

SYSTEM AND METHOD FOR EXTRACTING ATMOSPHERIC WATER

Field Of Invention

The present field of invention generally relates to extraction of atmospheric water.

- 5 More particularly, it relates to a system and a method for obtaining potable water from extracting atmospheric water.

Background

- 10 The earth consists mainly of water and water exists on the earth's surface, in aquifers in the soil as groundwater, and in the atmosphere as water vapour. Of all the water on earth, only less than 3 percent is fresh water. However, as majority of fresh water is trapped in ice caps, glaciers and aquifers, only less than 1 percent of the water supply on earth is portable and available for drinking purposes.

- 15 In recent years, global concerns regarding insufficient fresh water sources have increased greatly. Currently, sources of fresh water include water provided by lakes, rivers, and artesian wells. Unfortunately, these fresh water sources are not sustainable because of decline both in capacity and purity at alarming rates due to expansion of deserts. Furthermore, factors such as climate changes, environmental
20 pollution, as well as population growth further threaten existing fresh water sources.

- Besides having insufficient fresh water sources, there are also problems associated with provision of potable water. The provision of potable water is a serious problem in areas where rainfall is scarce, seasonal, or where there are relatively small water
25 catchment areas and little natural local water storage. Additionally, as fresh water sources are not evenly distributed globally, some geographical locations do not have ready access to fresh water. Constructing reservoirs and water desalination plants usually alleviates this problem. However, many countries are unable to afford water desalination plants due to the relatively high capital investment and operational costs
30 required.

Another problem associated with the provision of potable water relates to the setting up and maintenance of potable water distribution networks, such as water piping networks, which require significant efforts and resources. Further, water piping networks have limited lifespan and are frequently associated with water leakage and contamination problems. Water piping networks typically use water pipes made from metal ducts, concrete ducts or polyvinyl chloride (PVC) pipes. Metal and concrete ducts are vulnerable to corrosion by inorganic acid and alkaline contaminants, whereas organic solvents present in soil and building materials can be absorbed by and permeated through PVC pipes.

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One way to overcome the aforementioned problems is by extracting water from the atmosphere. Approximately 577,000 km³ of water evaporates into the atmosphere from water bodies, such as seas and rivers, and the earth's surface each year, with air remaining close to the earth's surface containing the greatest percentage of water.

15 Commercial water production systems capable of extracting atmospheric water have made it possible to supply potable water without the need for tapping on a central water source via complex water distribution networks. Such water production systems are therefore an attractive alternative to conventional ways of deriving and distributing potable water.

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In principle, these commercial water production systems collect water droplets formed by condensation of water vapour present in the atmosphere on cold surfaces cooled by refrigeration means. The working principle is similar to the disclosure in patents filed to Ehrlich in 1978 (U.S. Pat. No. 4,255,937), Reidy (U.S. Pat. No. 5,106,512, U.S. Pat. No. 5,149,446, U.S. Pat. No. 5,203,989) and Morgen et al. in 2002 (U.S. Pat. No. 6,931,756B2). With the advent of more efficient refrigeration techniques, the cost of electricity needed for extracting an amount of water from the atmosphere can be lower than the price of a bottled water of equivalent volume, or that of the utility charge of obtaining an equivalent volume of water from the tap with the additional cost for boiling or purifying water using mechanical and chemical filtering means.

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However, the cost of hardware of a commercial water production system comprising compressor, condenser, evaporator and filtration means remains relatively high leading to unattractive return of investment. Additionally, for climates with low ambient temperature levels or where temperature fluctuates significantly, atmospheric water extraction becomes difficult. Typically, these commercial water production systems for water vapour extraction operate above 20⁰C and above a relative humidity of 35%.

U.S. Pat. No. 3,675,442 to Swanson discloses an atmospheric water collector, which employs a cooling coil immersed in a fresh water bath that cools the bath. The cooled water is pumped through a conduit and condensing frame. Water vapour present in winds that pass over the condensing frame is condensed and drained into a collector. However, the cooled water is periodically mixed with the condensed water subjecting the condensed water to contamination.

