobutyraldehyde; and
> (e) isobutyraldehyde to isobutanol.
> 136. (New) The recombinant yeast microorganism of claim

rejected those claims as, inter alia, obvious over Donaldson and van Maris.[7] (11-54 D.I. 515 at GJA2525–27) Gevo argued in response that the *L. lactis* KIVD produced "unexpected results" and, on April 28, 2011, adopted the examiner's suggestion to narrow the claims to specifically recite an "α-ketoisovalerate decarboxylase from *Lactococcus lactis*."[8] (*Id.* at GJA2811–24) Gevo does not appear to dispute that it narrowed its claim through amendment, instead invoking the "unforseeability" exception to prosecution history estoppel. (D.I. 24 at 12) Indeed, the summary of Gevo's interview with the examiner on April 22, 2011, notes that Gevo "indicated that [it] would look into the possibility of broadening the scope of the genus of KIVDs. The [e]xaminer indicated that she would consider future amendments in that regard as well as arguments in support of a broader scope of the genus of KIVDs." (11-54 D.I. 515 at GJA2622)

> 132, wherein the enzyme that catalyzes the conversion of α-ketoisovalerate to isobutyraldehyde is a 2-keto acid decarboxylase.

(11-54 D.I. 515 at GJA2463-64) The amendment to the claims was filed February 4, 2011. (*Id.* at GJA2461)

[7]As used by the examiner, "Donaldson" is U.S. Application No. 11/586,315 filed on October 26, 2005, issued as U.S. Patent No. 7851188 on December 14, 2010, and "van Maris" is *Directed Evolution of Pyruvate Decarboxylase-Negative* Saccharomyces cerevisiae*, Yielding a C2-Independent, Glucose-Tolerant, and Pyruvate-Hyperproducing Yeast Antonius*, 70 Applied and Environmental Microbiology, 159-166 (2004).

[8]That Gevo stated that it did not agree with the examiner's characterization of the invention and indicated that it might seek to broaden its claims is of no moment in the court's analysis. (11-54 D.I. 515 at GJA2523, GJA2622) Gevo amended its claims and cannot now argue that it should not be held to those amended claims.

Contrary to Gevo's position,[9] the proper time frame for the foreseeability inquiry looks to what "the patent drafter could have foreseen during prosecution and included in the claims." *Honeywell*, 523 F.3d at 1313. Further, "an equivalent is foreseeable if it is disclosed in the pertinent prior art in the field of the invention. In other words, an alternative is foreseeable if it is known in the field of the invention as reflected in the claim scope before amendment." *Festo Corp. v. Shoketsu Kinzoku Kogyo Kabushiki Co., Ltd.*, 493 F.3d 1368, 1382 (Fed. Cir. 2007); *see e.g., Duramed Pharma. Inc. v. Paddock Labs, Inc.*, 644 F. 3d 1376, 1380-81 (Fed. Cir. 2011) (holding that "when the language of both the original and issued claims begins with the words '[a] pharmaceutical composition,' that language defines the field of the invention for purposes of determining foreseeability.").

Gevo argues that the indolepyruvate decarboxylase ("IPDC") enzyme from *Listeria grayi* ("*L. grayi*") was not known in the art and that the *L. lactis* KIVD was the only known KIVD at the relevant time. However, the five-step pathway for converting pyruvate to isobutanol was known in the art and the '375 patent relates to the use of microorganisms to produce isobutanol. ('375 patent, abstract & fig.1) Butamax's expert, Dr. Benner, relies on Atsumi (2009),[10] which describes alternative types of enzymes for use in engineering isobutanol pathways, to assert that *L. grayi* was known in the art. (11-54 D.I. 624, ex 42 at ¶ 102) Atsumi (2009) states:

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[9]That April 28, 2011 (the date of its amendment) is the relevant time for inquiry into forseeability.

[10]"Atsumi (2009)" is Shota Atsumi et al., *Acetolactate Synthase from* Bacillus subtilis *Serves as a 2-Ketoisovalerate Decarboxylase for Isobutanol Biosynthesis in* Escherichia coli, 75 Appl. Env. Microbiol., 6306 at 6306 (2009).

> One key reaction in the production of isobutanol is the conversion of KIV to isobutyraldehyde catalyzed by 2-ketoacid decarboxylase (Kdc) (Fig. 1C). Since *E. coli* does not have Kdc, *kdc* from *L. lactis* was overexpressed. Kdc is a nonoxidative thiamine PPi (TPP)-dependent enzyme and is relatively rare in bacteria, being more frequently found in plants, yeasts, and fungi (8, 19). **Several enzymes with Kdc activity have been found**, including pyruvate decarboxylase, phenylpyruvate de-carboxylase (18), branched-chain Kdc (8, 19), 2-ketoglutarate decarboxylase (10, 17, 20), and **indole-3-pyruvate decarboxylase** (13).

(emphasis added) As Gevo's original claims[11] attempted to encompass all enzymes used to convert α-ketoisovalerate to isobutyraldehyde,[12] IPDC enzymes clearly fulfill this function based on the scientific literature. There is also evidence in the record that Gevo identified the *L. grayi* IPDC as an enzyme that might have KIVD activity and, instead of broadening the scope of its claims of the '375 patent, it filed a new provisional application claiming the *L. grayi* IPDC.[13] (D.I. 18 at 17; US Patent Application No. 61/512,810, filed July 28, 2011) The court concludes that the *L. grayi* IPDC was not unforeseeable.

In addition, the doctrine of ensnarement - "asserting a scope of equivalency that would encompass, or 'ensnare,' the prior art" - bars Gevo's claim. *DePuy Spine, Inc. v.*

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[11]Or at least the first set of amended claims presented in the record.

