

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference IITM-017100WO		FOR FURTHER ACTION see Form PCT/ISA/220 as well as, where applicable, item 5 below.	
International application No. PCT/IN2020/050739	International filing date (day/month/year) 24-08-2020	(Earliest) Priority Date (day/month/year) 23-08-2019	
Applicant INDIAN INSTITUTE OF TECHNOLOGY MADRAS (IIT MADRAS)			

This international search report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This international search report consists of a total of 3 sheets.

It is also accompanied by a copy of each prior art document cited in this report.

1. **Basis of the report**

a. With regard to the **language**, the international search was carried out on the basis of:

the international application in the language in which it was filed.

a translation of the international application into _____ which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b)).

b. This international search report has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43.6bis(a)).

c. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, see Box No. I.

2. **Certain claims were found unsearchable** (see Box No. II).

3. **Unity of invention is lacking** (see Box No. III).

4. With regard to the **title**,

the text is approved as submitted by the applicant.

the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,

the text is approved as submitted by the applicant.

the text has been established, according to Rule 38.2, by this Authority as it appears in Box No. IV. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. With regard to the **drawings**,

a. the figure of the **drawings** to be published with the abstract is Figure No. 1

as suggested by the applicant.

as selected by this Authority, because the applicant failed to suggest a figure.

as selected by this Authority, because this figure better characterizes the invention.

b. none of the figures is to be published with the abstract.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IN2020/050739

A. CLASSIFICATION OF SUBJECT MATTER F03G7/00,B01D69/00 Version=2020.01		
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) F03G, B01D		
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) TotalPatent One, IPO Internal Database		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP3475567A1 (ECOLE POLYTECHNIQUE FED LAUSANNE EPFL[CH]) 01 MAY, 2019 (01.05.2019) (Abstract; Paragraphs [0003], [0005]-[0042], [0044]-[53], [0057]-[0065], [0069]-[0124], [0127]-[0201]; Figures 1-12; Claims 1-17 & 20)	1-9
A	EP3344374A1 (CENTRE NAT RECH SCIENT [FR]; SWEETCH ENERGY [FR]) 11 JULY, 2018 (11.07.2018) (Whole Document)	1-9
A	JP2017196559A (ALTEC CORP; BIOREDOX KENKYUSHOKK; WATARI TAKAKIYO) 02 NOVEMBER, 2017 (02.11.2017) (Whole Document)	1-9
<input 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 "D" document cited by the applicant in the international application "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 10-12-2020		Date of mailing of the international search report 10-12-2020
Name and mailing address of the ISA/ Indian Patent Office Plot No.32, Sector 14,Dwarka,New Delhi-110075 Facsimile No.		Authorized officer Prakash Raushan Telephone No. +91-1125300200

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/IN2020/050739

Citation	Pub.Date	Family	Pub.Date
EP 3475567 A1	01-05-2019	EP 3263896 A1	03-01-2018
		EP 3475567 B1	26-02-2020
		US 10801478 B2	13-10-2020
		US 2019226463 A1	25-07-2019
		WO 2018002099 A1	04-01-2018
EP 3344374 A1	11-07-2018	AU 2016313787 A1	12-04-2018
		CA 2997169 A1	09-03-2017
		CN 108367242 A	03-08-2018
		JP 2018530866 A	18-10-2018
		KR 20180057640 A	30-05-2018
		US 2018353906 A1	13-12-2018
		WO 2017037213 A1	09-03-2017
JP 2017196559 A	02-11-2017	JP 6171047 B1	26-07-2017

PATENT COOPERATION TREATY

From the INTERNATIONAL SEARCHING AUTHORITY

PCT

NOTIFICATION OF TRANSMITTAL OF
THE INTERNATIONAL SEARCH REPORT AND
THE WRITTEN OPINION OF THE INTERNATIONAL
SEARCHING AUTHORITY, OR THE DECLARATION

(PCT Rule 44.1)

To: INDIAN INSTITUTE OF TECHNOLOGY MADRAS (IIT MADRAS) VENKATARAMAN, SHANKAR MAXVAL IP SERVICES PVT. LTD. INDIALAND TECHPARK CHIL SEZ, SARAVANAMPATTY PO ,COIMBATORE-641035 India

Date of mailing <i>(day/month/year)</i>	10-12-2020
Applicant's or agent's file reference IITM-017100WO	FOR FURTHER ACTION See paragraphs 1 and 4 below
International application No. PCT/IN2020/050739	International filing date <i>(day/month/year)</i> 24-08-2020
Applicant INDIAN INSTITUTE OF TECHNOLOGY MADRAS (IIT MADRAS)	

1. The applicant is hereby notified that the international search report and the written opinion of the International Searching Authority have been established and are transmitted herewith.

