the circulation of the ozone water (unused ozone water). Therefore, development of a technology for producing ozone water by an amount needed at a use point is desired.

[0009]

Embodiments of the present invention seek to provide a supply-liquid producing apparatus that may not need to take measures against temperature rise or contamination of a supply liquid (such as ozone water) due to circulation, or may reduce at least necessity of the measures, and may be capable of producing the supply liquid by an amount needed at a use point. More specifically, embodiments of the present invention seek to provide a supply-liquid producing apparatus capable of supplying a supply liquid having a constant flow rate or constant pressure and constant concentration to a use point.

Solution to Problem

[0010]

A supply-liquid producing apparatus as disclosed includes: a mixing unit that mixes a first raw material and a second raw material to produce a mixed liquid; a pump unit that changes a flow rate of the first raw material to be supplied to the mixing unit; a gas-liquid separation tank unit that separates the mixed liquid produced by the mixing unit into a supply liquid to be supplied to a use point, and exhaust gas to be

liquid thus measured, and therefore the supply liquid (such as ozone water) can be produced by an amount needed at the use point.

[0012]

The supply-liquid producing apparatus as disclosed may further include a second flow measuring unit that measures the flow rate of the first raw material to be supplied to the mixing unit, in which the flow control unit may perform feedback control for making the flow rate of the first raw material measured by the second flow measuring unit coincide with the flow rate of the supply liquid measured by the flow measuring unit.

[0013]

According to this configuration, the flow rate of the first raw material is monitored, and when the flow rate is deviated from a desired flow rate, the feedback control of the pump can be performed in order to amend the flow rate.

[0014]

The supply-liquid producing apparatus as disclosed may further include a flow controller that determines a flow rate of the second raw material, in which the flow controller may adjust a production amount of the second raw material in response to the flow rate of the first raw material measured by the second flow measuring unit.

[0015]

According to this configuration, relation between the flow rate of the first raw material and the flow rate of the second material previously can be obtained so as to obtain a supply liquid having target concentration, and the second raw material can be allowed to flow in response to the flow rate of the first raw material.

[0016]

A supply-liquid producing apparatus as disclosed includes: a mixing unit that mixes a first raw material and a second raw material to produce a mixed liquid; a booster pump unit that increases pressure of the first raw material to be supplied to the mixing unit; a gas-liquid separation tank unit that separates the mixed liquid produced by the mixing unit into a supply liquid to be supplied to a use point, and exhaust gas to be discharged from an exhaust port; a flow measuring unit that measures a flow rate of the supply liquid to be supplied from the gas-liquid separation tank unit to the use point; and a boosting control unit that adjusts pressure of the first raw material to be increased in pressure and supplied to the mixing unit by controlling the booster pump unit in response to the flow rate of the supply liquid measured by the flow measuring unit; and an exhaust pressure control unit that controls exhaust pressure of the exhaust gas such that a liquid amount in the gas-liquid separation tank unit is kept constant.

[0017]

Claims

[Claim 1]

A supply-liquid producing apparatus comprising:

a mixing unit that mixes a first raw material and a second raw material to produce a mixed liquid;

a pump unit that changes a flow rate of the first raw material to be supplied to the mixing unit;

a gas-liquid separation tank unit that separates the mixed liquid produced by the mixing unit into a supply liquid to be supplied to a use point, and exhaust gas to be discharged from an exhaust port;

a first flow measuring unit that measures the flow rate of the supply liquid to be supplied from the gas-liquid separation tank unit to the use point;

an exhaust valve that adjusts an exhaust amount of the exhaust gas to be discharged from the exhaust port; and

an exhaust control unit that adjusts the exhaust amount of the exhaust gas to be discharged from the exhaust port by controlling the exhaust valve in response to the flow rate of the supply liquid measured by the first flow measuring unit such that the flow rate of the supply liquid to be supplied to the use point is kept at a constant flow rate, wherein

the exhaust control unit increases the exhaust amount of the exhaust gas to be discharged from the exhaust port in a case where the flow rate of the supply

liquid measured by the first flow measuring unit increases with respect to the constant flow rate, and the exhaust control unit decreases the exhaust amount of the exhaust gas to be discharged from the exhaust port in a case where the flow rate of the supply liquid measured by the first flow measuring unit decreases with respect to the constant flow rate.

[Claim 2]

The supply-liquid producing apparatus according to claim 1, further comprising

a flow control unit that adjusts the flow rate of the first raw material to be supplied to the mixing unit by controlling the pump unit in response to the flow rate of the supply liquid measured by the first flow measuring unit, wherein

the flow control unit controls such that flow rate of the supply liquid measured by the first flow measuring unit becomes the same as the flow rate of the first raw material to be supplied to the mixing unit.

[Claim 3]

The supply-liquid producing apparatus according to claim 2, further comprising

a second flow measuring unit that measures the flow rate of the first raw material to be supplied to the mixing unit.