[12]The court finds no support for Gevo's argument that the original claims also required that "the enzyme must have greater specificity for α-ketoisovalerate as a substrate, over pyruvate," and therefore does not consider this limitation. (D.I. 24 at 17 (citing 11-54 D.I. 645, ex. 118 at BUTAM576308-10, an internal DuPont presentation))

[13]Dr. Asleson Dundon, an inventor, admitted that the IPDC from *L. grayi* had been identified as a potential KIVD for use in the isobutanol pathway (11-54 D.I. 655, ex. 77 at 198:6-200:7) and was on a list of potential KIVDs before the '375 patent issued. (D.I. 25 at 5; 11-54 D.I. 655 at 169:8-17)

Medtronic Sofamor Danek, Inc., 567 F.3d 1314, 1321 (Fed. Cir. 2009). The specific question in this regard is whether Gevo has shown that a hypothetical claim, similar to claim 1 but broad enough to literally cover Butamax's *L. grayi* enzyme, could have been patentable. The examiner found that a claim directed to any enzyme that would convert α-ketoisovalerate to isobutyraldehyde was obvious over Donaldson and van Maris, a rejection which Gevo overcame by narrowing its claims. Therefore, unless Gevo could have shown that the *L. grayi* enzyme or any other enzyme also yielded the unexpected results that it relied on to overcome the prior art, the hypothetical claim would be ensnared by the prior art. Since the unexpected results were confined to the *L. lactis* enzyme, any purported equivalent would have been rendered obvious by the prior art. The ensnarement doctrine prohibits just such an outcome.

The doctrine of claim vitiation and the exclusion principle also bar Gevo's assertion that the *L. grayi* enzyme was the equivalent of the *L. lactis* enzyme. *Carnegie Mellon Univ. v. Hoffmann–La Roche Inc.*, 541 F.3d 1115, 1129 (Fed. Cir. 2008). Construing "α-ketoisovalerate decarboxylase from *Lactococcus lactis*" to mean "any enzyme" would read the limitation out of the patent. *See id.* ("finding that Taq is an equivalent of *E. coli* would essentially render the 'bacterial source [is] *E. coli* ' claim limitation meaningless, and would thus vitiate that limitation of the claims"). Both parties agree that the *L. grayi* IPDC enzyme comes from a different source and has a very different amino acid sequence (sharing only 46% amino acid sequence identity) from the *L. lactis* KIVD enzyme. (D.I. 18 at 14; D.I. 24 at 20) To allow Gevo to allege that the enzymes are equivalent "would vitiate [the] claim limitation" requiring an

"α-ketoisovalerate decarboxylase from *Lactococcus lactis*."

The court concludes that use of the *L. grayi* enzyme was not unforseeable. Therefore, Gevo cannot assert infringement of independent claim 1 through the application of the doctrine of equivalents for enzymes other than what it specifically claimed, i.e., an "α-ketoisovalerate decarboxylase from *Lactococcus lactis*."[14] Additionally, the court concludes that the doctrines of ensnarement and claim vitiation also preclude Gevo from asserting its equivalence argument. Although Gevo does not appear to concede the issue, Gevo does not argue that Butamax's use of the *L. grayi* enzyme literally infringes independent claim 1 of the '375 patent. For the foregoing reasons, the court grants Butamax's motion for summary judgment of non-infringement of the asserted claims 1-3 and 5-7 of the '375 patent.

Turning to the '376 patent, Gevo concedes that it made a narrowing amendment, but argues that prosecution history estoppel does not prevent the application of the doctrine of equivalents as the second exception applies, i.e., the rationale for the amendment bears only a tangential relation to Butamax's strains. *See Festo VII.*, 535 U.S. at 740-41. The examiner proposed a narrowing amendment after an interview, which amendment deleted "or homologs thereof" from the independent claim. (11-54 D.I. 517 at GJA4395) The examiner's explanation focused on the overexpression of Aft, but did not address the reasoning behind the deletion of homologs. Homologs are defined in the '376 specification as proteins with similar amino acid sequences, which correspond to their original proteins by "functional, structural or genomic similarities."

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[14]Claims 2-7 of the '375 patent depend on claim 1.

('376 patent, 15:6-17) While neither party argues that FRA2[15] is a homolog of AFT, Gevo asserts that non-expression of FRA2 has the same function as Aft overexpression. (D.I. 25 at 15-16, n.9) Butamax maintains that, since Gevo surrendered overexpressing homologs, it necessarily surrendered other functional equivalents. The court concludes that, even if the prosecution history supported surrendering overexpressing Aft homologs, Butamax's deletion of FRA2 bears at most a tangential relationship to the amendment and, consequently, prosecution history estoppel does not apply.

The parties agree that the disputed limitation of independent claim 1 is the recombinant overexpression of the gene encoding the Aft protein, causing an increase of Aft protein in the cell. (D.I. 18 at 24-25; D.I. 24 at 27, 32-33; '376 patent, 2:10-13, 16:58-61) The function of the claim is to increase the enzymatic activity of dihydroxyacid dehydratase ("DHAD"). ('376 patent, 2:1-10) This is achieved through "recombinant yeast cells engineered to provide increased heterologous or native expression of AFT1 and/or AFT2 . . . ." (*Id.* at 2:10-13) Dr. Winge explains that the overexpression of AFT "increases the amount of nuclear Aft1 to activate transcription of genes in the iron regulon . . . ." (11-54 D.I. 646 at 21-22) In contrast, in Butamax's strain, deletion of the FRA2 gene prevents the transcription and translation of the Fra2 mRNA and Fra2 protein. (11-54 D.I. 624, ex. 56 at ¶¶ 67-71) While the role of Fra2 is unknown, Gevo posits (and Butamax does not dispute for purposes of this motion) that the deletion of FRA2 does not produce excess Aft protein, but removes the alleged

[15]"FRA" refers to the gene, "Fra" refers to the protein.

negative regulator allowing the native Aft to be used in the iron regulon in a greater amount. (D.I. 25 at 19-20, 26-27; 11-54 D.I. 624, ex. 54 at ¶¶ 66-67)

By asserting that overexpression of the AFT gene is equivalent to deleting the FRA2 gene, Gevo appears to seek to "convert a multi-limitation claim to one of [fewer] limitations to support a finding of equivalency." *Perkin-Elmer Corp. v. Westinghouse Elec. Corp.*, 822 F.2d 1528, 1532 (Fed. Cir. 1987). Instead, a limitation-by-limitation comparison is still required. *See Pennwalt Corp. v. Durand-Wayland, Inc.*, 833 F.2d 931, 935 (Fed. Cir. 1987), overruled in part on other grounds by, *Cardinal Chem. Co. v. Morton Int'l*, 508 U.S. 83 (1993). In other words, an equivalent of a claim limitation cannot substantially alter the manner of performing the claimed function. *See Dolly, Inc. v. Spalding & Evenflo Cos, Inc.*, 16 F.3d 394, 400 (1994) (quoting *Pennwalt*, 833 F.2d at 935)).

