[0004]

Patent Document 1: Japanese Patent No. 4499835

SUMMARY OF THE INVENTION

PROBLEM TO BE SOLVED BY THE INVENTION

[0005]

In the seawater desalination system of Patent Document 1, however, the first processing part and the second processing part are controlled according to the quantity of the sewage, and thus the quality of the generated fresh water depends on the quantity of the sewage. Here, the sewage is effluent obtained by filtrating organic waste water containing organic substances, inorganic waste water at manufacturing facilities, or the like water. This means that the quality and quantity of the sewage to be supplied is not stable. Accordingly, the seawater desalination system of Patent Document 1 has difficulty in ensuring the quality of the generated fresh water.

[0006]

The object of the present invention is to provide a seawater desalination system that enables a reduction in the energy required for generating fresh water and that ensures the quality of the generated fresh water.

MEANS TO SOLVE THE PROBLEM

[0006a]

In an aspect, there is provided a seawater desalination system comprising: a sewage-associated reverse osmosis membrane processing means that subjects sewage to membrane separation treatment for generating sewage-associated permeate and sewage-associated concentrate; and a seawater-associated reverse osmosis membrane processing means that subjects a water mixture of the sewage-associated concentrate and collected seawater to membrane separation treatment for generating seawater-associated permeate and seawater-associated concentrate and that has a salt concentration measuring means for measuring the salt concentration of the generated seawater-associated permeate, wherein the generated seawater-associated permeate is supplied to the sewage-associated reverse osmosis membrane processing means if the

salt concentration of the seawater-associated permeate measured by the salt concentration measuring means does not meet a predetermined reference value therefor.

[0006b]

In another aspect, there is provided a seawater desalination system comprising: a sewage-associated reverse osmosis membrane processing means that subjects sewage to membrane separation treatment for generating sewage-associated permeate and sewage-associated concentrate; the system further comprising: a seawater-associated reverse osmosis membrane processing means that pressurizes a water mixture of the sewage-associated concentrate and collected seawater using a pressure pump and subjects the pressurized water mixture to membrane separation treatment for generating seawater-associated permeate and seawater-associated concentrate wherein the seawater-associated reverse osmosis membrane processing means has a salt concentration measuring means for measuring the salt concentration of the generated seawater-associated permeate; and a control means that slows down the operation of the pressure pump of the seawater-associated reverse osmosis membrane processing means if the salt concentration of the seawater-associated permeate measured by the salt concentration measuring means does not meet a predetermined reference value therefor, wherein the control means controls to supply the seawater-associated permeate to the sewage-associated reverse osmosis membrane processing means according to the salt concentration of the seawater-associated permeate measured by the salt concentration measuring means, and the sewage-associated reverse osmosis membrane processing means subjects a water mixture of sewage and the seawater-associated permeate supplied from the seawater-associated reverse osmosis membrane processing means to membrane separation treatment.

[0006c]

In another aspect, there is provided a seawater desalination method comprising: a sewage-associated reverse osmosis membrane processing step of subjecting sewage to membrane separation treatment for generating sewage-associated permeate and sewage-associated concentrate; a seawater-associated reverse osmosis membrane processing step of subjecting a water mixture of the sewage-associated concentrate and

collected seawater to membrane separation treatment for generating seawater-associated permeate and seawater-associated concentrate; a salt concentration measuring step of measuring the salt concentration of the seawater-associated permeate; and a seawater-associated permeate recycling step of returning the seawater-associated permeate to the sewage-associated reverse osmosis membrane processing step according to the salt concentration of the seawater-associated permeate.

[0006d]

In another aspect, there is provided a seawater desalination method comprising: a sewage-associated reverse osmosis membrane processing step of subjecting sewage to membrane separation treatment for generating sewage-associated permeate and sewage-associated concentrate; a seawater-associated reverse osmosis membrane processing step of pressurizing a water mixture of the sewage-associated concentrate and collected seawater using a pressure pump and subjecting the pressurized water mixture to membrane separation treatment for generating seawater-associated permeate and seawater-associated concentrate; a salt concentration measuring step of measuring the salt concentration of the seawater-associated permeate; a continuation determination step of stopping continuation of the operation of the pressure pump in the seawater-associated reverse osmosis membrane processing step if the salt concentration of the seawater-associated permeate does not meet a predetermined reference value therefor; and a seawater-associated permeate recycling step of returning the seawater-associated permeate to the sewage-associated reverse osmosis membrane processing step according to the salt concentration of the seawater-associated permeate measured in the salt concentration measuring step, wherein the sewage-associated reverse osmosis membrane processing step is a step of subjecting a water mixture of sewage and the seawater-associated permeate returned in the seawater-associated permeate recycling step to membrane separation treatment.

