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C12P 7/06 (2006.01) *C12R 1/91* (2006.01)

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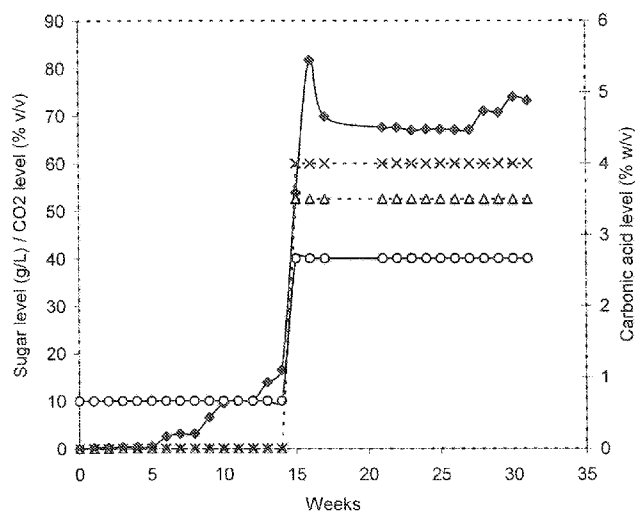
(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, 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, 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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[Continued on next page]

(54) Title: PHOTOSYNTHETIC PROCESS

Fig 1:



(57) Abstract: The present invention provides a method of producing a photosynthetic product, the method comprising maintaining a photosynthetic plant or algal cell suspension culture, in the presence of water, light and a carbonic acid-enriched growth medium. The carbonic acid may, for example be provided by feeding the photosynthetic plant cell suspension culture with a carbonic acid solution, a solid or liquid precursor thereof, or a gaseous mixture of carbon dioxide and one or more other gases. The invention also provides a method for producing a photosynthetic product, the method comprising maintaining a photosynthetic plant or algal cell suspension culture, in the presence of water, light and a carbon source selected from carbon dioxide and carbonic acid, wherein the culture is maintained at a pH of less than 7.0, preferably 4.5 to 5.5.



UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (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))*

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INTERNATIONAL SEARCH REPORT

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A. CLASSIFICATION OF SUBJECT MATTER		
INV.	C12P19/02 C12R1/91	C12P19/12 C12P7/06 C12P7/64 C12R1/89
ADD.		
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) C12P C12N		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) EPO-Internal, WPI Data, EMBASE, BIOSIS, INSPEC		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP 7 087958 A (MATSUNAGA TADASHI; MITSUBISHI HEAVY IND LTD) 4 April 1995 (1995-04-04) cited in the application	1-6,8, 11,14, 15,17, 21,27, 83-85
Y	abstract	1-21, 25-32, 83-87
X	JP 55 018449 A (DAINIPPON INK & CHEMICALS) 8 February 1980 (1980-02-08)	1-4, 83-85
Y	abstract	1-32, 83-87
X	US 2005/221456 A1 (SRINIVASAN VENKATESH [US] ET AL) 6 October 2005 (2005-10-06)	1-4, 83-85
Y	page 2, paragraph 20 page 6, paragraph 57; examples 2,4-8	1-32, 83-87
	-/-	
☒ 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 another 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 10 December 2012		Date of mailing of the international search report 19/12/2012
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016		Authorized officer Mateo Rosell, A

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International application No.
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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 additional 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 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.:

1-32, 83-87
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.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 22-24(completely); 1-21, 25-32, 83-87(partially)

A method for producing a photosynthetic product, comprising maintaining a photosynthetic plant cell suspension culture, in the presence of water, light and in a carbonic acid-enriched growth medium

2. claims: 1-21, 25-32, 83-87(all partially)

A method for producing a photosynthetic product, comprising maintaining a photosynthetic algal cell suspension culture, in the presence of water, light and in a carbonic acid-enriched growth medium.

3. claims: 33-65, 79-82

A method for the production of a biological product comprising (i) maintaining a first cell suspension culture of photosynthetic plant or algal cells in a carbonic acid-enriched medium to generate and release a photosynthetic product; and (ii) maintaining a second culture in the presence of a photosynthetic product generated by (i) to allow growth and production of the biological product.

4. claims: 66-78

A two-culture system for producing a biological product, comprising a first cell culture and a second cell culture and its use; a carbon dioxide capture system and use thereof; a carbon dioxide producing power generating facility

INTERNATIONAL SEARCH REPORT

International application No
PCT/GB2012/051135

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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Y	example 7	1-32, 83-87
X	----- WO 2009/133351 A2 (ECO RECLAIM LTD [GB]; WHITTON PETER ANDREW [GB]; DIXON GEOFFREY ROBERT) 5 November 2009 (2009-11-05) cited in the application	1-4, 83-87
Y	page 11, line 19 - page 12, line 23 page 15, line 31 - page 16, line 16 page 16, line 18 - page 18, line 15 page 18, line 27 - page 19, line 10 page 20, line 27 - page 22, line 4; example 5	1-32, 83-87
X	----- DE 100 59 372 A1 (JANSEN MARCEL [DE]) 6 June 2002 (2002-06-06) abstract page 1, paragraph [0007]; figure 1	1
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Y	----- PUTT R ET AL: "An efficient system for carbonation of high-rate algae pond water to enhance CO ₂ mass transfer", BIORESOURCE TECHNOLOGY, ELSEVIER BV, GB, vol. 102, no. 3, 1 February 2011 (2011-02-01), pages 3240-3245, XP027582980, ISSN: 0960-8524 [retrieved on 2011-01-04] abstract page 3241, left-hand column, last paragraph - page 3245, left-hand column, paragraph 2; tables 1,2 ----- -/-	1-32, 83-87

INTERNATIONAL SEARCH REPORT

International application No

PCT/GB2012/051135

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	CHINNASAMY S ET AL: "Biomass production potential of a wastewater alga chlorella vulgaris ARC 1 under elevated levels of CO₂ and temperature", INTERNATIONAL JOURNAL OF MOLECULAR SCIENCES 200902 CH LNKD-DOI:10.3390/IJMS10020518, vol. 10, no. 2, February 2009 (2009-02), pages 518-532, XP002684810, ISSN: 1422-0067 abstract page 519, paragraph 4; figures 1,2 page 521, paragraph 1 - page 524, paragraph 1; figures 3-4; table 1 page 525, paragraph 2 - page 526, paragraph 3 -----	1-32, 83-87
Y	RODRIGUEZ-MAROTO J M ET AL: "Air bubbling results in carbon loss during microalgal cultivation in bicarbonate-enriched media: experimental data and process modeling", AQUACULTURAL ENGINEERING, ELSEVIER SCIENCE PUBLISHERS LTD, AMSTERDAM, NL, vol. 32, no. 3-4, 1 April 2005 (2005-04-01), pages 493-508, XP027721374, ISSN: 0144-8609 [retrieved on 2005-04-01] abstract page 494, paragraph 1 - page 495, paragraph 2; table 1 page 506, paragraph 2 - page 507, paragraph 3 -----	1-32, 83-87
Y	JP 5 015363 A (MITSUBISHI AGRICULT MACH) 26 January 1993 (1993-01-26) cited in the application abstract -----	1-32, 83-87

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/GB2012/051135

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