Gevo's reliance on *Corning* in this regard is inapposite. In *Corning*, the Federal Circuit affirmed a finding of infringement under the doctrine of equivalents finding that the accused fibers achieved the same refractive index differential by the addition of dopant, as required by the claim, albeit by adding a negative dopant to a different component. *Corning Glass Works v. Sumitomo Elec. U.S.A., Inc.,* 868 F.2d 1251, 1260 (Fed. Cir. 1989) (alterations in original) (quoting *Corning Glass Works v. Sumitomo Elec. U.S.A., Inc.*, 671 F. Supp. 1369, 1387 (S.D.N.Y.1987)). Specifically,

> [t]he use of fluorine as a [negative] dopant in the cladding thus performs substantially the same function in substantially the same way as the use of a [positive] dopant in the core to produce the same result of creating the refractive index differential between the core and cladding of the fiber which is necessary for the fiber to function as an

optical waveguide.

Id.

In the case at bar, to find that Butamax's strains are the equivalent of Gevo's strains would render the limitation of overexpressing Aft superfluous and would essentially negate the manner in which the limitation achieves transcription of the genes in the iron regulon. *Dolly*, 16 F.3d at 400 (quoting *Perkin-Elmer*, 822 F.2d at 1531 n.6) ("Where an accused device performs substantially the same function to achieve substantially the same result but in a substantially different manner, there is no infringement under the doctrine of equivalents."). The deletion of FRA2 does not perform the same function in substantially the same way as the overexpression of Aft1, as it does not increase the Aft protein levels as called for by the claim, in order to then increase the enzymatic activity of DHAD.[16] Instead the deletion of FRA allows the native Aft1 protein to be used in the iron regulon. As the claim language (and, indeed, the parties' agreed upon construction) requires the increase of Aft1 via overexpression, the court concludes that the doctrine of equivalents does not apply.[17]

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[16]Butamax's internal document noting that for certain strains, a particular "AFT1[] is equivalent to FRA2 deletion in terms of enzymatic activity and isobutanol production" does not alter the court's analysis. (11-54 D.I. 696 at BUTAM957212) The document is included in a scientific year end summary and cannot be equated to a legal analysis, nor can its use of the term "equivalent" be equated to the legal use of the term.

[17]Under the insubstantial differences test, "[a]n element in the accused device is equivalent to a claim limitation if the only differences between the two are insubstantial." *Honeywell Int'l Inc. v. Hamilton Sundstrand Corp.*, 370 F.3d 1131, 1139 (Fed. Cir. 2004). Although Gevo asserts otherwise (11-54 D.I. 646 at ¶¶ 54-59), the court concludes that FRA2 deletion and the overexpression of AFT are not insubstantially different. Butamax's strain deletes the FRA2 gene and the role of the Fra2 protein is unknown. Gevo overexpresses the AFT gene and avers that AFT overexpression is a superior way to practice claim 1.

Similarly, the court concludes that Gevo's equivalence theory vitiates the claim limitation requiring overexpression of AFT, leading to the increase in Aft production. *See Warner–Jenkinson*, 520 U.S. at 39 n. 8 ("[I]f a theory of equivalence would entirely vitiate a particular claim element, partial or complete judgment should be rendered by the court."); *see also Mirror Worlds, LLC v. Apple Inc.*, 692 F.3d 1351,1358 (Fed. Cir. 2012) ("an argument that the absence of a feature is equivalent to its presence" negates the doctrine of equivalents"); *Planet Bingo, LLC v. GameTech Intern., Inc.*, 472 F.3d 1338, 1345 (Fed. Cir. 2006) (refusing to apply the doctrine of equivalents to change "before" to "after" in the claim limitation stating that it had "refused to apply the doctrine [of equivalents] in other cases where the accused device contained the antithesis of the claimed structure). Gevo concedes that the accused Butamax strains do not literally infringe the asserted claims of the '376 patent. (D.I. 24 at 36) Therefore, the court grants Butamax's motion for summary judgment of non-infringement of the asserted claims of the '376 patent.[18]

B. Invalidity

1. Enablement and written description

a. Standard

The statutory basis for the enablement and written description requirements, 35 U.S.C. § 112 ¶1, provides in relevant part:

> The specification shall contain a written description of the invention, and of the manner and process of making and

[18]On the current record, which does not contain sufficient details for the determination of obviousness, the court declines to address Butamax's contention that Gevo's strains ensnare the prior art.

> using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same . . . .

"The enablement requirement is met where one skilled in the art, having read the specification, could practice the invention without 'undue experimentation.'" *Streck, Inc. v. Research & Diagnostic Systems, Inc.*, 665 F.3d 1269, 1288 (Fed. Cir. 2012) (citation omitted). "While every aspect of a generic claim certainly need not have been carried out by the inventor, or exemplified in the specification, reasonable detail must be provided in order to enable members of the public to understand and carry out the invention." *Genentech, Inc. v. Novo Nordisk A/S*, 108 F.3d 1361, 1366 (Fed. Cir. 1997). The specification need not teach what is well known in the art. *Id.* (citing *Hybritech v. Monoclonal Antibodies, Inc.*, 802 F.2d 1367, 1384 (Fed. Cir. 1986)). A reasonable amount of experimentation may be required, so long as such experimentation is not "undue." *ALZA Corp. v. Andrx Pharms., Inc.*, 603 F.3d 935, 940 (Fed. Cir. 2010).