[Claim 4]

The supply-liquid producing apparatus according to claim 2, further comprising

a liquid amount measuring unit that detects a liquid amount in the gas-liquid separation tank unit, wherein

the boosting control unit decreases the flow rate of the first raw material to be supplied to the mixing unit in a case where the liquid amount in the gas-liquid separation tank unit measured by the liquid amount measuring unit increases with respect to a predetermined liquid amount, and the boosting control unit increases the flow rate of the first raw material to be supplied to the mixing unit in a case where the liquid amount in the gas-liquid separation tank unit measured by the liquid amount measuring unit decreases with respect to the predetermined liquid amount.

[Claim 5]

A supply-liquid producing method comprising the steps of:

mixing a first raw material and a second raw material to produce a mixed liquid by a mixing unit;

separating the mixed liquid produced by the mixing unit into a supply liquid to be supplied to a use point, and exhaust gas to be discharged from an exhaust port by a gas-liquid separation tank unit;

measuring a flow rate of the supply liquid to be supplied from the gas-liquid separation tank unit to the use point by a first flow measuring unit; and

adjusting an exhaust amount of the exhaust gas to be discharged from the exhaust port by an exhaust valve in response to the flow rate of the supply liquid measured by the first flow measuring unit such that the flow rate of the supply liquid to be supplied to the use point is kept at a constant flow rate, wherein

in the step of adjusting the exhaust amount of the exhaust gas, the exhaust amount of the exhaust gas to be discharged from the exhaust port is increased in a case where the flow rate of the supply liquid measured by the first flow measuring unit increases with respect to the constant flow rate, and the exhaust amount of the exhaust gas to be discharged from the exhaust port is decreased in a case where the flow rate of the supply liquid measured by the flow measuring unit decreases with respect to the constant flow rate.

[Claim 6]

A supply-liquid producing apparatus comprising:

a mixing unit that mixes a first raw material and a second raw material to produce a mixed liquid;

a pump unit that changes a flow rate of the first raw material to be supplied to the mixing unit;

a gas-liquid separation tank unit that separates the mixed liquid produced by the mixing unit into a supply liquid to be supplied to a use point, and exhaust gas to be discharged from an exhaust port;

a pressure measuring unit that measures pressure of the supply liquid to be supplied from the gas-liquid separation tank unit to the use point;

an exhaust valve that adjusts an exhaust amount of the exhaust gas to be discharged from the exhaust port; and

an exhaust control unit that adjusts the exhaust amount of the exhaust gas to be discharged from the exhaust port by controlling the exhaust valve in response to the pressure of the supply liquid measured by the pressure measuring unit such that the pressure of the supply liquid to be supplied to the use point is kept at constant pressure, wherein

the exhaust control unit increases the exhaust amount of the exhaust gas to be discharged from the exhaust port in a case where the pressure of the supply liquid measured by the pressure measuring unit increases with respect to the constant pressure, and the exhaust control unit decreases the exhaust amount of the exhaust gas to be discharged from the exhaust port in a case where the pressure of the supply liquid measured by the pressure measuring unit decreases with respect to the constant pressure.

[Claim 7]

The supply-liquid producing apparatus according to claim 6, further comprising

a first flow measuring unit that measures the flow rate of the supply liquid to be supplied from the gas-liquid separation tank unit to the use point; and

a flow control unit that adjusts the flow rate of the first raw material to be supplied to the mixing unit by controlling the pump unit in response to the flow rate of the supply liquid measured by the first flow measuring unit, wherein

the flow control unit controls such that the flow rate of the supply liquid measured by the first flow measuring unit becomes the same as the flow rate of the first raw material to be supplied to the mixing unit.

[Claim 8]

The supply-liquid producing apparatus according to claim 7, further comprising

a second flow measuring unit that measures the flow rate of the first raw material to be supplied to the mixing unit.

[Claim 9]

The supply-liquid producing apparatus according to claim 7, further comprising

a liquid amount measuring unit that detects a liquid amount in the gas-liquid separation tank unit, wherein

the flow control unit decreases the flow rate of the first raw material to be supplied to the mixing unit in a case where the liquid amount in the gas-liquid separation tank unit measured by the liquid amount measuring unit

increases with respect to a predetermined liquid amount, and the flow control unit increases the flow rate of the first raw material to be supplied to the mixing unit in a case where the liquid amount in the gas-liquid separation tank unit measured by the liquid amount measuring unit decreases with respect to the predetermined liquid amount.

