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- (81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM,

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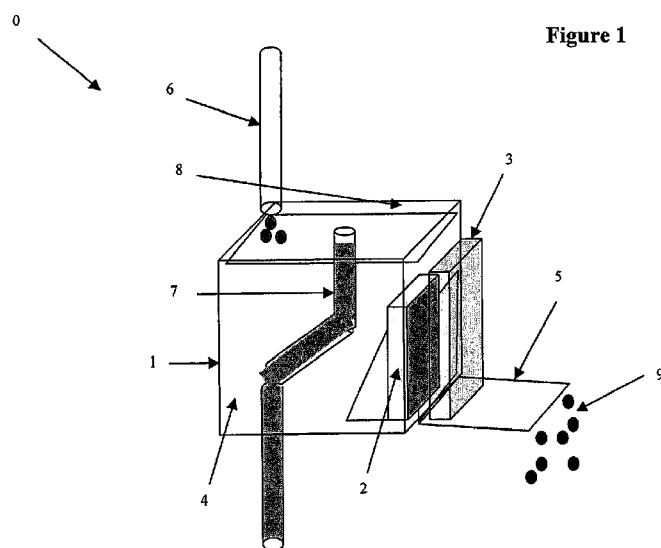
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**Published:**

- 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))

(88) Date of publication of the international search report:  
11 April 2013

(54) Title: MICROBIAL FUEL CELL



(57) Abstract: The present invention provides an arrangement of microbial fuel cells (MFCs) in which the MFCs are in discontinuous flow communication, methods of operating such an arrangement, methods of hydrogen production and electrical production using such an arrangement, a digester for use in the arrangement and methods of increasing power output from the arrangement.

WO 2012/120314 A3

# INTERNATIONAL SEARCH REPORT

International application No PCT/GB2012/050537
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<b>A. CLASSIFICATION OF SUBJECT MATTER</b> INV. H01M8/16 ADD.				
According to International Patent Classification (IPC) or to both national classification and IPC				
<b>B. FIELDS SEARCHED</b>				
Minimum documentation searched (classification system followed by classification symbols) H01M				
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				
<b>C. DOCUMENTS CONSIDERED TO BE RELEVANT</b>				
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.		
X  Y	WO 2010/147683 A1 (INTACT LABS LLC [US]; SILVER MATTHEW [US]; BUCK JUSTIN [US]; TAYLOR NO) 23 December 2010 (2010-12-23) page 21, paragraph 2-5; figure 10 page 22, paragraph 2 page 9, paragraph 1; figure 2 figure 1  -----  -/--	1,3, 10-13, 15-40 14		
<table style="width: 100%; border: none;"> <tr> <td style="width: 50%; border: none;"><input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C.</td> <td style="width: 50%; border: none;"><input checked="" type="checkbox"/> See patent family annex.</td> </tr> </table>			<input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C.	<input checked="" type="checkbox"/> See patent family annex.
<input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C.	<input checked="" type="checkbox"/> 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	Date of mailing of the international search report			
11 June 2012	05/02/2013			
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  Koessler, Jean-Luc			

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**INTERNATIONAL SEARCH REPORT**

International application No PCT/GB2012/050537
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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	GALVEZ A ET AL: "Landfill leachate treatment with microbial fuel cells; scale-up through plurality", BIORESOURCE TECHNOLOGY, ELSEVIER BV, GB, vol. 100, no. 21, 1 November 2009 (2009-11-01), pages 5085-5091, XP026321202, ISSN: 0960-8524, DOI: 10.1016/J.BIORTECH.2009.05.061 [retrieved on 2009-06-25]	1-10,12, 13, 15-21, 23,27, 29, 31-36, 38,39
Y	page 5086, paragraph 2.5; figure 1 page 5085, paragraph 2.1 -----	14
Y	US 7 695 834 B1 (BOROLE ABHIJEET P [US]) 13 April 2010 (2010-04-13) column 12, paragraph 18-23 -----	14

# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/GB2012/050537

## 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.:
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.:

1-40

### 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: 1-40

An arrangement of multiple microbial fuel cells (MFCs) in which the MFCs are in discontinuous flow communication and related methods of claims 34-40, 54.

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2. claims: 41-56

A digester for use in the arrangement of any of claims 1 to 33.

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3. claims: 57-59

A method of optimising the mixed bacterial community of claim 44 or 45

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4. claims: 60, 61

A perfusion matrix biofilm that can be transplanted from one digester to another, in order to start a new bacterial community.

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5. claim: 62

A microbial fuel cell (MFC) comprising a ceramic proton exchange membrane (PEM).

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# INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/GB2012/050537

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2010147683	A1	23-12-2010	
		AU 2010260473 A1	02-02-2012
		CA 2765767 A1	23-12-2010
		EP 2443070 A1	25-04-2012
		JP 2012529987 A	29-11-2012
		US 2012132521 A1	31-05-2012
		WO 2010147683 A1	23-12-2010
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US 7695834	B1	13-04-2010	
		US 7695834 B1	13-04-2010
		WO 2010044983 A2	22-04-2010
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