

PURE WATER PREPARATION METHOD AND DEVICE

TECHNICAL FIELD

[0001] The present invention relates to water treatment, and more particularly to purification treatment of water.

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TECHNICAL BACKGROUND

[0002] Distillation is an effective method for water purification, and the purification of water is mainly achieved by phase change. However, there is a problem of high energy consumption in atmospheric distillation. Reduced pressure distillation can reduce distillation temperature and save energy, however, original water still needs to be heated during the reduced pressure distillation, and a lot of energy is also consumed.

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SUMMARY

[0003] An object of the present invention is to provide a water purification method that can reduce energy consumption. The working principle of the present invention is to use an air pump to produce a steam pressure difference to achieve phase change, transfer and purification of water. The air pump can transport the air on an original water side to a pure water side and maintain an air pressure on the original water side lower than that on the pure water side. Steam is transferred from the original water side to the pure water side under the action of the air pump, the original water side has a low steam pressure and the pure water side has a high steam pressure. On the original water side, the steam pressure is lower than a saturated steam pressure of original water, the original water is changed from a liquid state to a gaseous state; on the pure water side, the steam pressure is greater than a saturated steam pressure of pure water, the steam is changed from gaseous state water to liquid water. The original water is changed from the liquid water to the gaseous state water under vacuum.

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The change of the original water from the liquid water to the gaseous state water is an endothermic process, the original water can be heated by external heating to accelerate a vaporization process, or can be cooled by itself without the external heating to provide the energy required for vaporization. The change of the steam from the gaseous state to the liquid water is an exothermic process, this

process can be natural cooling or forced cooling by the original water. This water purification method is a continuous working method.

[0004] A pure water preparation device mainly consists of an original water inlet pipeline, an original water outlet pipeline, a vacuum vaporization chamber, a steam liquefaction chamber, an original water inlet pump, an air pump, a pure water outlet pump, an original water inlet valve, an original water outlet valve, a steam pipeline valve, a pure water outlet valve, a steam pipeline and a pure water outlet pipeline. The vacuum vaporization chamber is connected to the original water inlet pipeline, the original water outlet pipeline, and the steam pipeline, the original water inlet valve and the original water pump are mounted on the original water inlet pipeline, the original water outlet valve is mounted on the original water outlet pipeline, the steam pipeline valve is mounted on the steam pipeline, the steam pipeline is connected to the air pump and the steam liquefaction chamber at the same time, the steam liquefaction chamber is connected to the pure water outlet pipeline, the pure water outlet valve and the pure water outlet pump are mounted on the pure water outlet pipeline.

Under the impetus of the original water inlet pump, the original water enters the vacuum vaporization chamber from the original water outlet pipeline through the original water inlet valve, some of the original water is vaporized in the vacuum vaporization chamber, and the rest of the original water flows out through the original water outlet pipeline and the original water outlet valve. The steam vaporized in the vacuum vaporization chamber is pumped into the steam liquefaction chamber by the air pump through the steam pipeline, the steam is liquefied into pure water in the steam liquefaction chamber, and the pure water is discharged from the pure water outlet pipeline through the pure water outlet valve under the action of the pure water outlet pump. The vacuum of the vacuum vaporization chamber is maintained by the gravity of the original water, the original water level of the vacuum vaporization chamber is 9-10 meters higher than an original water inlet level. Further, the original water can be heated in various ways, and the higher the temperature of the original water, the faster the rate of vaporization. Further, the vaporization of the original water can be accelerated by spraying in the vacuum vaporization chamber, and the vaporization of the original water can also be accelerated by various methods of expanding a liquid-gas interface. Further, the steam liquefaction chamber can be additionally equipped with various condensing devices to accelerate steam

liquefaction. Further, the cooling water of the condensing device installed in the steam liquefaction chamber is the original water entering the device.

BRIEF DESCRIPTION OF THE DRAWINGS

5 [0005] The drawing is a diagram of a pure water preparation device of the present invention, in which
1—original water inlet pipeline, 2—original water outlet pipeline, 3—vacuum vaporization chamber,
4—steam liquefaction chamber, 5—original water inlet pump, 6—air pump , 7—pure water outlet
pump, 8—original water inlet valve
Door, 9—original water outlet valve, 10—steam pipeline valve, 11—pure water outlet valve, 12—
10 steam pipeline, 13—pure water outlet pipeline.