[Claim 10]

A supply-liquid producing method comprising the steps of:

mixing a first raw material and a second raw material to produce a mixed liquid by a mixing unit;

separating the mixed liquid produced by the mixing unit into a supply liquid to be supplied to a use point, and exhaust gas to be discharged from an exhaust port by a gas-liquid separation tank unit;

measuring pressure of the supply liquid to be supplied from the gas-liquid separation tank unit to the use point by a pressure measuring unit; and

adjusting an exhaust amount of the exhaust gas to be discharged from the exhaust port by an exhaust valve in response to the pressure of the supply liquid measured by the pressure measuring unit such that the pressure of the supply liquid to be supplied to the use point is kept at constant pressure, wherein

in the step of adjusting the exhaust amount of the exhaust gas, the exhaust amount of the exhaust gas to be discharged from the exhaust port is increased in a case

where the pressure of the supply liquid measured by the pressure measuring unit increases with respect to the constant pressure, and the exhaust amount of the exhaust gas to be discharged from the exhaust port is decreased in a case where the pressure of the supply liquid measured by the pressure measuring unit decreases with respect to the constant pressure.

[Claim 11]

A supply-liquid producing apparatus comprising:

a mixing unit that mixes a first raw material and a second raw material to produce a mixed liquid;

a pump unit that changes a flow rate of the first raw material to be supplied to the mixing unit;

a gas-liquid separation tank unit that separates the mixed liquid produced by the mixing unit into a supply liquid to be supplied to a use point, and exhaust gas to be discharged from an exhaust port;

a first flow measuring unit that measures the flow rate of the supply liquid to be supplied from the gas-liquid separation tank unit to the use point;

a pressure measuring unit that measures pressure of the supply liquid to be supplied from the gas-liquid separation tank unit to the use point;

an exhaust valve that adjusts the exhaust amount of the exhaust gas to be discharged from the exhaust port;

a flow rate constant control unit that adjusts an exhaust amount of the exhaust gas to be discharged from

the exhaust port by controlling the exhaust valve in response to the flow rate of the supply liquid measured by the first flow measuring unit such that the flow rate of the supply liquid to be supplied to the use point is kept at a constant flow rate;

a pressure constant control unit that adjusts the exhaust amount of the exhaust gas to be discharged from the exhaust port by controlling the exhaust valve in response to the pressure of the supply liquid measured by the pressure measuring unit such that the pressure of the supply liquid to be supplied to the use point is kept at constant pressure; and

a control selection unit that selects any one of flow rate constant control for adjusting the exhaust amount of the exhaust gas by the flow rate constant control unit, and pressure constant control for adjusting the exhaust amount of the exhaust gas by the pressure constant control unit, wherein

in a case where the control selection unit selects the flow rate constant control, the flow rate constant control unit increases the exhaust amount of the exhaust gas to be discharged from the exhaust port when the flow rate of the supply liquid measured by the first flow measuring unit increases with respect to the constant flow rate, and the flow rate constant control unit decreases the exhaust amount of the exhaust gas to be discharged from the exhaust port when the flow rate of

the supply liquid measured by the flow measuring unit decreases with respect to the constant flow rate, and

in a case where the control selection unit selects the pressure constant control, the pressure constant control unit increases the exhaust amount of the exhaust gas to be discharged from the exhaust port when the pressure of the supply liquid measured by the pressure measuring unit increases with respect to the constant pressure, and the pressure constant control unit decreases the exhaust amount of the exhaust gas to be discharged from the exhaust port when the pressure of the supply liquid measured by the pressure measuring unit decreases with respect to the constant pressure.

[Claim 12]

A supply-liquid producing method comprising the steps of:

mixing a first raw material and a second raw material to produce a mixed liquid by a mixing unit;

separating the mixed liquid produced by the mixing unit into a supply liquid to be supplied to a use point, and exhaust gas to be discharged from an exhaust port by a gas-liquid separation tank unit;

measuring a flow rate of the supply liquid to be supplied from the gas-liquid separation tank unit to the use point by a flow measuring unit;

measuring pressure of the supply liquid to be supplied from the gas-liquid separation tank unit to the use point by a pressure measuring unit; and

selecting any one of flow rate constant control for adjusting an exhaust amount of the exhaust gas to be discharged from the exhaust port by controlling the exhaust valve in response to the flow rate of the supply liquid measured by the flow measuring unit such that the flow rate of the supply liquid to be supplied to the use point is kept at a constant flow rate, and pressure constant control for adjusting the exhaust amount of the exhaust gas to be discharged from the exhaust port by controlling the exhaust valve in response to the pressure of the supply liquid measured by the pressure measuring unit such that the pressure of the supply liquid to be supplied to the use point is kept at constant pressure, wherein

in a case where the flow rate constant control is selected, the exhaust amount of the exhaust gas to be discharged from the exhaust port is increased when the flow rate of the supply liquid measured by the flow measuring unit increases with respect to the constant flow rate, and the exhaust amount of the exhaust gas to be discharged from the exhaust port is decreased when the flow rate of the supply liquid measured by the flow measuring unit decreases with respect to the constant flow rate, and

in a case where the pressure constant control is selected, the exhaust amount of the exhaust gas to be discharged from the exhaust port is increased when the pressure of the supply liquid measured by the pressure measuring unit increases with respect to the constant pressure, and the exhaust amount of the exhaust gas to be discharged from the exhaust port is decreased when the pressure of the supply liquid measured by the pressure measuring unit decreases with respect to the constant pressure.