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(54) Title: A SELF-SUSTAINING CLOSE CONTROLLED AGRICULTURAL SYSTEM

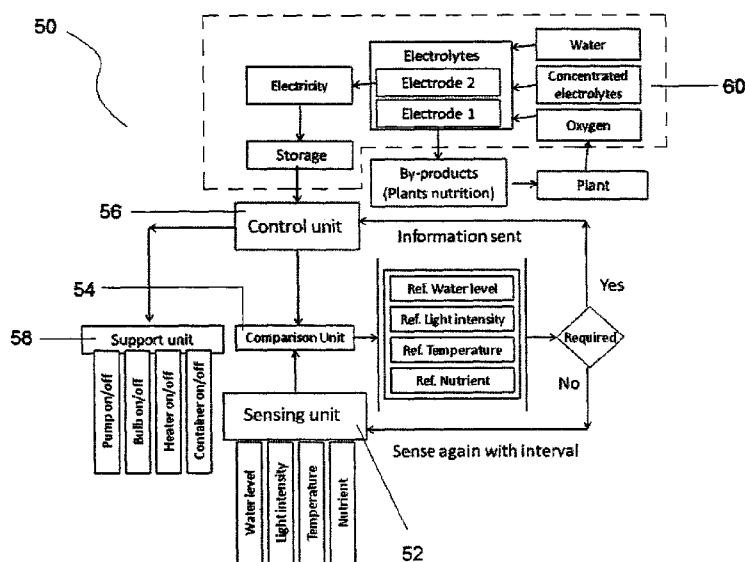


FIGURE 1

(57) Abstract: The present invention relates to a self-sustaining close controlled agricultural system. The system comprises of a sensing unit (52) for sensing environmental parameters values; a comparison unit (54) for comparing the environmental parameters values with predefined values; a control unit (56) for keeping the environmental parameters values at the predefined values by generating a set of instruction; a support unit (58) for executing the set of instruction from the control unit; and an energy generating unit (60) wherein the energy generating unit (60) is able to generate energy for operating the system (50). The present invention also further relates to a method for growing a plant in a close controlled environmental system.

A SELF-SUSTAINING CLOSE CONTROLLED AGRICULTURAL SYSTEM

FIELD OF THE INVENTION

5 The present invention relates to a self-sustaining agricultural system for growing plant in a close and controlled environment.

BACKGROUND OF THE INVENTION

10 In agriculture, environmental condition is crucial for plant to grow well. Temperature, water, light and nutrient are examples of important parameter referring to the environmental condition. The parameters must be maintained at a required level for the plant to survive. Thus, close and controlled environment is often employed where the plant is planted in a confined environment and the parameters are maintained at the required level manually.
15 However, this requires large human dependency since it involves manual maintenance.

 In minimizing human dependency, an automatic controlled environmental system is employed where automatic sensor is used to sense any change of the parameter level. In operation, the sensor must be supplied with electric power. Often, external power such as
20 battery or grid power are used to power the sensor.

 Therefore, there is a need to provide an automatic controlled environmental system capable of generating power by itself.

SUMMARY OF THE INVENTION

 According to a first aspect of the first invention, there is provided a self-sustaining close controlled agricultural system comprising: a sensing unit for sensing environmental parameters values; a comparison unit for comparing the environmental parameters values
30 with predefined values; a control unit for keeping the environmental parameters values at the predefined values by generating a set of instruction; a support unit for executing the set of instruction from the control unit; and an energy generating unit wherein the energy generating unit is able to generate energy for operating the system.

The provision of energy generating unit is advantageous as it generates energy continuously for operating the system.

Advantageously, the system is suitable to be employed at remote area.

5

According to a second aspect of the present invention, there is provided an energy generating unit comprising: a container for containing electrolyte having a base and a wall; a plantation bed positioned inside the container; an inlet for channelling the electrolyte into the container; and a storage box attached to outer surface of the wall wherein a first electrode is attached to inner surface of the wall and a second electrode is attached to bottom of the plantation bed enabling electrochemical reaction thereby generating energy.