"Whether undue experimentation is needed is not a single, simple factual determination, but rather is a conclusion reached by weighing many factual considerations." *Martek Biosciences Corp. v. Nutrinova, Inc.*, 579 F.3d 1363, 1378 (Fed. Cir. 2009) (citing *In re Wands*, 858 F.2d 731, 737 (Fed. Cir. 1988). The Federal Circuit has provided several factors that may be utilized in determining whether a disclosure would require undue experimentation: (1) the quantity of experimentation necessary; (2) the amount of direction or guidance disclosed in the patent; (3) the presence or absence of working examples in the patent; (4) the nature of the invention; (5) the state of the prior art; (6) the relative skill of those in the art; (7) the predictability

of the art; and (8) the breadth of the claims. *In re Wands*, 858 F.2d at 737. These factors are sometimes referred to as the "*Wands* factors." A court need not consider every one of the *Wands* factors in its analysis, rather, a court is only required to consider those factors relevant to the facts of the case. *See Streck, Inc.*, 655 F.3d at 1288 (citing *Amgen, Inc. v. Chugai Pharm. Co., Ltd.*, 927 F.2d 1200, 1213 (Fed. Cir. 1991)).

A discrete, but related, inquiry considers the presence of inoperative embodiments and informs the enablement inquiry. *National Recovery Techs. Inc. v. Magnetic Separation Sys., Inc.*, 166 F.3d 1190, 1196 (Fed. Cir. 1999). Pursuant to this inquiry, a claim is invalid for lack of enablement "if it reads on a significant number of inoperative embodiments." *Crown Operations Int'l, Ltd. v. Solutia Inc.*, 289 F.3d 1367, 1381 (Fed. Cir. 2002) (internal citations omitted). The use of prophetic examples does not automatically make a patent non-enabling. The burden is on one challenging validity to show, by clear and convincing evidence, that the prophetic examples together with the other parts of the specification are not enabling. *Atlas Powder Co. v. E.I. Du Pont de Nemours & Co.*, 750 F.2d 1569, 1577 (Fed. Cir. 1984).

The enablement requirement is a question of law based on underlying factual inquiries. *See Green Edge Enters., LLC v. Rubber Mulch Etc., LLC*, 620 F.3d 1287, 1298-99 (Fed. Cir. 2010) (citation omitted); *Wands*, 858 F.2d at 737. Enablement is determined as of the filing date of the patent application. *In re '318 Patent Infringement Litigation*, 583 F.3d 1317, 1323 (Fed. Cir. 2009) (citation omitted). The burden is on one challenging validity to show, by clear and convincing evidence, that the

specification is not enabling. *See Streck, Inc.*, 665 F.3d at 1288 (citation omitted).

A patent must also contain a written description of the invention. 35 U.S.C. § 112, ¶ 1. The written description requirement is separate and distinct from the enablement requirement. *See Ariad Pharms., Inc. v. Eli Lilly and Co.*, 598 F.3d 1336, 1351 (Fed. Cir. 2011). It ensures that "the patentee had possession of the claimed invention at the time of the application, i.e., that the patentee invented what is claimed." *LizardTech, Inc. v. Earth Resource Mapping, Inc.*, 424 F.3d 1336, 1344-45 (Fed. Cir. 2005). The Federal Circuit has stated that the relevant inquiry – "possession as shown in the disclosure" – is an "objective inquiry into the four corners of the specification from the perspective of a person of ordinary skill in the art. Based on that inquiry, the specification must describe an invention understandable to that skilled artisan and show that the inventor actually invented the invention claimed." *Ariad*, 598 F.3d at 1351.

This inquiry is a question of fact: "the level of detail required to satisfy the written description requirement varies depending on the nature and scope of the claims and on the complexity and predictability of the relevant technology." *Id.* (citation omitted). In this regard, Butamax must provide clear and convincing evidence that persons skilled in the art would not recognize in the disclosure a description of the claimed invention. *See PowerOasis, Inc. v. T-Mobile USA, Inc.*, 522 F.3d 1299, 1306-17 (Fed. Cir. 2008) (citation omitted). While compliance with the written description requirement is a question of fact, the issue is "amenable to summary judgment in cases where no reasonable fact finder could return a verdict for the non-moving party." *Id.* at 1307

(citing *Invitrogen Corp. v. Clontech Labs., Inc.*, 429 F.3d 1052, 1072-73 (Fed. Cir. 2005)).

b. Analysis

The parties agree that the term "theoretical yield of . . . from glucose" in the '375 patent means "the maximum amount of product that can be produced from the total amount of glucose provided." Atsumi (2008) describes an experiment yielding 0.35 g isobutanol per g glucose, as 86% of theoretical maximum yield.[19] To calculate the theoretical yield, Atsumi (2008) divides the amount of glucose consumed by the cell by the theoretical maximum yield for isobutanol of 0.41 g isobutanol per g glucose. *Id.* at 87 & fig. 2. After reviewing the data provided in the patent application, the patent examiner suggested the amendments adding theoretical yield, based on calculations using the amount of glucose consumed by the cell.[20] (11-54 D.I. 515, GJA3018) Gevo's expert, Dr. Voigt, explains that yields are calculated in the art based on the amount of substrate consumed by the cell. (11-54 D.I. 620 at ¶¶ 20, 32) The court agrees. Consistent with the scientific literature cited in the '375 patent, the prosecution history, and Gevo's expert, "the total amount of glucose provided" is that consumed by

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[19]"Atsumi (2008)" is Shota Atsumi et. al, *Non-Fermentative Pathways for Synthesis of Branched-Chain Higher Alcohols as Biofuels*, 451 Nature, 86-89, 87, fig. 2 (2008). The theoretical maximum yield for isobutanol is 0.41 g isobutanol per g glucose. *Id.* at fig. 2.