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U.S. Pat. No. 5,056,593 to Hull discloses, in several variations, the use of electrostatic and magnetic fields to substantially enhance water product extraction yields in a dehumidifying heat exchanger apparatus. Liquid water droplets are electrostatically collected on grounded or charged heat transfer tubes in the heat exchanger apparatus. In one variation, charged or grounded horizontally-declined heat transfer tubes with attached drainage wicks attract liquid droplets and accelerate condensing heat transfer by continuous absorption and transfer of condensate. The use of drainage wicks to absorb and confine condensate collected on the surfaces of the heat transfer tubes may result in the loss of water extracted and advance the growth of fungi and bacteria on the drainage wicks. Additionally, the heat exchanger apparatus may be electrically unsafe with charged electrode wires entrenched between the tubes of the heat exchange unit.

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U.S. Pat. No. 7,000,410 to Hutchinson discloses a device that utilizes a condenser type refrigerant system with multiple fans and two air chambers to produce water from the air. The apparatus further deploys a stainless steel ioniser to charge the ambient air to maximise extraction of moisture from the air. The two air chambers

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operate in tandem to mix desiccated ionised air that exited from the evaporator plates with fresh incoming air drawn through a compressor, a condenser and the ioniser. This causes partial drying of the newly formed condensation, which results in loss of condensation leading to reduced output and efficiency.

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JP Pat. No. 02,172,587 to Katsumi and U.S. Pat. No. 5,435,151 to Han disclose water making apparatus for use on vehicles. U.S. Pat. App. No. 20040040322 filed by Engel et al. discloses a similar water extraction device for vehicles, together with some applications including central air system and mobile unit. All the disclosed devices tap on existing or external air conditioning systems to simplify system design and lower device cost. However, conventional designs fail to function properly in many temperate areas where ambient temperature drops below 20°C during the night or during cold spells and storms. This problem accentuates for water extraction devices installed on vessels and ships, on caravans and emergency vehicles.

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Therefore, there is a need for a system and a method for obtaining potable water from extracting atmospheric water, which at least addresses one of the aforementioned disadvantages.

20 **Summary**

The present embodiment of the invention disclosed herein provides an atmospheric water extraction system and a method for extracting atmospheric water for obtaining potable water.

25 In accordance with a first aspect of the invention, there is disclosed an atmospheric water extraction system comprising a passage, a cooling unit and an ioniser. The passage comprises a condenser portion and a cooling portion inter-configured for cyclical passage of fluid therethrough. The cooling unit is in thermal communication with the cooling portion and is for extracting heat from liquid passing through the cooling portion to thereby cool the liquid, in which the liquid is transportable to the
30 condenser portion subsequent to passing through the cooling portion. The ioniser is for ionising ambient air into ionised air, in which the ionised air is charged for

enhancing adhesion of water vapour thereto. The ionised air is transportable for thermal interaction with the condenser portion of the passage for condensing the water vapour into water droplets, and the liquid passing through the condenser portion receives heat from the ionised air during thermal interaction of the ionised air with the condenser portion. The liquid is then transportable to the cooling portion of the passage for re-cooling thereby subsequent to passing through the condenser portion.

In accordance with a second aspect of the invention, there is disclosed an atmospheric water extraction method. The method comprises providing a passage having a condenser portion and a cooling portion inter-configured for cyclical passage of fluid therethrough. The method also comprises extracting heat from liquid passing through a cooling portion to thereby cool the liquid using a cooling unit, whereby the cooling unit is in thermal communication with the cooling portion. The liquid is then transportable to the condenser portion subsequent to passing through the cooling portion. The method further comprises ionising ambient air into ionised air using an ioniser, in which the ionised air is charged for enhancing adhesion of water vapour thereto. The ionised air is transportable for thermal interaction with the condenser portion of the passage for condensing the water vapour into water droplets, and the liquid passing through the condenser receives heat from the ionised air during thermal interaction of the ionised air with the condenser portion. The liquid is then transportable to the cooling portion of the passage for re-cooling thereby subsequent to passing through the condenser portion.