10

Accordingly, the first electrode is made from aluminium.

15

Accordingly, the second electrode is an air electrode.

Accordingly, the electrolyte is hydroquinone, dihydroxyanthracene, dihydroxynphtalene, parietin, sodium hypophosphite or phosphonic acid.

20

Accordingly, the energy is stored in the storage box.

25

According to a third aspect of the present invention, there is provided a method for growing a plant in a close controlled environmental system comprising: providing a plant; planting the plant on a plantation bed; inspecting environmental parameters values; comparing the environmental parameters values with predefined values; providing sufficient environmental parameter input to the plant; and generating energy by electrochemical reaction for enabling operation of the system wherein the system performing third step to sixth step automatically.

30

Advantageously, by-product of the electrochemical reaction is used by the plant as a nutrient for growth.

Advantageously, the method is environmentally friendly.

BRIEF DESCRIPTION OF THE FIGURE

FIGURE 1: illustrates schematic diagram of the self-sustaining close controlled agricultural system.

5

FIGURE 2: illustrates top view of the system.

FIGURE 3: illustrates cross section of the system.

10 **FIGURE 4:** illustrates the system.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

The present invention relates to a self-sustaining close controlled agricultural system. The system is employed for growing plant in a close and controlled environment. The system is automatic where sensor is used to monitor and control crucial environmental parameters for plant growth. External power is not required by this system as it equips with a unit that able to generate energy continuously for operating the whole system. Thus, the system is suitable to be employed at remote area

20

As seen in **FIGURE 1**, the system comprises of a sensing unit **52**, a comparison unit **54**, a control unit **56**, a support unit **58** and an energy generating unit **60**.

The sensing unit **52** functions in sensing environmental parameters values. The environmental parameters are light intensity, temperature, water level and nutrient level. The comparison unit **54** functions in comparing the environmental parameters values with predefined values. The control unit **56** functions in keeping the environmental parameters values at the predefined values by generating a set of instruction. The support unit **58** functions in executing the set of instruction from the control unit **56**. The support unit **58** further comprises of a light bulb **103** for controlling the light intensity, a heater for controlling the temperature and a pump **101** for controlling the water level and the nutrient level. The energy generating unit **60** functions in generating energy for operating the system.

25

30

Generally, the environmental parameters values are sensed by the sensing unit 52. The environmental parameters values are then compared with the predefined values by the comparison unit 54. When the environmental parameters values are different from the predefined values, a corrective action is required where the support unit 58 is activated by the control unit 56. The control unit 56 generates instructions to be executed by the support unit 58. The support unit 58 is turned on when the environmental parameters values are lower than the predefined values and turned off when the environmental parameters values exceed the predefined values. For light intensity control, the light bulb 103 is turned on when the environment is dark and turned off when the environment is bright. For temperature control, the heater is turned on when the temperature is low and turned off when the temperature is high. For water level and nutrient level control, the pump 101 is turned on when the level of both water and nutrient is low and turned off when the level of both water and nutrient is high. The water and nutrient are pumped from a storage through an inlet 107. When the environmental parameters values are within a range of the predefined values, the corrective action is not required. The sensing unit 52 is then sensed the environmental parameters values again within a time interval.

The energy generating unit 60 generates energy from electrochemical reaction. The energy generating unit 60 is further comprises of a container 100, a plantation bed 106, an inlet 107, a storage box 108, a first electrode 110 and a second electrode 112.