[20]While the court may accord some deference to an examiner's reasoning, that the examiner proposed the language of the claim is not dispositive of the validity issue. *Microsoft Corp. v. i4i Ltd. P'ship*, ___U.S. ___, 131 S.Ct. 2238, 2251-52 (2011). Here, the examiner's reasoning does not clarify that the factual issues underlying Butamax's defense were considered, therefore, the court independently evaluates the invalidity arguments without deference.

the cell.[21] Based on this definition, the '375 patent specification provides examples of yields greater than 10%.

Butamax argues that the patent is invalid for lack of written description and enablement as it does not support the claimed high yields of greater than 50% up to greater than 97.5%, asserting that "undue experimentation" would be required to achieve these high theoretical yields.[22] (D.I. 16 at 14-16; '375 patent, 24:21-45) These yields are far beyond the inventor's highest actual obtained yield of 12.8%.[23] (D.I. 16 at 15; '375 patent, tbl. EX8A-2) Gevo's expert, Dr. Voigt, opines that a person of ordinary skill in the art would look to the specification and examples, which provide a path for achieving the higher yields. (11-54 D.I. 620 at ¶¶ 84-91) Dr. Papoutsakis also testified that one could optimize the process to potentially achieve the higher yields. (11-54 D.I. 619, ex. 110 at 109:11-110:24) On the other hand, Butamax's expert, Dr. Henry, avers

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[21] Butamax argues that "the total amount of glucose provided" is that provided to the system or media. (D.I. 16 at 11-12) Dr. Henry calculates the yield based on the media used in the examples, which contain 20 g/L of glucose. Dr. Henry notes that, at a certain growth, "glucose was added to a concentration of 5%," which serves to increase "the total amount of glucose provided and renders the reported isobutanol yields even further from the claimed 10% theoretical yields." (11-54 D.I. 594, ex. 3 at ¶¶ 79-80, n.10) Using the amount of glucose provided to the media renders this measurement arbitrary, as this amount could be increased or decreased as needed to achieve desired yields.

[22]The court does not address herein Butamax's argument that the '375 patent may not claim priority to the earlier filed '483 provisional application, as it is not pertinent to the issues at bar. (D.I. 16 at 13-14)

[23]While the court may accord some deference to an examiner's reasoning, that the examiner proposed the language of the claim is not dispositive of the validity issue. *Microsoft Corp. v. i4i Ltd. P'ship*, ___U.S. ___, 131 S.Ct. 2238, 2251-52 (2011). Here, the examiner's reasoning does not clarify that the factual issues underlying Butamax's defense were considered, therefore, the court independently evaluates the invalidity arguments without deference.

that the application fails to teach one of ordinary skill in the art how to obtain recombinant yeast microorganisms capable of producing isobutanol at the upper end of the theoretical yields. (11-54 D.I. 594 at ¶ 87) Additionally, there have been no reports before or after the issuance of the '375 patent of yeast organisms producing isobutanol at theoretical yields of up to 90%. (*Id.* at ¶ 88, 92)

As to written description, the court concludes that Butamax has shown, by clear and convincing evidence, that persons skilled in the art would not recognize in the disclosure a description of the higher yields of the claimed invention. The parties' experts agree that the technology at issue is both complex and unpredictable. (*See e.g.*, 11-54 D.I. 619, ex. 110 at 109:24-110:7, 127:2-128:12; 11-54 D.I. 594, ex. 3 at ¶ 87) The specification provides no detail on how to practice claim 1 to achieve higher yields.

As to enablement, "the specification of a patent must teach those skilled in the art how to make and use the full scope of the claimed invention without undue experimentation." *Genentech, Inc.*, 108 F.3d at 1365. Claim 1 broadly claims that the recombinant yeast produce isobutanol at a yield of "at least 10% of theoretical yield." However, the patent's examples teach a maximum theoretical yield of 12.8%, nowhere near the 97.5% claimed. There is no direction or guidance disclosed in the patent to instruct a person of ordinary skill in the art on how to optimize or change the process to achieve the higher yields. Instead the specification simply states that in other embodiments, higher yields of 50-97.52% were obtained. As Dr. Henry stated, no reports of these higher yields are available in the literature. (11-54 D.I. 594, ex. 3 at ¶¶ 19, 85-88) Dr. Voigt, Gevo's expert, states that the "'375 application clearly teaches"

the higher yields, but simply points to the specification (11-54 D.I. 620 at ¶ 54) and avers that "in [his] opinion, the inventors were in possession of the invention as of the '375 application filing date." (*Id.* at ¶ 55) Dr. Papoutsakis testified that through experimentation, a person of ordinary skill could achieve higher yields, but did not describe the amount of experimentation or how high the expected yields could be.[24]

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[24]Testifying:

> Q. . . . Does the patent tell you how to get yields of 90 percent?
>
> A. No, but it doesn't have to.
>
> Q. Why do you say that?
>
> A. Because once you've reached, say, 10 percent of which constitutes a substantial level in our mind, **then one could sort of think then of optimization processes** with strain development and selection of clonal selection that will get you to higher, **but you cannot really tell how high you can go because that's really the unpredictability of the art**.
>
> Q. So, is it your view that you could predict that the organism that makes a 10 percent theoretical yield of isobutanol could also make 90 percent theoretical yield?
> . . .
>
> A. I do not know that I can answer -- I mean, **I do not know if this is going to happen, but it may**.

(11-54 D.I. 619, ex. 110 at 109:19-110:24 (emphasis added)) When asked about attaining yields greater than 50%, Dr. Papoutsakis responded:

> You can never predict. You can sort of be assured that you're -- you're on the right path towards that goal. Because from a -- biology, metabolic engineering, and fermentation are not mathematical sciences. There's a lot of unpredictability and a lot of issues.