In accordance with a third aspect of the invention, there is disclosed an atmospheric water extraction system comprising an ioniser and a condenser portion. The ioniser ionises ambient air for obtaining ionised air therefrom, in which the ionised air is charged for enhancing adhesion of water vapour thereto. The condenser portion is disposed alongside the ioniser for condensing water vapour in the ionised air into water droplets.

Brief Description Of The Drawings

An embodiment of the invention is described hereinafter with reference to the following drawings, in which:

- 5 FIG. 1 shows a partial schematic diagram of an atmospheric water extraction system according to an embodiment of the invention; and

FIG. 2 shows an operational flow of the atmospheric water extraction system of FIG. 1.

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Detailed Description

An atmospheric water extraction system and a method for extracting atmospheric water are described hereinafter for addressing at least one of the aforementioned disadvantages.

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For purposes of brevity and clarity, the description of the invention is limited hereinafter to applications relating to atmospheric water extraction. This however does not preclude various embodiments of the invention from other applications. The fundamental inventive principles of the embodiments of the invention shall remain
20 common throughout the various embodiments.

An embodiment of the invention described in the detailed description provided hereinafter is in accordance with Fig. 1 and Fig. 2 of the drawings, in which like elements are numbered with like reference numerals.

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With reference to Fig. 1, an atmospheric water extraction system 100 (hereinafter known as system 100) for extracting atmospheric water is described according to an embodiment of the invention. The system 100 generally comprises an extraction unit 110, a passage 111, a water collection unit 112 and a cooling unit 113.

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The extraction unit 110 is for extracting water vapour in ambient air and the extraction unit 110 has an intake 114 and an exhaust 116 formed therein for allowing

flow of the ambient air therethrough. The extraction unit 110 comprises an ioniser 118 and a condenser portion 120, in which the condenser portion 120 is disposed alongside the ioniser 118. The extraction unit 110 further comprises an air filter 122, a ventilator 124 and a water collection tray 126.

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The ioniser 118 is for ionising the ambient air into ionised air. When the ioniser 118 ionises the ambient air, air particles present in the ambient air become positively or negatively charged, although negative charging is preferable in most uses. The charged air particles (ionised air) enhance adhesion of water vapour thereto for
 10 extracting atmospheric water over varying ambient temperatures and humidity. Due to the polar nature of water, each water molecule has an electric dipole moment. The oxygen atom in each water molecule has a partial negative charge while each hydrogen atom in each water molecule has a partial positive charge. As such, the difference in charge causes water molecules to be attracted to each other and to other
 15 polar molecules. Since the ionised air comprises charged particles, adhesion of water vapour thereto is enhanced due to the partial negative and positive charges present on water molecules. The ioniser 118 is also for sterilising the ambient air and for inhibiting growth of fungi and bacteria when the system 100 is in use.

20 The condenser portion 120 is for condensing water vapour in the ionised air to obtain water droplets. The ionised air is transportable for thermal interaction with the condenser portion 120 for condensation of water vapour to take place. Condensation of water vapour occurs when a surface is colder than the dew point temperature (condensation threshold temperature) of the air surrounding the surface. At this
 25 temperature, the air has a relative humidity of equivalent to 100 percent and the air becomes saturated with water. The dew point temperature of the air is dependent on both air temperature and humidity. Therefore, surfaces of the condenser portion 120 over which the ionised air flows must have a temperature that is lower than the dew point of the ionised air.