Filing of amendments and statement under Article 19:
The applicant is entitled, if he so wishes, to amend the claims of the international application (see Rule 46):

When? The time limit for filing such amendments is normally two months from the date of transmittal of the international search report.

How? Directly to the International Bureau preferably through ePCT, or on paper to:
The International Bureau of WIPO, 34, chemin des Colombettes, 1211 Geneva 20, Switzerland

For more detailed instructions, see the *PCT Applicant's Guide*, International Phase, paragraphs 9.004 – 9.011.

2. The applicant is hereby notified that no international search report will be established and that the declaration under Article 17(2)(a) to that effect and the written opinion of the International Searching Authority are transmitted herewith.

3. **With regard to any protest** against payment of (an) additional fee(s) under Rule 40.2, the applicant is notified that:

the protest together with the decision thereon has been transmitted to the International Bureau together with any request to forward the texts of both the protest and the decision thereon to the designated Offices.

no decision has been made yet on the protest; the applicant will be notified as soon as a decision is made.

4. **Reminders**

The applicant may **submit comments on an informal basis on the written opinion of the International Searching Authority** to the International Bureau. These comments will be made available to the public after international publication. The International Bureau will send a copy of such comments to all designated Offices unless an international preliminary examination report has been or is to be established.

Shortly after the expiration of **18 months from the priority date, the international application will be published** by the International Bureau. If the applicant wishes to avoid or postpone publication, a notice of withdrawal of the international application, or of the priority claim, must reach the International Bureau before the completion of the technical preparations for international publication (Rules 90*bis*.1 and 90*bis*.3).

Within **19 months** from the priority date, but only in respect of some designated Offices, a demand for international preliminary examination must be filed if the applicant wishes to postpone the entry into the national phase **until 30 months** from the priority date (in some Offices even later); otherwise, the applicant must, **within 20 months** from the priority date, perform the prescribed acts for **entry into the national phase** before those designated Offices. In respect of other designated Offices, the time limit of **30 months** (or later) will apply even if no demand is filed within 19 months. For details about the applicable time limits, Office by Office, see www.wipo.int/pct/en/texts/time_limits.html and the *PCT Applicant's Guide*, National Chapters.

Within **22 months from the priority date, the applicant may request that a supplementary international search be carried out** by a different International Searching Authority that offers this service (Rule 45*bis*.1). The procedure for requesting supplementary international search is described in the *PCT Applicant's Guide*, International Phase, paragraphs 8.006-8.032.

Name and mailing address of the ISA/ Indian Patent Office Plot No. 32, Sector 14, Dwarka, New Delhi- 110075 Facsimile No.	Authorized officer Prakash Raushan Telephone No. +91-1125300200
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PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

PCT

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43bis.1)

To: VENKATARAMAN, SHANKAR MAXVAL IP SERVICES PVT. LTD. INDIALAND TECHPARK CHIL SEZ, SARAVANAMPATTY PO, COIMBATORE-641035 India
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Date of mailing <i>(day/month/year)</i> 10-12-2020

Applicant's or agent's file reference IITM-017100WO	FOR FURTHER ACTION See paragraph 2 below
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International application No. PCT/IN2020/050739	International filing date <i>(day/month/year)</i> 24-08-2020	Priority date <i>(day/month/year)</i> 23-08-2019
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International Patent Classification (IPC) or both national classification and IPC F03G7/00,B01D69/00 Version=2020.01

Applicant INDIAN INSTITUTE OF TECHNOLOGY MADRAS (IIT MADRAS)

<p>1. This opinion contains indications relating to the following items:</p> <ul style="list-style-type: none"> <input checked="" type="checkbox"/> Box No. I Basis of the opinion <input type="checkbox"/> Box No. II Priority <input type="checkbox"/> Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability <input type="checkbox"/> Box No. IV Lack of unity of invention <input checked="" type="checkbox"/> Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step and industrial applicability; citations and explanations supporting such statement <input type="checkbox"/> Box No. VI Certain documents cited <input type="checkbox"/> Box No. VII Certain defects in the international application <input type="checkbox"/> Box No. VIII Certain observations on the international application <p>2. FURTHER ACTION</p> <p>If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1bis(b) that written opinions of this International Searching Authority will not be so considered.</p> <p>If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.</p> <p>For further options, see Form PCT/ISA/220.</p>
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Name and mailing address of the ISA/ Indian Patent Office Plot No. 32, Sector 14, Dwarka, New Delhi-110075 Facsimile No.	Date of completion of this opinion 10-12-2020	Authorized officer Prakash Raushan Telephone No. +91-1125300200
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WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/IN2020/050739

Box No. I **Basis of this opinion**

1. With regard to the **language**, this opinion has been established on the basis of:
 - the international application in the language in which it was filed.
 - a translation of the international application into _____ which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b)).