DETAILED DESCRIPTION

[0006] Embodiment 1

A seawater desalination device mainly consists of a seawater inlet pipeline, a seawater outlet
15 pipeline, a vacuum vaporization chamber, a steam liquefaction chamber, a seawater inlet pump, an
air pump, and a pure water outlet pump, wherein the vacuum vaporization chamber is connected to
the seawater inlet pipeline, the seawater outlet water pipeline and a steam pipeline, the seawater inlet
valves and the seawater inlet pump are mounted on the seawater inlet pipeline, a seawater outlet
valve is mounted on the seawater outlet pipeline, a steam pipeline valve is mounted on the steam
20 pipeline, the steam pipeline is connected to the air pump and the steam liquefaction chamber at the
same time, the steam liquefaction chamber is connected to the pure water outlet pipeline, a pure
water outlet valve and the pure water outlet pump are mounted on the pure water outlet pipeline, the
vacuum vaporization chamber is more than 9 meters above a sea surface, the vacuum of the vacuum
vaporization chamber is maintained by the gravity of seawater itself, the steam liquefaction chamber
25 is located below the sea surface, a cooling device of the steam liquefaction chamber is seawater. For
a seawater desalination method, seawater enters a vacuum vaporization chamber under the action of
a water inlet pump, the seawater is vaporized under vacuum, steam is transferred to a steam
liquefaction chamber under the action of an air pump. The steam is liquefied into pure water in the

steam liquefaction chamber, the steam pressure on a seawater side is lower than a steam pressure of a pure water side, on the seawater side, the steam pressure is less than a saturated steam pressure of the seawater, the seawater is changed from liquid water to the steam; on the pure water side, the steam pressure is greater than a saturated steam pressure of the pure water, the steam becomes the liquid water. The concentration of unvaporized seawater rises and is discharged from the seawater outlet pipeline. Further, a heating device is mounted on the vacuum vaporization chamber, and the heating device may be a solar heating device or a steam compression liquefaction heat releasing device. Further, a spray device is mounted on the vacuum vaporization chamber, and seawater is sprayed from the spray device to form small water droplets, which can accelerate the vaporization of the seawater.

[0007] Embodiment 2

A pure water preparation device mainly consists of an original water inlet pipeline, an original water outlet pipeline, a vacuum vaporization chamber, a steam liquefaction chamber, an original water inlet pump, an air pump, and a pure water outlet pump, wherein the vacuum vaporization chamber is connected to the original water inlet pipeline and the original water outlet pipeline and a steam pipeline, an original water inlet valve and the original water inlet pump are mounted on the original water inlet pipeline, the original water outlet valve is mounted on the original water outlet pipeline, a steam pipeline valve is mounted on the steam pipeline, the steam pipeline is connected to the air pump and the steam liquefaction chamber, and steam liquefaction chamber is connected to the pure water outlet pipeline, a pure water outlet valve and the pure water outlet pump are mounted on the pure water outlet pipeline, the vacuum vaporization chamber is more than 9 meters above the surface of original water, the vacuum of the vacuum vaporization chamber is maintained by the gravity of original water itself, the steam liquefaction chamber is located under the surface of the original water, and a cooling device of the steam liquefaction chamber is the original water. For a method for preparing pure water, original water enters a vacuum vaporization chamber under the action of a water inlet pump, the original water is vaporized in a vacuum state, steam is transferred to a steam liquefaction chamber under the action of an air pump, the steam is liquefied into pure water in the steam liquefaction chamber, a steam pressure of original water side is lower than a steam pressure of

a pure water side, on the original water side, the steam pressure is less than a saturated steam pressure of the original water, the original water is changed from liquid water to the steam, on the pure water side, the steam pressure is greater than a saturated steam pressure of pure water, the steam is changed into the liquid water, the original water that has not been vaporized is discharged from the original water outlet pipeline. Further, a heating device is mounted on the vacuum vaporization chamber, and the heating device may be a solar heating device or a steam compression liquefaction heat releasing device. Further, a spray device is mounted on the vacuum vaporization chamber, the original water is sprayed from the spray device to form small water droplets, which can accelerate the vaporization of the original water.