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The passage 111 is inter-configured for cyclical passage of fluid therethrough. The passage 111 comprises a first fluid channel 128 and a second fluid channel 130 for

interconnecting the extraction unit 110 and the cooling unit 113. The first fluid channel 128 is for receiving liquid from the cooling unit 113 and a second fluid channel 130 for returning the liquid to the cooling unit 113. The cooling unit 113 is in thermal communication with a cooling portion 132 for extracting heat from the liquid passing through the cooling portion 132 to thereby cool the liquid. The liquid is then transportable to the condenser portion 120 subsequent to passing through the cooling portion 132 for cooling the surfaces of the condenser portion 120 to a temperature that is lower than the dew point temperature of the air surrounding the surfaces for condensation of water vapour to occur. The surfaces of the condenser portion 120 can be made of any material of which water vapour condensation can occur in response to cooling of the material in a given environment. For instance, the material can comprise of metal, glass, plastic, or the like.

Additionally, the surfaces of the condenser portion 120 are film-coated with food-grade materials, such as, gold, tin, Teflon or the like in compliance with public health requirements governing use of materials in contact with drinking water. The surfaces of the condenser portion 120 are preferably plated with gold or any material of which enhances the rate of heat transfer. The condenser portion 120 is preferably designed for optimising air circulation, velocity and distribution of air on the surfaces for achieving an optimal rate of water vapour extraction.

The cooling unit 113 comprises a drive assembly 136 for displacing the liquid from the cooling unit 113 to the condenser portion 120 via the first fluid channel 128. The drive assembly 136 comprises an actuator valve 138 and a fluid pump 140. The fluid pump 140 is one of a centrifugal pump and a displacement pump. Further, the cooling unit 113 is couplable to an external cooling source (not shown) for extracting heat from the liquid to cool liquid. The external cooling source can comprise a refrigerant, such as Freon, for extracting heat from the liquid. As such, instead of relying on the cooling portion 132 for extracting heat from the liquid, the cooling unit 113 can tap on the external cooling source for cooling the liquid. The liquid is one of water and alcohol, or the like. The cooling unit 113 further comprises a temperature

measurement device 142 for measuring the temperature of the liquid passing therethrough. The temperature of the liquid is preferably in the range of 5°C to 15°C.

Prior to ionisation of the ambient air by the ioniser 118, the ambient air is passed through the air filter 122 of the extraction unit 110. The air filter 122 is for filtering the ambient air and is disposed in the vicinity of the ioniser 118. The air filter 122 can also be disposed in the intake 114 or in the vicinity of the intake 114. Furthermore, the air filter 122 is replaceable and therefore can be replaced when necessary.

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The ventilator 124, on the other hand, is disposed in the vicinity of the condenser portion 120 and is for displacing and directing the ambient air into the extraction unit 110. The ventilator 124 is preferably a form or the like impeller-based air mover controllable to vary flow rate of the ambient air. By varying the flow rate of the ambient air, convecting air currents necessary for obtaining sufficient water vapour condensation on the surfaces of the condenser portion 120 is generatable. The ventilator 124 can also be disposed at or adjacent the exhaust 116. The air filter 122 and the ventilator 124 are orientable or disposed as readily recognised by those skilled in the art to achieve effectively clean or dust-controlled airflow or circulation inside the extraction unit 110.

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The water collection tray 126 of the extraction unit 110 is for receiving the water droplets from the condenser portion 120. The water collection tray 126 is disposed in the extraction unit 110 such that the water droplets received are directed to the water collection unit 112. The water collection unit 112 of the system 100 comprises a water collection tank 144, a drive assembly 146 and a water purifier 148.

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The water collection tank 144 is for receiving the water droplets from the water collection tray 126. The water collection tank 144 preferably comprises a sediment filter (not shown) for filtering the water droplets received. The water collection tank 144 further comprises a water level measurement device 150 for measuring the water level present in the water collection tank 144 and a water purifier 152 for purifying

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the water droplets received. The water level measurement device 150 is an optical or a float switch type while the water purifier 152 preferably comprises an ultra-violet light or an ozone generator. Further, the water purifier 152 may incorporate other filtration means including any mechanical, chemical or biological filtering systems
5 suitable for purifying water for drinking purposes.