2. This opinion has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43*bis*.1(b)).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, this opinion has been established on the basis of a sequence listing:
 - a. forming part of the international application as filed:
 - in the form of an Annex C/ST.25 text file.
 - on paper or in the form of an image file.
 - b. furnished together with the international application under PCT Rule 13*ter*.1(a) for the purposes of international search only in the form of an Annex C/ST.25 text file.
 - c. furnished subsequent to the international filing date for the purposes of international search only:
 - in the form of an Annex C/ST.25 text file (Rule 13*ter*.1(a)).
 - on paper or in the form of an image file (Rule 13*ter*.1(b) and Administrative Instructions, Section 713).

4. 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 forming part of the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

5. Additional comments:

**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**

International application No. PCT/IN2020/050739
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Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step and industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims	NONE	YES
	Claims	1-9	NO
Inventive step (IS)	Claims	NONE	YES
	Claims	1-9	NO
Industrial applicability (IA)	Claims	1-9	YES
	Claims	NONE	NO

2. Citations and explanations:

Reference is made to the following documents:

D1: EP3475567A1 (ECOLE POLYTECHNIQUE FED LAUSANNE EPFL[CH]) 01 MAY, 2019 (01.05.2019)

D2: EP3344374A1 (CENTRE NAT RECH SCIENT [FR]; SWEETCH ENERGY [FR]) 11 JULY, 2018 (11.07.2018)

D3: JP2017196559A (ALTEC CORP; BIOREDOX KENKYUSHOKK; WATARI TAKAKIYO) 02 NOVEMBER, 2017 (02.11.2017)

Novelty under Article 33(2):

Regarding independent claim 1, D1 discloses an osmotic power generator system(1) comprising: a housing(2); an active membrane(i.e. A porous scalable membrane)(6) made of an electrochemically etchable 2D material including any one or combination of graphene or silicene(i.e. Silicon nitride) having first surface and second surface placed within the housing(2); a first chamber portion(3a) disposed on a first side of the active membrane for receiving a first electrolyte liquid(4a) comprising a first electrode(9a) and a second chamber portion(3b) disposed on a second side of the active membrane for receiving a second electrolyte liquid(4b) comprising a second electrode(9b); a load(i.e. generator load)(13) connected between the first electrode(9a) and second electrode(9b) wherein the system is configured to pass ions between the first and second surface of active membrane(i.e. A porous membrane) due to an osmotic gradient between first and second electrolytes to generate a difference in potential and ionic current between the first and second electrodes; the active membrane includes at least one pore(11) allowing ions to pass between the first and second sides of the membrane under osmosis due to an osmotic gradient between the first and second electrolyte liquids to generate said difference in potential and ionic current between the first and second electrodes(9a & 9b)(See Abstract; Paragraphs [0003], [0005]-[0042], [0044]-[53], [0057]-[0065], [0069]-[0124],

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.

Continuation of:

Continuation of Citation and Explanation(Box5)

[0127]-[0201]; Figures 1-12; Claims 1-17 & 20).

Therefore, in view of D1, The subject matter of independent claim 1 is not novel.

Regarding claims 6 & 7, D1 discloses the system wherein, the first electrolyte liquid is seawater and the second electrolyte liquid is freshwater(See Paragraphs [0038]; Claim-15).

Regarding claims 2, 3, 4, 5, 8 & 9, the subject matter as disclosed in claims 2, 3, 4, 5, 8 & 9 do not have any technical feature and can not be considered novel and inventive because it would have been implicit to a person skilled in the art.

Therefore the subject matter as disclosed in independent claim 1 and subsequent dependent claims 2-9 are not novel in view of D1 and do not fulfill the requirements of Article 33(2) of PCT.

Inventive Step under Article 33(3):

The present application does not meet the criterion of Article 33(3) of PCT because claims 1-9 lack novelty in view of document D1 hence claims 1-9 lack inventive step in view of D1.

Industrial Applicability:

The subject matter of claims 1-9 is considered to have industrial applicability and therefore complies with the requirements of Article 33(4) of PCT.