

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
19 March 2009 (19.03.2009)

PCT

(10) International Publication Number
WO 2009/036067 A3

(51) International Patent Classification:

C12N 15/74 (2006.01) C07K 14/195 (2006.01)
C12N 15/00 (2006.01) C07K 14/02 (2006.01)
C12N 1/21 (2006.01) C12P 21/06 (2006.01)

(21) International Application Number:

PCT/US2008/075858

(22) International Filing Date:

10 September 2008 (10.09.2008)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

60/971,418 11 September 2007 (11.09.2007) US
60/971,412 11 September 2007 (11.09.2007) US
61/130,892 2 June 2008 (02.06.2008) US

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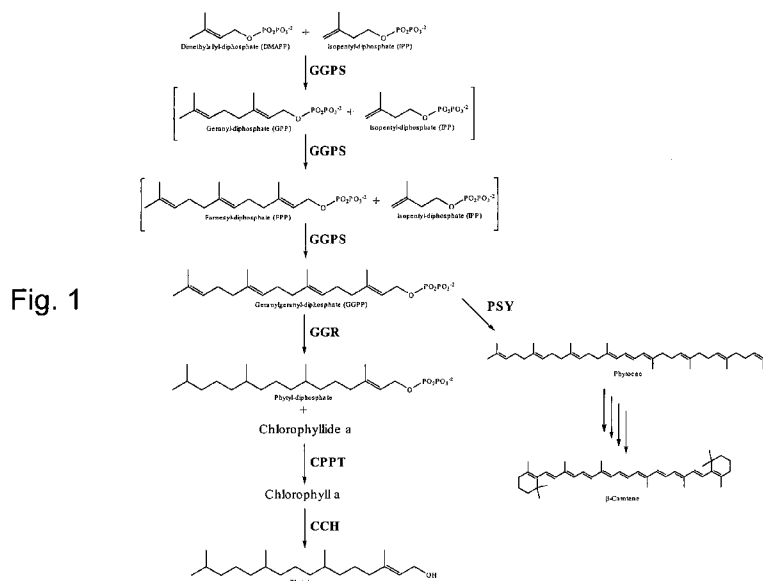
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(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MT, NL, NO, PL, PT, RO, SE, SI, SK, TR), OAPI

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(54) Title: MOLECULE PRODUCTION BY PHOTOSYNTHETIC ORGANISMS



(57) Abstract: The present invention provides compositions and methods for producing products by photosynthetic organisms. The photosynthetic organisms are genetically modified to effect production, secretion, or both, of products. The methods and compositions are particularly useful in the petrochemical industry.

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(BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*

Published:

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

(88) Date of publication of the international search report:
27 August 2009

A. CLASSIFICATION OF SUBJECT MATTER

C12N 15/74(2006.01)i, C12N 15/00(2006.01)i, C12N 1/21(2006.01)i, C07K 14/195(2006.01)i, C07K 14/02(2006.01)i, C12P 21/06(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 8 C12N 15/74, C12N 15/82, C12N 1/20

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
N.A.

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

eKIPASS, WPI, USPTO, PAJ, NCBI, PubMed : INSPECT "isoprenoid, enzyme, nucleic acid, promoter, chloroplast, phosphate, microalgae, etc."

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 7129392 B2 (Hahn F.M., et al., US) 31 Oct 2006 - see abstract; col.1, line 35 ~ col.3, line 31; col.4, lines 24 ~ 55; col.7, line 49 ~ col.10, line 24; col.17, line 63 ~ col.19, line 44; EXAMPLE 19; and claims	1-11, 32, 33 and 22-27 (partial)
A	US 6072045 A (Chappell, J., et al., US) 06 Jun 2000 - see abstract; col.2, line 49 ~ col.4, line 3; & claims	1-11, 32, 33 and 22-27 (partial)
A	US 2003-0166255 A1 (Chappell, J., et al., US) 04 Sep 2003 - see abstract; & claims	1-11, 32, 33 and 22-27 (partial)
A	Biochem. J. vol.333:381-388 (Disch, A., et al., DE) 1998 "Distribution of the mevalonate and glyceraldehyde phosphate/pyruvate pathways for isoprenoid biosynthesis in unicellular algae and the cyanobacterium Synechocystis PCC 6714" - see abstract; pages 381 ~ 382; page 384; and Table 1	1-11, 32, 33 and 22-27 (partial)

Further documents are listed in the continuation of Box C.