The drive assembly 146 is for transporting water collected in the water collection tank 144 to the water purifier 148 of the water collection unit 112. The drive assembly 146 is one of a fluid pump, a centrifugal pump and a displacement pump.
10 The drive assembly 146 provides additional gravitational pressure to extract the water collected out of the water collection tank 144 and displace the water through the water purifier 148. The water purifier 148 comprises any suitable device capable of sterilising water, for instance, suitable chemical means, heating elements, ultra-violet radiation emitters, or the like. The water after passing through the water purifier 148
15 is suitable for drinking and can be transported through a fluid duct 153 to external appliances or any storage.

The system 100 further comprises a temperature measurement device 154 for measuring ambient air temperature and a relative humidity measurement device 156
20 for measuring relative humidity of the ambient air. Additionally, the system 100 further comprises a controller 158 for controlling the system 100. The controller 158 is couplable to a signalling interface module for relaying any control signals for operating any electrically driven parts and components of the system 100 that require instructions, signalling and/or electricity supply.

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The controller 158 preferably comprises a microprocessor (not shown) for storing and executing software applications or embedded codes capable of generating appropriate control signals in accordance with a set of pre-programmed instructions. Measured data is further processable in the controller 158 in which the processes
30 include logging, reading and writing, storing and backing-up, analysing and displaying of measured and/or control data. Further, the controller 158 is coupled to external computing equipment via a wired or wireless data exchange interface (not

shown). Finally, electrical power supplied to the controller 158 and the system 100 may be single-phase or multi-phase alternating current tapped from power grids or mobile electricity generators such as those used on vessels, cruises, caravans, oil rigs, construction sites and other similar facilities. Alternatively, electrical power can be
 5 supplied as direct current.

Fig. 2 illustrates the operational flow 200 of the system 100. Upon supplying electrical power to the system 100, in a step 210, the controller 158 activates the ioniser 118 and the ventilator 124. Further, the controller 158 samples data measured
 10 by the temperature measurement device 142 of the cooling unit 113, the water level measurement device 150, the temperature measurement device 154 of the system 100 and the relative humidity measurement device 156 at a predetermined regular interval to obtain measured data therefrom. The controller 158 then analyses the measured data and determines the mode of operation, and may display the measured data for
 15 visual monitoring by an operator of the system 100 in a step 212.

Next in a step 214, the controller 158 retrieves the required controls according to the mode of operation that is determined in the step 212. Further, in a step 216, the controller 158 looks up required controls for required parts of the system 100 based
 20 on the measured data. Finally, in a step 218, corresponding control signals provided by the steps 214 and 216 are sent to the corresponding elements of the system 100.

An example of operating the system 100 is provided hereinafter.

25 The controller 158 selects a first mode of operation denoted as a NORMAL mode when (a) the ambient temperature measured by the temperature measurement device 154 is greater than a first predetermined threshold T_{LA01} , (b) the ambient relative humidity measured by the relative humidity measurement device 156 is greater than a first predetermined level RHL_{01} , (c) the temperature of the liquid from the cooling
 30 portion 132 measured by the temperature measurement device 142 is lower than a predetermined threshold of $T_{LC_{HI}}$, (d) the water level in the water collection tank 144 detected by the water level measurement device 150 does not exceed a predetermined

level WLC_{HI} , and (e) if an external water storage tank is present (coupled to the system 100), and the external water storage tank does not indicate FULL state (not shown).

- 5 If the above conditions are met, the controller 158 opens the actuator valve 138 to allow the liquid from the cooling portion 132 to flow into the first fluid channel 128. Further, the controller 158 activates the fluid pump 140 to convey the liquid to the condenser portion 120 via the first fluid channel 128. The liquid is then circulated from the condenser portion 120 back to the cooling portion 132 by means of the
- 10 second fluid channel 130. The liquid passing through the condenser portion 120 receives heat from the ionised air during thermal interaction of the ionised air with the condenser portion 120. The liquid is then transportable to the cooling portion 132 of the passage 111 for re-cooling thereby subsequent to passing through the condenser portion 120. The liquid passing through the passage 111 is substantially
- 15 isobaric.