As seen in **FIGURE 1** and **FIGURE 2**, the container 100 has a base 102 and a wall 104. The container contains water and an electrolyte for the electrochemical reaction. The water and electrolyte are channelled into the container 100 through an inlet 107 at the wall 104. However, multiple inlets could also be attached at the wall to channel water and electrolyte respectively. The plantation bed 106 is positioned inside the container 100. Preferably, the plantation bed 106 is a cork sheet. The first electrode 110 is attached to inner surface of the wall 104 while the second electrode 112 is attached to bottom of the plantation bed 106. The first electrode 110, the second electrode 112 and the electrolyte undergo electrochemical reaction and thus generating energy. The energy is then stored inside the storage box 108.

The first electrode 110 and the second electrode 112 could be changed during replacement of the plant.

Preferably, the container **100** is arranged on top of another in a rack as seen in **FIGURE 4**. This arrangement reduces space requirement.

The present invention also relates to an energy generating unit **60**. The energy
5 generating unit **60** comprises of a container **100** for containing electrolyte having a base **102**
and a wall **104**; a plantation bed **106** positioned inside the container **100**; an inlet **107** for
channelling the electrolyte into the container **100**; and a storage box **108** attached to outer
surface of the wall **104** wherein a first electrode **110** is attached to inner surface of the wall
104 and a second electrode **112** is attached to bottom of the plantation bed **106** enabling
10 electrochemical reaction thereby generating energy.

In the electrochemical reaction, aluminium is used as the first electrode **110** while air
electrode is used as the second electrode **112**. Hydroquinone, dihydroxyanthracene,
dihydroxynaphtalene, parietin, sodium hypophosphite, phosphonic acid or the like are used as
15 the electrolyte. The electrolyte could be used solely or in combination. The generated energy
is then stored inside the storage box **108**.

The present invention further relates to a method for growing a plant in a close
controlled environmental system comprises of providing a plant; planting the plant on a
20 plantation bed; inspecting environmental parameters values; comparing the environmental
parameters values with predefined values; providing sufficient environmental parameter input
to the plant; and generating energy by electrochemical reaction for enabling operation of the
system wherein the system performing third step to sixth step automatically. The method is
suitable for growing plant having a short life cycle.

25

Preferably, by-product of the electrochemical reaction is used by the plant as a
nutrient for growth. The method is environmentally friendly as the by-product is not dispose
to environment.

30 The invention being thus described, it will be apparent that the same may be varied in
many ways. Such variations are to be regarded as within the scope of the invention, and all
such modifications as would be apparent to one skilled in the art are intended to be within the
scope of the following claims.

CLAIM

1. A self-sustaining close controlled agricultural system **50** comprising:
a sensing unit **52** for sensing environmental parameters values;
5 a comparison unit **54** for comparing the environmental parameters values with predefined values;
a control unit **56** for keeping the environmental parameters values at the predefined values by generating a set of instruction;
a support unit **58** for executing the set of instruction from the control unit; and
10 an energy generating unit **60**
wherein the energy generating unit **60** is able to generate energy for operating the system **50**.
2. A system **50** according to Claim 1, wherein the energy generating unit **60** further
15 comprising:
a container **100** for containing electrolyte having a base **102** and a wall **104**;
a plantation bed **106** positioned inside the container **100**;
an inlet **107** for channelling the electrolyte into the container **100**;
a storage box **108** attached to outer surface of the wall **104**; and
20 a first electrode **110** attached to inner surface of the wall **104** and a second electrode **112** attached to bottom of the plantation bed **106** enabling electrochemical reaction thereby generating energy.
3. A system **50** according to Claim 2, wherein the energy is stored in the storage box
25 **108**.
4. A system **50** according to Claim 1, wherein the support unit **58** comprising a light bulb, a heater and a pump.
- 30 5. An energy generating unit **60** comprising:
a container **100** for containing electrolyte having a base **102** and a wall **104**;
a plantation bed **106** positioned inside the container **100**;
an inlet **107** for channelling the electrolyte into the container **100**; and
a storage box **108** attached to outer surface of the wall **104**

wherein a first electrode **110** is attached to inner surface of the wall **104** and a second electrode **112** is attached to bottom of the plantation bed **106** enabling electrochemical reaction thereby generating energy.

