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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, BN, BR, BW, BY, BZ, CA, CH, CL, 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, IR, IS, JP, KE, KG, 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, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.
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— with international search report (Art. 21(3))

[Continued on nextpage]

- (54) Title: RECOMBINANT MICROORGANISMS HAVING A METHANOL ELONGATION CYCLE (MEC)

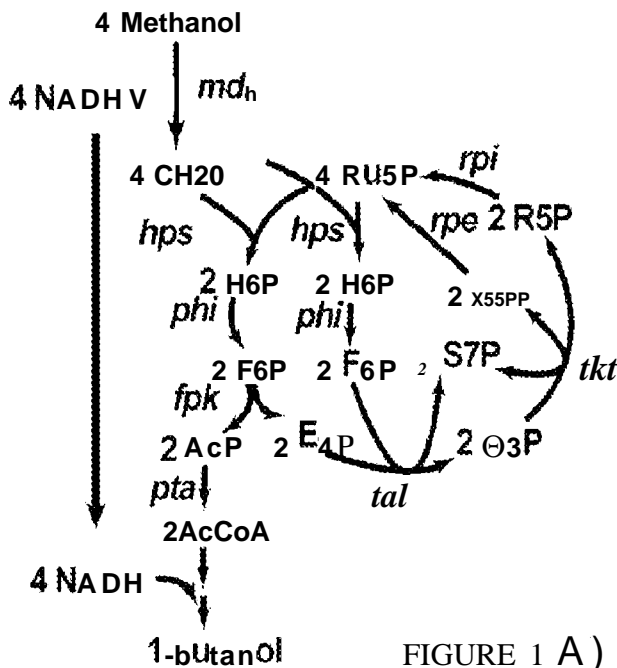


FIGURE 1 A)

(57) Abstract: Provided are microorganisms that catalyze the synthesis of chemicals and biochemicals from a methanol, methane and/or formaldehyde. Also provided are methods of generating such organisms and methods of synthesizing chemicals and biochemicals using such organisms.

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— *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))*

— *with sequence listing part of description (Rule 5.2(a))*

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13 November 2014

INTERNATIONAL SEARCH REPORT

014/029603-12.09.2014

International application No.

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A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - C12N 15/81 (201 4.01)

USPC - 435/92

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 1/20, 9/88, 15/60, 15/81 ; C12P 7/04, 7/54, 7/62, 13/08, 19/32, 19/34 (2014.01)
 USPC - 435/92; 135, 140, 157, 254.2

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
 CPC - C12N 15/81 ; C12P 7/04, 7/54, 7/62, 19/32 (2014.06)

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

Orbit, Google Patents, Google Scholar

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	WO 2012/098662 A1 (MURAMATSU et al) 26 July 2012 (26.07.2012) entire document; see machine translation	1-5, 61-74, 79-82, 84-87, 89-100
Y	LJUNGDAHL et al. "Incorporation of C14 From Carbon Dioxide into Sugar Phosphates, Carboxylic Acids, and Amino Acids by Clostridium thermoaceticum" Journal of Bacteriology, 01 April 1965 (01.04.1965), Vol. 89, No. 4, Pgs. 1055-1064. entire document	1-5, 61-74, 79-82, 92-100
Y	WO 2010/038903 A1 (GRONSKY et al) 08 April 2010 (08.04.2010) entire document	1-5, 61-74, 79-82, 84, 85-87
Y	KUYPER et al. "Metabolic engineering of a xylose-isomerase-expressing Saccharomyces cerevisiae strain for rapid anaerobic xylose fermentation" FEMS Yeast Research, 26 November 2004 (26.11.2004), Vol. 5, Pgs. 399-409. entire document	80-82, 85
Y	SHEN et al. "Driving Forces Enable High-Titer Anaerobic 1-Butanol Synthesis in Escherichia coli." Applied and Environmental Microbiology, 01 May 2011 (01.05.2011), Vol. 77, No. 9, Pgs. 2905-2915. entire document	86, 87, 90, 91
Y	EP 1 063 288 A2 (TSUJIMOTO) 27 December 2000 (27.12.2000) entire document	89-91
A	US 2013/0295616 A1 (MURAMATSU et al) 07 November 2013 (07.11.2013) entire document	1-5, 61-74, 79-82, 84-87, 89-100

H Further documents are listed in the continuation of Box C.

* Special categories of cited documents:	"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
"A" document defining the general state of the art which is not considered to be of particular relevance	"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
"E" earlier application or patent but published on or after the international filing date	"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
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&" document member of the same patent family
"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	

Date of the actual completion of the international search	Date of mailing of the international search report
20 August 2014	12 SEP 2014

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 PCT OSP: 571-272-7774

Box No. I Nucleotide and/or amino acid sequence(s) (Continuation of item I.c of the first sheet)

1. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the international search was carried out on the basis of a sequence listing filed or furnished:

a. (means)



on paper



in electronic form

b. (time)



in the international application as filed



together with the international application in electronic form



subsequently to this Authority for the purposes of search

2. In addition, in the case that more than one version or copy of a sequence listing has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

3. Additional comments:

SEQ ID NOs:2, 14, 16, 18, 20, and 22 were searched.

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.: 6-60, 75-78, 83, 88, 101-107
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:

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

4. No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

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.