Excessive airflow generated by the ventilator 124 may hamper the extraction of water vapour from the ambient air. As such, the speed of the airflow generated by the ventilator 124 should preferably be controlled at a predetermined optimised rate. The

- 20 controller 158 can control the ventilator 124 and the controller 158 attains a predetermined airflow by adjusting fan speed of the ventilator 124. In the first mode of operation, the controller 158 sets the fan speed of the ventilator 124 to low or medium. The ambient air is then controllably induced into the system 100 by the ventilator 124. The incoming air first passes through the air filter 122 followed by an
- 25 ionising field created by the ioniser 118. The ionised air then passes through the condenser portion 120 and surrounds the surfaces of the condenser portion 120 in which condensation of water vapour takes place. The water droplets obtained after condensation drips onto the water collection tray 126 and are directed into the water collection tank 144. The water level measurement device 150 measures the water
- 30 level present in the water collection tank 144 to detect predetermined high (WLC_{HI}) and low (WLC_{LO}) water levels.

During the NORMAL mode and when the water level detected by the water level measurement device 150 exceeds a predetermined level low (WLC_{LO}) level, the water purifier 152 in the water collection tank 144 is activated by the controller 158 on either a continuous or regular basis with the water purifier 152 being periodically
 5 activated for a first duration of WPU_{ON1} and deactivated for a second duration of WPU_{OFF1} . When the water level measured by the water level measurement device 150 detects a predetermined high (WLC_{HI}) level, and if the external water storage tank is present and the external water storage tank does not indicate the FULL state, the controller 158 activates the drive assembly 146 to transfer the water from the
 10 water collection tank 144 through the water purifier 148 of the water collection unit 112. The controller 158 can activate the water purifier 148 on either a continuous or regular basis.

The controller 158 selects a second mode of operation denoted as a COLD mode
 15 when (a) the ambient temperature measured by the temperature measurement device 154 falls between the first predetermined threshold TLA_{01} and a second predetermined threshold TLA_{02} , (b) the ambient relative humidity measured by the relative humidity measurement device 156 is equal to or greater than the predetermined level RHL_{LO} , (c) the temperature of the liquid from the cooling
 20 portion 132 measured by the temperature measurement device 142 equals to or lower than the predetermined threshold of TLC_{LO} , (d) the water level in the water collection tank 144 detected by the water level measurement device 150 does not exceed the predetermined level WLC_{HI} , and (e) if the external water storage tank is present (coupled to the system 100) and the external water storage tank does not indicate
 25 FULL status (not shown).

If the above conditions are met, the controller 158 operates the system 100 through the same control and decision-making steps as performed for the NORMAL mode. The only exception is that the fan speed of the ventilator 124 is set to high for
 30 increasing the air circulation in the vicinity of the condenser portion 120, leading to higher water vapour condensation efficiency when the ambient air temperature is low.

The controller 158 selects a third mode of operation denoted as a SUSPEND mode when (a) the ambient temperature measured by the temperature measurement device 154 falls below the second predetermined threshold TLA_{02} , or (b) the ambient relative humidity measured by the relative humidity measurement device 156 falls below a second predetermined level RHL_{02} , or (c) the temperature of the liquid from the cooling portion 132 measured by the temperature measurement device 142 is higher than a predetermined threshold of TLC_{HI} , or (d) the water level in the water collection tank 144 detected by the water level measurement device 150 equals or exceeds the predetermined level WLC_{HI} , or (e) if the external water storage tank is present (coupled to the system 100) and the external water storage tank indicates FULL state (not shown).

