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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, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, 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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Published:

- with international search report (Art. 21(3))
- 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))

(88) Date of publication of the international search report:

3 October 2013

(54) Title: RECOMBINANT MICROORGANISMS AND METHODS OF USE THEREOF

(57) Abstract: The invention relates to methods for the production of chemical compounds, particularly but not exclusively ethanol, by microbial fermentation. Also described are genetically modified micro-organisms capable of using carbon monoxide to produce one or more products, particularly but not exclusively ethanol as a main product, and producing a reduced amount or substantially no 2,3-butanediol and/or a precursor thereof.



WO 2013/115659 A3

INTERNATIONAL SEARCH REPORT

International application No.
PCT/NZ2013/000012**A. CLASSIFICATION OF SUBJECT MATTER****C12N 1/21(2006.01)i, C12N 15/52(2006.01)i, C12N 15/53(2006.01)i, C12N 15/74(2006.01)i, C12P 7/06(2006.01)i, C12P 7/40(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)

C12N 1/21; C12M 1/00; C12P 5/02; C12P 21/04; C12P 7/18; C12N 9/16; C12N 9/10; C12P 7/02; C12P 7/06; C12N 15/52; C12N 15/53; C12N 15/74; C12P 7/40

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

Korean utility models and applications for utility models
Japanese utility models and applications for utility models

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

eKOMPASS(KIPO internal) & keywords: carboxydrotrophic acetogenic, 2,3 butanediol biosynthesis pathway, carbon monoxide, ethanol, Clostridium

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 2010-121849 A1 (EVONIK DEGUSSA GMBH) 28 October 2010 See claims 1-2.	1-4, 15-18
A	US 2008-0293101 A1 (PETERS, MATTHEW W. et al.) 27 November 2008 See claims 1 and 10-11.	1-4, 15-18
A	WO 2009-113878 A1 (LANZATECH NEW ZEALAND LIMITED) 17 September 2009 See claims 1-2.	1-4, 15-18
A	ABRINI, JAMAL et al., "Clostridium autoethanogenum, sp. nov., an anaerobic bacterium that produces ethanol from carbon monoxide", Archives of Microbiology, April 1994, Vol. 161, No. 4, pp 345-351. See age 345.	1-4, 15-18
A	US 2010-0285548 A1 (FRIEDMANN, HANS et al.) 11 November 2010 See claim 22.	1-4, 15-18

 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

25 July 2013 (25.07.2013)

Date of mailing of the international search report

26 July 2013 (26.07.2013)

Name and mailing address of the ISA/KR


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INTERNATIONAL SEARCH REPORT

International application No.
PCT/NZ2013/000012

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.: 14,29
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:
Claims 14 and 29 are unclear since they refer to claims which are not searchable due to not being drafted in accordance with the second and third sentence of Rule 6.4(a).

3. Claims Nos.: 5-13,19-28
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 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.:

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.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/NZ2013/000012

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2010-121849 A1	28/10/2010	AU 2010-241185 A1 CN 102414314 A DE 102009002583 A1 EP 2421960 A1 JP 2012-524529 A US 2012-0101304 A1	27/10/2011 11/04/2012 28/10/2010 29/02/2012 18/10/2012 26/04/2012
US 2008-0293101 A1	27/11/2008	WO 2008-013996 A2 WO 2008-013996 A3	31/01/2008 02/10/2008
WO 2009-113878 A1	17/09/2009	AU 2009-224112 A1 AU 2009-224112 B2 AU 2009-224112 B9 CA 2718219 A1 CA 2718219 C CN 101998997 A EA 201071067 A1 EP 2250274 A1 EP 2250274 A4 JP 2011-512869 A JP 2013-063081 A KR 10-2010-0132974 A NZ 587563 A US 2011-0059499 A1 US 8119378 B2	17/09/2009 16/08/2012 31/01/2013 17/09/2009 08/01/2013 30/03/2011 29/04/2011 17/11/2010 22/08/2012 28/04/2011 11/04/2013 20/12/2010 27/07/2012 10/03/2011 21/02/2012
US 2010-0285548 A1	11/11/2010	CN 101861394 A DE 102007048277 A1 EP 2198034 A2 US 8426162 B2 WO 2009-047275 A2 WO 2009-047275 A3 WO 2009-047275 A8	13/10/2010 09/04/2009 23/06/2010 23/04/2013 16/04/2009 06/08/2009 05/11/2009