See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family


Date of the actual completion of the international search

29 JUNE 2009 (29.06.2009)

Date of mailing of the international search report

29 JUNE 2009 (29.06.2009)

Name and mailing address of the ISA/KR

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

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

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

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

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

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

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

- see the Extra sheet

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

4. No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:
1-11, 32, 33 and 22-27 (partial)

Remark on Protest

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

Box No. III Lack of Unity of Invention

This ISA found multiple inventions in this application as follows:

- Group 1 : claims 1-11, 32, 33 and claims 22-27 (partial) feature a vector comprising a nucleic acid encoding an enzyme that produces an isoprenoid with two phosphates and a promoter for expression in a chloroplast of a non-vascular, photosynthetic organism
- Group 2 : claims 12-21 and claims 22-27 (partial) feature a vector comprising a nucleic acid encoding an enzyme that produces an isoprenoid with two phosphates and a nucleic acid encoding a chloroplast targeting molecule
- Group 3 : claims 28-31 are drawn to a host cell comprising at least two copies of a nucleotide sequence of Table 5
- Group 4 : claims 34-50 are drawn to a method of producing an isoprenoid comprising transforming a chloroplast of a non-vascular, photosynthetic organism with a nucleic acid encoding an enzyme that produces an isoprenoid with two phosphates and (b) collecting said isoprenoid
- Group 5 : claims 51-54 are drawn to a genetically modified chloroplast, wherein said chloroplast comprises a nucleic acid encoding at least one isoprenoid producing enzyme in a high saline environment
- Group 6 : claims 55-60 are drawn to a method for preparing an isoprenoid comprising transforming an organism with a nucleic acid to increase production of isoprenoid in a high saline environment
- Group 7 : claims 61-66 are drawn to a vector comprising a heterologous nucleic acid encoding at least one isoprenoid producing enzyme and a promoter for expression in a photosynthetic bacteria
- Group 8 : claims 67-70 are drawn to a host cell (a non-vascular, photosynthetic organism) comprising a nucleic acid encoding a botryococcene synthase and a nucleic acid encoding an FPP synthase
- Group 9 : claims 71-91, 92-96, 97-109 and 120-127 feature a nucleic acid encoding a protein and a nucleic acid encoding a selectable marker in one open reading frame expressed in a non-vascular, photosynthetic organism
- Group 10 : claims 110-119 are drawn to a nucleic acid encoding a protein and a nucleic acid encoding a selectable marker expressed in a non-vascular, photosynthetic organism
- Group 11 : claims 128-138, 139-147 and 148-157 feature a nucleic acid that results in an increase in production of phytol expressed in a non-vascular photosynthetic organism
- Group 12 : claims 158-163 are drawn to a composition comprising at least 3% phytol and a trace amount of a cellular portion of a genetically modified non-vascular photosynthetic organism

1) *a priori* lack of Unity :

Groups 1-8 and Groups 11 & 12 (called 'Group I' hereafter) concern production of isoprenoid, whereas Groups 9 & 10 (called 'Group II' hereafter) concern a nucleic acid encoding a protein and a nucleic acid encoding a selectable marker to be expressed in a non-vascular, photosynthetic organism.

- Continued on the following sheet

Inventions belonging to Groups I & II do not share a single general inventive concept linking the two Groups together within the meaning of PCT Rule 13.1.

2) *a posteriori* lack of Unity as to Group I :

The single general concept linking Groups 1-8, 11 & 12 together is merely "a nucleic acid encoding at least one isoprenoid producing enzyme" or "production of isoprenoid in a non-vascular, photosynthetic organism.

This common concept is, however, described in US 7129392 B2, 31 Oct 2006, (Hahn F.M., et al., US) and, therefore, does not represent any contribution over the prior art.

Hence the inventions listed as Groups 1-8, 11 & 12 do not relate to a single general inventive concept under PCT Rule 13.1 because the above mentioned common concept fails to make a contribution over the prior art within the meaning of PCT Rule 13.2.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2008/075858

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 7129392 B2	31.10.2006	US 2003-0033626 A1	13.02.2003
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