- 5 6. An energy generating unit **60** according to Claim 5, wherein the first electrode **110** is aluminium.
7. An energy generating unit **60** according to Claim 5, wherein the second electrode **112** is an air electrode.
- 10 8. An energy generating unit **60** according to Claim 5, wherein the electrolyte is selected from a group of hydroquinone, dihydroxyanthracene, dihydroxynaphtalene, parietin, sodium hypophosphite or phosphonic acid.
- 15 9. An energy generating unit **60** according to Claim 5, wherein the energy is stored in the storage box **108**.
10. A method for growing a plant in a close controlled environmental system comprising:
 providing a plant;
20 planting the plant on a plantation bed;
 inspecting environmental parameters values;
 comparing the environmental parameters values with predefined values;
 providing sufficient environmental parameter input to the plant; and
 generating energy by electrochemical reaction for enabling operation of the system
25 wherein the system performing third step to sixth step automatically.
11. A method according to Claim 10, wherein by-product of the electrochemical reaction is used by the plant as a nutrient for growth.
- 30

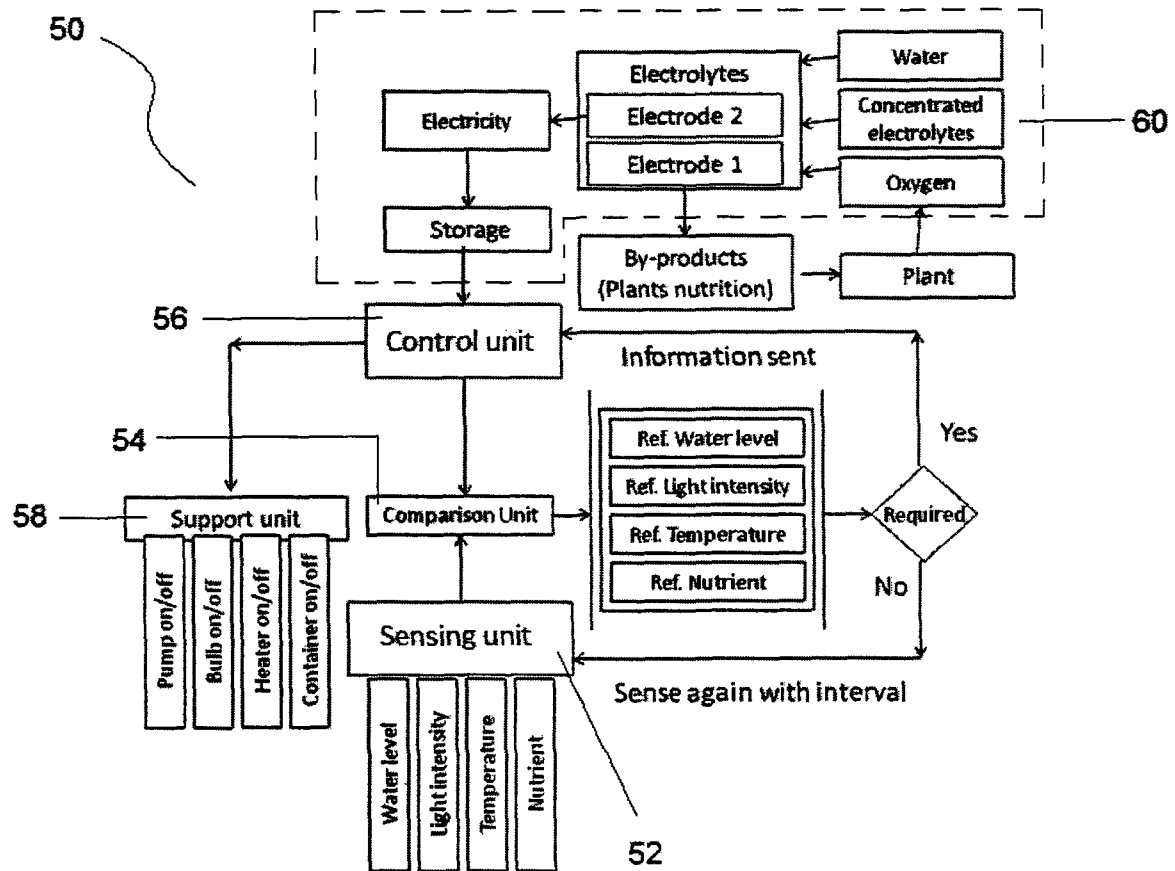


FIGURE 1

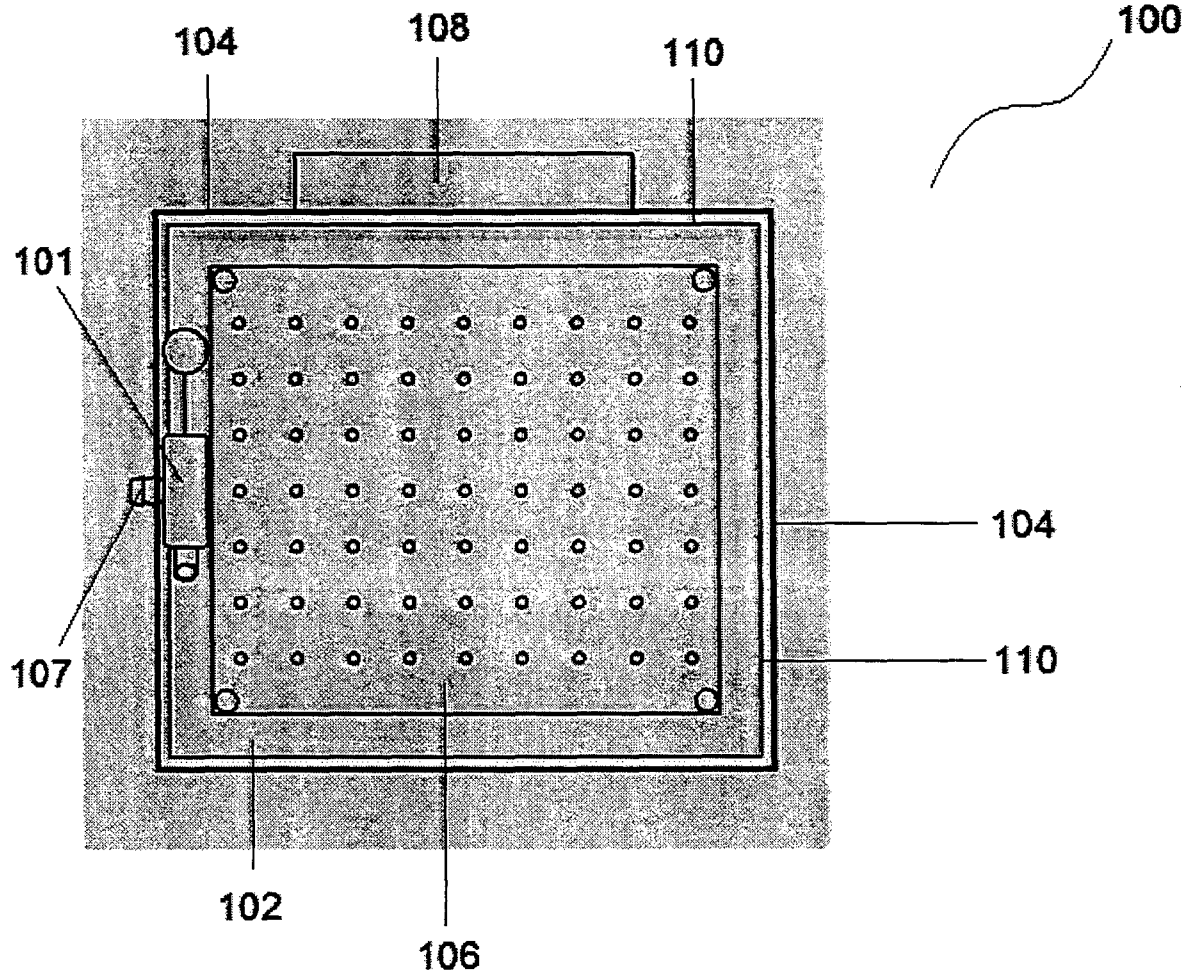
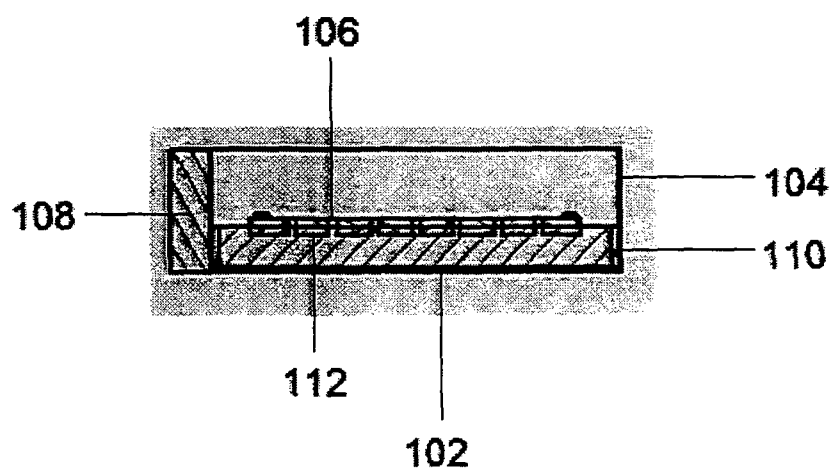
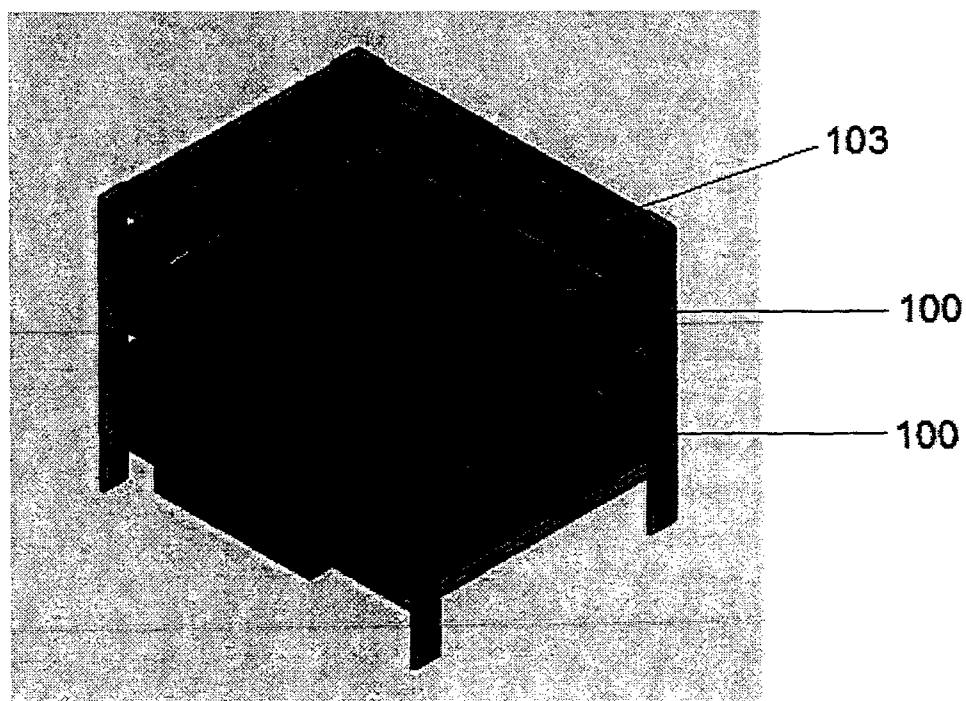


FIGURE 2

**FIGURE 3****FIGURE 4**

INTERNATIONAL SEARCH REPORT

International application No.