(*Id.* at 127:7-19)

(11-54 D.I. 619, ex. 110 at 109:19-110:24) Dr. Henry also opines (unrefuted by Gevo's experts) that "yeast become toxic to levels of alcohol in media exceeding about 17%," limiting their production of isobutanol. (11-54 D.I. 594, ex. 3 at ¶ 91)

Turning to the case law, the Court of Customs and Patent Appeals found claims reciting a potency of "**at least 1** International Unit of ACTH per milligram" not enabled when the specification disclosed compounds with a maximum potency of 1.11 and 2.3 International Units per milligram. *In re Fisher*, 427 F.2d 833, 835, 839 (1970) (emphasis added). The Court concluded that the specification did not enable ACTH potencies much greater than 2.3 International Units per milligram, which was insufficient to allow an inventor to dominate all compositions with potencies far in excess of those obtainable from the specification plus ordinary skill. *Id.* at 839. Similarly, the Federal Circuit affirmed a holding that claims directed to a "change in the resistance by **at least 10%**" were invalid for lack of enablement when the specification taught how to construct junctions with a maximum resistive change of up to 11.8%.[25] *Magsil Corp. v. Hitachi Global Storage Techs., Inc.*, 687 F.3d 1377, 1379-80 (2012) (emphasis added). The Court held that,

> [t]he enablement doctrine's prevention of over broad claims ensures that the patent system preserves necessary incentives for follow-on or improvement inventions. In this case, for instance, many additional inventions and advances were necessary to take this technology from a 20% resistance change to the over 600% change in present data storage systems. Moreover this technology area will continue to profit from inventive contributions. Enablement

[25]The resistive change may progress up to 1,000%, with maximum resistive change of infinity.

> operates to ensure fulsome protection and thus "enable" these upcoming advances.

Id. at 1384.

The court concludes that Gevo has only offered conclusory allegations to support yields above the reported 12.8% and, therefore, has not offered any evidence to show that the full scope of claim 1 was enabled. There is no expert testimony that would allow a reasonable jury to conclude that the higher yields would be achievable at all, or at least without undue experimentation. There is no unresolved genuine issue of material fact in this regard. As Butamax has met its clear and convincing burden, sufficient to invalidate the patent for lack of enablement, the court grants Butamax's motion for summary judgment of invalidity of the '375 patent for lack of written description and enablement.[26]

Turning to the '376 patent, Gevo argues that the disclosure of U.S. Provisional Application No. 61/263,952 ("the '952 application") provides support for the claims of the later issued '376 patent. (D.I. 20 at 29) The parties do not dispute that the '952 application discloses only recombinant yeast microorganisms overexpressing cytosolically localized DHAD. (11-54 D.I. 643, ex 67 at ¶ 31; *see also* D.I. 594, ex. 8 at ¶ 87; D.I. 26 at 8; 11-54 D.I. 618 at ¶ 28 & ex. B) The parties apparently disagree over whether the disclosures of the '376 patent are commensurate, thus allowing the '376 patent to claim priority to the '952 application. The '376 patent specification references

[26]As the claim construction provides a proper comparison (above at III.C.2, 3), the court does not address Butamax's arguments that the comparison terms of claim 1 and claim 2 render these claims indefinite. Similarly, as it has construed the KARI term (above at III.B), the court also does not address Butamax's arguments that Gevo's KARI construction renders claim 1 invalid for written description.

both "cytosolically localized DHAD enzyme" and "mitochondrially localized DHAD enzyme" throughout. (*See e.g.* '376 patent, abstract, 21:10-14, 24:40-45) Of the asserted claims, only dependent claim 9 recites a location for DHAD in the cytosol.[27] Given the above, the court concludes that the '952 application lacks written description to support the claims of the '376 patent. This precludes the '376 patent from claiming priority to the '952 application.

Butamax asserts that the '376 patent specification lacks written description and enablement, and suggests several bases for its assertions. To the extent that Butamax alleges a lack of enablement based on inoperable embodiments, Butamax must show that the asserted claims "read[ ] on significant numbers of inoperative embodiments." *Crown*, 289 F.3d at 1380. As long as one of ordinary skill possesses the "necessary information to limit the claims to operative embodiments," there is no failure to satisfy the enablement requirement for claiming substantial inoperable embodiments. *Crown*, 289 F.3d at 1380 (citing *In re Cook*, 58 C.C.P.A. 1049, 439 F.2d 730, 735 (1971)); *see also Atlas Powder*, 750 F.2d at 1576 ("[e]ven if some of the claimed combinations [are] inoperative, the claims are not necessarily invalid."). Butamax argues that the '376 patent claims encompass overexpressing the AFT gene from a 2-micron plasmid, after Gevo established that DHAD activity could not be increased through the use of these plasmids. (D.I. 16 at 34-35) Gevo asserts that this failure with a single inoperative embodiment does not render the '376 patent invalid in view of the extensive disclosure. (D.I. 20 at 34-35) The court agrees with Gevo. There is no genuine issue of material

[27]Dependent claim 10 recites DHAD located in the mitochodria.

fact in dispute regarding whether a single inoperative embodiment, the 2-micron plasmid, should be considered to represent substantial embodiments.

Butamax also contends that the working examples in the '376 patent specification are not sufficient to enable the claims and that it would take undue experimentation to practice the claimed invention of the '376 patent. Gevo contends that its working examples enable the claims and argues that the '952 application teaches how to achieve a yeast cell recombinantly overexpressing DHAD and AFT genes resulting in increased DHAD activity. (D.I. 20 at 33-35; D.I. 26 at 16; '952 application at ¶¶ 28, 151-52, 154, 330, 384-85) These teachings paired with standard available yeast recombinant DNA technology would enable a person of ordinary skill in the art to practice the claims without undue experimentation. (D.I. 20 at 33-35) Butamax counters that the asserted claims encompass the overexpression of AFT genes, while the specification only enables overexpression of AFT1 and AFT2. Further, the specification does not teach the "optimal level" of AFT expression required to increase DHAD activity, requiring undue experimentation to extend the teachings of the '376 specification to the full scope of the claims. (D.I. 23 at 38) Gevo replies that the working examples show that the level of AFT expression was disclosed, sufficient to enable the patent. (D.I. 20 at 36-37) The court concludes that, on the record before it, the parties have raised genuine issues of material fact bearing on the disclosures and the amount of experimentation required to practice the full scope of the claims, thus precluding entry of summary judgment.