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CLAIMS

1. A method for preparing pure water, which mainly purifies water through a phase change of liquid-steam-liquid, on an original water side, a steam pressure is lower than a saturated steam pressure of original water, the original water is changed from liquid water to steam, on a pure water side, the steam pressure is greater than the saturated steam pressure of pure water, the steam becomes the liquid water, wherein 1) the steam on the original water side is transferred from the original water side to the pure water side under the action of an air pump; 2) an air pressure on the original water side is lower than an air pressure on the pure water side; 3) the original water is changed from the liquid water to the steam under vacuum; 4) the phase change of the liquid-vapor-liquid of the pure water preparation is continuously performed.
2. The method for preparing the pure water according to claim 1, wherein the vacuum of the original water from the liquid water to the steam in a vacuum state is maintained by the gravity of the water itself.
3. A device for preparing pure water for realizing a method for preparing the pure water according to claim 1, mainly consisting of an original water inlet pipeline, an original water outlet pipeline, a vacuum vaporization chamber, a steam liquefaction chamber, an original water inlet pump, an air pump, and a pure water outlet pump, wherein the original water inlet pipeline, the original water outlet pipeline and a steam pipeline are connected to the vacuum vaporization chamber, an original water inlet valve and an original water inlet pump are mounted on the original water inlet pipeline, an original water outlet valve is mounted on the original water outlet pipeline, a steam pipeline valve is mounted on the steam pipeline, the steam pipeline is connected to the air pump and the steam liquefaction chamber at the same time, the steam liquefaction chamber is connected to a pure water outlet pipeline, a pure water outlet valve and a pure water outlet pump are mounted on the pure water outlet pipeline, the original water enters the vacuum vaporization chamber under the action of the water inlet pump and is vaporized under the vacuum state, the steam is transferred to the steam liquefaction chamber under the action of the air pump, the steam is liquefied into the pure water in the steam

liquefaction chamber; and the original water without vaporization is discharged through the original water outlet pipeline.

4. The device for preparing the pure water according to claim 3, wherein the vacuum of the vacuum vaporization chamber is maintained by the gravity of the original water, and the vacuum vaporization chamber is more than 9 meters above an inlet liquid level of the original water.

5. The device for preparing the pure water according to claim 3, wherein the vacuum vaporization chamber has a heating device, and the original water can be heated via the heating device to accelerate vaporization.

6. The device for preparing the pure water according to claim 3, wherein the vacuum vaporization chamber is provided with a spray device, and the original water can be accelerated to vaporize by spraying.

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7. The device for preparing the pure water according to claim 3, wherein the steam liquefaction chamber has a forced cooling device, and the steam can be accelerated to liquefy by the forced cooling device.

8. The device for preparing the pure water according to claim 7, wherein cooling water of the forced cooling device of the steam liquefaction chamber is the original water entering the device.

9. A seawater desalination method, wherein seawater enters a vacuum vaporization chamber under the action of an inlet pump, the seawater is vaporized in a vacuum state, steam is transferred to a steam liquefaction chamber under the action of an air pump, the steam is liquefied into pure water in the steam liquefaction chamber; a steam pressure on a seawater side is lower than a steam pressure

on a pure water side, on the seawater side, the steam pressure is lower than a saturated steam pressure of the seawater, the seawater is changed from liquid water to steam, on the pure water side, the steam pressure is greater than the saturated vapor pressure of the pure water, steam turns into liquid water; the vacuum of the vacuum vaporization chamber is maintained by the gravity of the
5 seawater itself, and the steam liquefaction chamber is cooled by the seawater.

10. A seawater desalination device, mainly consisting of an original water seawater inlet pipeline, a seawater outlet pipeline, a vacuum vaporization chamber, a steam liquefaction chamber, a seawater inlet pump, an air pump, and a pure water outlet pump, wherein the vacuum vaporization chamber is
10 connected to the seawater inlet pipeline, the seawater outlet pipeline and a steam pipeline, a seawater inlet valve and a seawater inlet pump are mounted on the seawater inlet pipeline, a seawater outlet valve is mounted on the seawater outlet pipeline, a steam pipeline valve is mounted on the steam pipeline, the steam pipeline is connected to the steam liquefaction chamber at the same time, the steam liquefaction chamber is connected to a pure water outlet pipeline, a pure water outlet
15 valve and the pure water outlet pump are mounted on the pure water outlet pipeline, the vacuum vaporization chamber is more than 9 meters above a sea surface, and the steam liquefaction chamber is located below the sea surface.