If any of the above conditions is met, the controller 158 stops all the steps required to extract water vapour. However, the ioniser 118 and the ventilator 124 can continue to operate controllably by the controller 158. The controller 158 may also continue to monitor all measurement means if any. Further, should the water level in the water collection tank 144 is above WLC_{LO} , the controller 158 may continue to activate the water purifier 152 of the water collection tank 144 on a continuous or periodic basis.

Exemplary parameters that are preferably used in the system 100 for extracting atmospheric water are as follows:

- 1) $TLA_{01} = 25^{\circ}\text{C}$ and $TLA_{02} = 15^{\circ}\text{C}$, as temperature threshold values used for classifying the modes of operation;
- 2) $RHL_{01} = 50\%$ and $RHL_{02} = 25\%$, as relative humidity threshold values used for classifying the modes of operation;
- 3) $TLC_{LO} = 5^{\circ}\text{C}$ and $TLC_{HI} = 15^{\circ}\text{C}$, as temperature threshold values of the liquid being cooled by the cooling portion 132 used for activation and deactivation of the actuator valve 138 and drive assembly 146; and

4) $WPU_{ONI} = 30$ seconds and $WPU_{OFFI} = 45$ minutes, for periodic activation and cut off durations of the water purifier 152 of the water collection tank 144.

5 The system 100 for extracting water vapour from the ambient air for obtaining potable water provides a solution to water harvesting without the need for extensive water distribution networks. Hence, the system 100 is well suited for indoor, outdoor, fixed and mobile applications. Further, as the system 100 is able to ride on external cooling sources such as existing refrigeration and central air system for extracting heat from the liquid for cooling the liquid, the system 100 offers a cost-effective water making system with relatively low equipment, operational and maintenance costs.

15 Furthermore, the system 100 is able to operate at an ambient air temperature of as low as 15°C , thus making the system 100 well suited for many indoor and outdoor, fixed and mobile applications not only in tropical regions, but also in temperate areas with ambient air temperatures well below what conventional systems are designed to operate at.

20 In the foregoing manner, an atmospheric water extraction system and a method for extracting atmospheric water are described according to one embodiment of the invention for addressing at least one of the foregoing disadvantages. Although only one embodiment of the invention is disclosed, the invention is not to be limited to specific forms or arrangements of parts so described and it will be apparent to one skilled in the art in view of this disclosure that numerous changes and/or modification
25 can be made without departing from the scope and spirit of the invention.

Claims

1. An atmospheric water extraction system comprising:
 - a passage having a condenser portion and a cooling portion inter-configured for cyclical passage of a fluid therethrough;
 - 5 a cooling unit in thermal communication with the cooling portion for extracting heat from the fluid passing through the cooling portion to thereby cool the fluid, the fluid being transportable to the condenser portion subsequent to passing through the cooling portion; and
 - an ioniser for ionising air particles of ambient air introduced into the system into ionised air particles, the ionised air particles being charged for enhancing adhesion of water vapour of the ambient air thereto,
 - 10 wherein the ambient air is transportable for thermal interaction with the condenser portion of the passage for condensing the water vapour of the ambient air to obtain water droplets, the fluid passing through the condenser portion receiving heat from the water vapour of the ambient air during thermal interaction of the ambient air with the condenser portion, the fluid being transportable to the cooling portion of the passage for re-cooling thereby subsequent to passing through the condenser portion.
- 20 2. The atmospheric water extraction system as in claim 1, wherein the fluid passing through the passage is substantially isobaric.
3. The atmospheric water extraction system as in claim 1, further comprising:
 - 25 a ventilator for displacing the ambient air into the atmospheric water extraction system, the ventilator being operable for controlling flow rate of the ambient air displaced.
4. The atmospheric water extraction system as in claim 1, further comprising:
 - 30 an air filter for filtering the ambient air for being received by the ioniser.