2. Conception and Reduction to Practice

a. Standard

Under 35 U.S.C. § 102(g)(2), an applicant is not entitled to a patent if, "before the applicant's invention thereof the invention was made in this country by another who had not abandoned, suppressed, or concealed it." The Federal Circuit has explained that, "if a patentee's invention has been made by another, prior inventor who has not abandoned, suppressed, or concealed the invention, § 102(g) will invalidate that patent." *Apotex USA, Inc. v. Merck & Co.*, 254 F.3d 1031, 1035 (Fed. Cir. 2001). The Federal Circuit also has observed that this section "retains the rules governing the determination of priority of invention." *Hybritech, Inc. v. Monoclonal Antibodies, Inc.*, 802 F.2d 1367, 1376 (Fed. Cir. 1986) (quoting *Kimberly-Clark Corp. v. Johnson & Johnson*, 745 F.2d 1437, 1444 (Fed. Cir. 1984)). To this end, a party alleging prior invention can establish that he was the first to invent by showing either: (1) he was first to reduce the invention to practice; or (2) he was first to conceive the invention and then exercised reasonable diligence in attempting to reduce the invention to practice from a date just prior to the applicant's conception to the date of his reduction to practice. 35 U.S.C. § 102(g) ("In determining priority of invention . . . there shall be considered not only the respective dates of conception and reduction to practice of the invention, but also the reasonable diligence of one who was the first to conceive and last to reduce to practice, from a time prior to conception by the other."). As recognized by the Federal Circuit,

> [a] principal purpose of § 102(g) is to ensure that a patent is awarded to a first inventor. However, it also encourages prompt public disclosure of an invention by penalizing the unexcused delay or failure of a first inventor to share the "benefit of the knowledge of [the] invention" with the public after the invention has been completed.

Checkpoint Sys. v. United States Int'l Trade Comm'n, 54 F.3d 756, 761 (Fed. Cir. 1995) (citing *Paulik v. Rizkalla*, 760 F.2d 1270, 1280 (Fed. Cir. 1985)).

Conception is the "formation in the inventor's mind of a definite and permanent idea of the complete and operative invention, as it is hereafter to be applied in practice." *Hybritech*, 802 F.2d at 1376 (citations omitted). A conception must encompass all limitations of the claimed invention, and "is complete only when the idea is so clearly defined in the inventor's mind that only ordinary skill would be necessary to reduce the invention to practice, without extensive research or experimentation." *Singh v. Brake*, 317 F.3d 1334, 1340 (Fed. Cir. 2002) (citations omitted). Put differently, every limitation must be shown to have been known to the inventor at the time the invention is alleged to have been conceived. *Davis v. Reddy*, 620 F.2d 885, 889 (C.C.P.A. 1980) (citing *Schur v. Muller*, 372 F.2d 546, 551 (1967); *Anderson v. Anderson*, 403 F. Supp. 834, 846 (D. D.C. 1975)). Because conception is a mental act, "it must be proven by evidence showing what the inventor has disclosed to others and what that disclosure means to one of ordinary skill in the art." *In re Jolly*, 308 F.3d 1317, 1321 (Fed. Cir. 2002) (quoting *Spero v. Ringold*, 377 F.2d 652, 660 (C.C.P.A. 1967)). The Federal Circuit has opined that a court should apply the "rule of reason" in determining conception. That is, the court should examine, analyze, and evaluate reasonably all pertinent evidence when weighing credibility of an inventor's story. *Holmwood v. Sugavanam*, 948 F.2d 1236, 1239 (Fed. Cir. 1991). Evidence in the form of documents does not need to be corroborated. *Id.* Rather, "[o]nly the inventor's testimony requires

corroboration before it can be considered." *Price v. Symsek*, 988 F.2d 1187, 1195 (Fed. Cir. 1993).

Reduction to practice may either occur actually or constructively. Actual reduction to practice requires a showing by the inventor that "the invention is suitable for its intended purpose." *Mahurkar v. C.R. Bard, Inc.*, 79 F.3d 1572, 1578 (Fed. Cir. 1996). This may require actual testing for a complicated invention or may require only the complete construction of a prototype for a simple invention with obvious purpose and workability. *Id.* For a party alleging prior invention to establish that he actually reduced his invention to practice by testimony, he must corroborate his proffered testimony with independent evidence, which is evaluated under a rule of reason considering all the evidence. *Loral Fairchild Corp. v. Matsushita Elec. Indus. Corp. Ltd.*, 266 F.3d 1358, 1363 (Fed. Cir. 2001). Notably, there is no requirement that the "prior invention" be commercialized in order for it to be actually reduced to practice. *Steinberg v. Seitz*, 517 F.2d 1359, 1363 (C.C.P.A. 1975). The key is whether the invention can be commercialized or has reached the point where "practical men [would] take the risk of commercializing the invention." *Goodrich v. Harmsen*, 442 F.2d 377, 383 (C.C.P.A. 1971). Constructive reduction to practice, in contrast, occurs when a party alleging prior invention files a patent application on the claimed invention. *Hybritech*, 802 F.2d at 1376.

The party alleging prior invention must be able to show diligence "from a date just prior to the other party's conception to . . . [the date of] reduction to practice [by the party first to conceive]." *Monsanto Co. v. Mycogen Plant Sci., Inc.*, 261 F.3d 1356,

1369 (Fed. Cir. 2002); *Mahurkar*, 79 F.3d at 1577. However, it is not necessary for a party alleging prior invention to drop all other work and concentrate solely on the particular invention involved. *Rines v. Morgan*, 250 F.2d 365, 369 (C.C.P.A. 1957). There also need not be evidence of activity on every single day if a satisfactory explanation is evidenced. *Monsanto*, 261 F.3d at 1369 (citations omitted). Additionally, determining whether the required "reasonable diligence" has been satisfied involves specific inquiry. *Id.* (citations omitted).