PCT/MY2011/000157

A. CLASSIFICATION OF SUBJECT MATTER

Int. Cl.

A01G 9/24 (2006.01)

A01G 9/26 (2006.01)

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)

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)

WPI, EPODOC: ECLA, IPC: A01G1/-, A01G9/-, keywords: self, automatic, control, PC, PLC, energy, power generating, electro-chemical and like terms.

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP 2009-050174 A (KEIYO GAS KK) 12 March 2009 Figure 1 & translation from http://www.ipdl.inpit.go.jp/homepg_e.ipdl	1, 4, 10 & 11
X	US 2009/0320366 A1 (MATLEN) 31 December 2009 Figures 5A, 5B, 6, 10, 11, 15, Paragraphs [0072]-[0089] & [0107]	1 & 10
A	US 2010/0042234 A1 (May et al.) 18 February 2010 Figures 1-3 & Paragraphs [0028]-[0035]	



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	"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
"E" earlier application or patent but published on or after the international filing date	"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
"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)	"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
"O" document referring to an oral disclosure, use, exhibition or other means	"&" document member of the same patent family
"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
10 November 2011

Date of mailing of the international search report
02/12/2011

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/MY2011/000157

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 Supplemental Box I

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.: **1, 4, 10 & 11**

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

International application No.

PCT/MY2011/000157

Supplemental Box I

(To be used when the space in any of Boxes I to IV is not sufficient).

Continuation of Box No: III

This International Application does not comply with the requirements of unity of invention because it does not relate to one invention or to a group of inventions so linked as to form a single general inventive concept.

This Authority has found that there are different inventions based on the following features that separate the claims into distinct groups:

First Invention: Claims 1-4, 10 & 11 are directed to a self-sustaining close controlled agricultural system and a method for growing a plant in a close controlled agricultural system. The combination of features of "a sensing unit 52 for sensing environmental parameter's values; a comparison unit 54 for comparing the environmental parameters values with predefined values" is specific to this group of claims.

Second Invention: Claims 5-9 are directed to an energy generating unit. The feature of "a first electrode ... enabling electrochemical reaction thereby generating energy" is specific to this group of claims.

PCT Rule 13.2, first sentence, states that unity of invention is only fulfilled when there is a technical relationship among the claimed inventions involving one or more of the same or corresponding special technical features.

PCT Rule 13.2, second sentence, defines a special technical feature as a feature which makes a contribution over the prior art.

When there is no special technical feature common to all the claimed inventions there is no unity of invention.

In the above groups of claims, the identified features may have the potential to make a contribution over the prior art but are not common to all the claimed inventions and therefore cannot provide the required technical relationship. The only feature common to all of the claimed inventions is 'an energy generating unit'. However it is considered that this feature is generic in this particular art.

Therefore in this light this common feature cannot be a special technical feature. Therefore there is no special technical feature common to all the claimed inventions and the requirements for unity of invention are consequently not satisfied *a posteriori*.

It is considered that search and examination for the second invention will require more than negligible additional search and examination effort over that for the first invention, and therefore an additional search fee is warranted.

Additionally appendant claims 2 & 3 introduce features of the second invention and yet are appendant to claims directed to the first invention. Hence claims 2 & 3 will only be searched and reported on to the extent that additional search fees have been paid for the second invention.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/MY2011/000157

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report		Patent Family Member			
JP	2009050174	NONE			
US	2009320366	NONE			
US	2010042234	US	2007289207	US	7617057
				US	7987632
Due to data integration issues this family listing may not include 10 digit Australian applications filed since May 2001.					
END OF ANNEX					