5. The atmospheric water extraction system as in claim 1, wherein the cooling unit comprises a drive assembly for displacing the fluid from the cooling unit to the condenser portion of the passage.
- 5 6. The atmospheric water extraction system as in claim 5, wherein the drive assembly comprises an actuator valve and one of a fluid pump, a displacement pump and a centrifugal pump.
- 10 7. The atmospheric water extraction system as in claim 5, wherein the cooling unit further comprises a temperature measurement device for measuring the temperature of the fluid.
- 15 8. The atmospheric water extraction system as in claim 4, wherein the cooling unit is couplable to an external cooling source, the external cooling source for extracting heat from the fluid.
- 20 9. The atmospheric water extraction system as in claim 1, further comprising a water collection tray for receiving the water droplets from the condenser portion.
- 25 10. The atmospheric water extraction system as in claim 9, further comprising a water collection tank for receiving the water droplets from the water collection tray.
- 30 11. The atmospheric water extraction system as in claim 10, wherein the water collection tank comprises a water level measurement device and a water purifier.
12. The atmospheric water extraction system as in claim 1, further comprising a temperature measurement device for measuring ambient air temperature and a relative humidity measurement device for measuring relative humidity of the ambient air.

13. An atmospheric water extraction method comprising:
- providing a passage having a condenser portion and a cooling portion inter-configured for cyclical passage of a fluid therethrough;
- extracting heat from the fluid passing through a cooling portion to thereby cool the fluid using a cooling unit, the cooling unit in thermal communication with the cooling portion, the fluid being transportable to the condenser portion subsequent to passing through the cooling portion; and
- ionising air particles within ambient air introduced into the system into ionised air particles using an ioniser, the ionised air particles being charged for enhancing adhesion of water vapour within the ambient air thereto,
- wherein the ambient air is transportable for thermal interaction with the condenser portion of the passage for condensing the water vapour within the ambient air into water droplets, the fluid passing through the condenser portion receiving heat from the ambient air during thermal interaction of the ambient air with the condenser portion, the fluid being transportable to the cooling portion of the passage for re-cooling thereby subsequent to passing through the condenser portion.
14. The atmospheric water extraction method as in claim 13, wherein the fluid passing through the passage is substantially isobaric.
15. The atmospheric water extraction method as in claim 13, further comprising: displacing the ambient air using a ventilator, the ventilator being operable for controlling flow rate of the ambient air displaced.
16. The atmospheric water extraction method as in claim 13, further comprising: filtering the ambient air for being received by the ioniser using an air filter.

17. The atmospheric water extraction method as in claim 13, wherein the cooling unit comprises a drive assembly for displacing the fluid from the cooling unit to the condenser portion of the passage.
- 5 18. The atmospheric water extraction method as in claim 17, wherein the drive assembly comprises an actuator valve and one of a fluid pump, a displacement pump and a centrifugal pump.
- 10 19. The atmospheric water extraction method as in claim 17, wherein the cooling unit further comprises a temperature measurement device for measuring the temperature of the fluid.
- 15 20. The atmospheric water extraction method as in claim 16, wherein the cooling unit is couplable to an external cooling source, the external cooling source for extracting heat from the fluid.
- 20 21. The atmospheric water extraction method as in claim 13, further comprising:
receiving the water droplets from the condenser portion using a water collection tray.
- 25 22. The atmospheric water extraction method as in claim 21, further comprising:
receiving the water droplets from the water collection tray using a water collection tank.
- 30 23. The atmospheric water extraction method as in claim 22, wherein the water collection tank comprises a water level measurement device and a water purifier.
24. The atmospheric water extraction method as in claim 13, further comprising:
providing a temperature measurement device for measuring ambient air temperature and providing a relative humidity measurement device for measuring relative humidity of the ambient air.

25. An atmospheric water extraction system comprising:

an ioniser for ionising air particles of ambient air introduced into the system for obtaining ionised air particles therefrom, the ionised air particles being charged for enhancing adhesion of water vapour within the ambient air thereto; and

a condenser portion disposed alongside the ioniser for condensing water vapour in the ambient air into water droplets.