In order to avoid a finding that a prior invention was abandoned, suppressed, or concealed, the party alleging prior invention must take affirmative steps to make the invention publicly known. *Friction Div. Prods., Inc. v. E. I. Du Pont de Nemours & Co.*, 658 F. Supp. 998, 1013 (D. Del. 1987) (citing *Ralston Purina Co. v. Far-Mar-Co, Inc.*, 586 F. Supp 1176, 1215 (D. Kan. 1984)). The Federal Circuit has explained that,

> when determining whether an inventor has abandoned, suppressed, or concealed an invention, a period of delay between completion of the invention and subsequent public disclosure may or may not be of legal consequence. The delay may be inconsequential if, for example, it is reasonable in length or excused by activities of the inventor. Furthermore, there is no particular length of delay that is per se unreasonable. Rather, a determination of abandonment, suppression, or concealment has "consistently been based on equitable principles and public policy as applied to the facts of each case." A court must determine whether, under the facts before it, any delay was reasonable or excused as a matter of law.

Checkpoint, 54 F.3d at 761 (citations omitted).

Finally, the party alleging prior invention must establish prior invention by clear and convincing evidence. *Apotex*, 254 F.3d at 1037-38. If the party alleging prior

invention does so, then the burden of production shifts to the patentee to produce evidence sufficient to create a genuine issue of material fact as to whether the party alleging prior invention abandoned, suppressed, or concealed the invention. *Id.* If the patentee carries this burden of production, then the party alleging prior invention may rebut the evidence of abandonment, suppression, or concealment with clear and convincing evidence. *Id.*

b. Analysis

Gevo contends that the inventors of the '376 patent conceived of the invention prior to February 17, 2010, the asserted priority date of Butamax's International Patent Application PCT/US2011/025258, which published as WO 2011/103300 ("the '300 publication"). (D.I. 20 at 26) To show conception and diligent reduction to practice, Dr. Aselson, one of the '376 inventors, relies on her work and a series of corroborating documents to show conception by September 2009 and follow-up research until the filing of the '952 application, on November 24, 2009.[28] (11-54 D.I. 617) The inventor's notebooks, in September 2009, show the concept of overexpressing AFT and DHAD in the same cell using standard yeast recombinant technology. (*Id.* at ¶ 8; 11-54 D.I. 619,

[28]The court briefly addresses Butamax's objections to Dr. Asleson's declaration. Dr. Asleson has defined her regular contact with her co-inventors and her review of the notebooks and discussion about the data. (11-54 D.I. 617 at ¶¶ 3-4) Dr. Asleson, as an inventor, may provide background information and explanations of problems existing at the time of invention. *Voice Technologies Group, Inc. v. VMC Systems, Inc.*, 164 F.3d 605, 615 (Fed. Cir. 1999) ("An inventor is a competent witness to explain the invention and what was intended to be conveyed by the specification and covered by the claims. The testimony of the inventor may also provide background information, including explanation of the problems that existed at the time the invention was made and the inventor's solution to these problems."). Butamax may bring up any specific issues at the pre-trial conference.

ex. 88) That the inventors had not actually performed experiments and obtained the hypothesized results does not necessarily preclude a finding of conception. However, conception must encompass all limitations of the claimed invention, and "is complete only when the idea is so clearly defined in the inventor's mind that only ordinary skill would be necessary to reduce the invention to practice, without extensive research or experimentation." Butamax's numerous factual questions regarding whether Gevo merely had "a wish list or plan for obtaining increased DHAD activity" present genuine issues of material fact, thus precluding the entry of summary judgment.[29] *Singh*, 317 F.3d at 1340 (citations omitted); (D.I. 23 at 33)

C. Excluding Expert Testimony

Rule 702 of the Federal Rules of Civil Procedure allows a qualified witness to testify in the form of an opinion if the witness' "scientific, technical, or other specialized knowledge will help the trier of fact to understand the evidence or to determine a fact in issue" and if his/her testimony is the product of reliable principles and methods which have been reliably applied to the facts of the case. Butamax moves to exclude the testimony and reports of Gevo's expert, Dr. Winge, on infringement of the '376 patent. Butamax's arguments that Dr. Winge did not independently conduct experiments as part of his analysis do not preclude his testimony or opinions. (D.I. 22 at 13-14) "A patentee may prove . . . infringement by either direct or circumstantial evidence. There

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[29]As there are genuine issues of material fact regarding whether Butamax's '300 publication is anticipatory prior art based on priority dates and conception arguments, the court does not address Butamax's substantive anticipation argument. However, if the '300 publication is found to be anticipatory, Gevo is precluded from making substantive arguments against anticipation as it did not do so herein. (D.I. 20 at 26; 11-54 D.I. 594, ex. 17 at ¶¶ 67-70)

is no requirement that direct evidence be introduced." *Liquid Dynamics Corp. v. Vaughan Co.*, 449 F.3d 1209, 1219 (Fed. Cir. 2006) (citing *Moleculon Research Corp. v. CBS, Inc.*, 793 F.2d 1261, 1272 (Fed. Cir. 1986) (abrogated on other grounds)). Dr. Winge formed his opinions based on scientific literature and was not required to retest the results and methods detailed therein. Butamax's arguments are based on specific factual statements made by Dr. Winge, which go to the weight of the testimony and should be addressed on cross-examination.

VI. Conclusion

For the foregoing reasons, the court grants Butamax's motion for summary judgment of non-infringement of the '375 and '376 patents (D.I. 17), grants in part and denies in part Butamax's motion for summary judgment of invalidity of the '375 and '376 patents (D.I. 15), and denies Gevo's summary judgment motion of validity of the '376 patent (D.I. 19). The court also denies Butamax's motion to exclude expert testimony on the '376 patent. (D.I. 21) An appropriate order shall issue.