[0007]

(1) A seawater desalination system characterized by comprising: a sewage-associated reverse osmosis membrane processing means that subjects sewage to membrane separation treatment for generating sewage-associated permeate and sewage-associated concentrate; and a seawater-associated reverse osmosis membrane processing means that subjects a water mixture of the sewage-associated concentrate and collected seawater to membrane separation treatment for generating seawater-associated permeate and seawater-associated concentrate and that has a salt concentration measuring means for measuring the salt concentration of the seawater-associated permeate, wherein the seawater-associated permeate is supplied to the sewage-associated reverse osmosis membrane processing means according to the salt concentration of the seawater-associated permeate measured by the salt concentration measuring means.

CLAIMS

1. A seawater desalination system characterized by comprising:

a sewage-associated reverse osmosis membrane processing means that subjects sewage to membrane separation treatment for generating sewage-associated permeate and sewage-associated concentrate; and

a seawater-associated reverse osmosis membrane processing means that subjects a water mixture of the sewage-associated concentrate and collected seawater to membrane separation treatment for generating seawater-associated permeate and seawater-associated concentrate and that has a salt concentration measuring means for measuring the salt concentration of the seawater-associated permeate,

wherein the seawater-associated permeate is supplied to the sewage-associated reverse osmosis membrane processing means according to the salt concentration of the seawater-associated permeate measured by the salt concentration measuring means.

2. The seawater desalination system of Claim 1 characterized in that it comprises a control means for controlling operation of the sewage-associated reverse osmosis membrane processing means and the seawater-associated reverse osmosis membrane processing means according to the salt concentration of the seawater-associated permeate measured by the salt concentration measuring means.

3. The seawater desalination system of Claim 2 characterized in that the control means controls to supply the seawater-associated permeate to the sewage-associated reverse osmosis membrane processing means according to the salt concentration of the seawater-associated permeate measured by the salt concentration measuring means, and

the sewage-associated reverse osmosis membrane processing means subjects a water mixture of the seawater-associated permeate supplied from the seawater-associated reverse osmosis membrane processing means and the sewage to membrane separation treatment.

4. The seawater desalination system of Claim 1, characterized in that the seawater-associated reverse osmosis membrane processing means includes a reverse osmosis membrane having a desalination rate determined based on:

the quantity and the salt concentration of the sewage supplied to the sewage-associated reverse osmosis membrane processing means;

the quantity and the salt concentration of the seawater supplied to the seawater-associated reverse osmosis membrane processing means; and

a preset quantity and a preset salt concentration of the seawater-associated permeate to be generated by the seawater-associated reverse osmosis membrane processing means.

5. A seawater desalination system characterized by comprising:

a sewage-associated reverse osmosis membrane processing means that subjects sewage to membrane separation treatment for generating sewage-associated permeate and sewage-associated concentrate;

a seawater-associated reverse osmosis membrane processing means that subjects seawater to membrane separation treatment for generating seawater-associated permeate and seawater-associated concentrate; and

a reserving system having a tank for reserving a permeate mixture of the sewage-associated permeate and the seawater-associated permeate and a water level gauge for measuring a water level of the permeate mixture reserved in the tank,

wherein the reserving system activates or stops the seawater-associated reverse osmosis membrane processing means according to the water level measured by the water level gauge.

6. The seawater desalination system of Claim 5 characterized in that the reserving system has a first salt concentration measuring means for measuring the salt concentration of the permeate mixture reserved in the tank,

the sewage-associated reverse osmosis membrane processing means has a second salt concentration measuring means for measuring the salt concentration of the sewage-associated permeate generated,

the seawater-associated reverse osmosis membrane processing means has a third salt concentration measuring means for measuring the salt concentration of the seawater-associated permeate generated, and

the seawater-associated reverse osmosis membrane processing means is activated or stopped according to the salt concentration of the seawater-associated permeate, the salt

concentration of the sewage-associated permeate, and the salt concentration of the permeate mixture.

7. A seawater desalination method characterized by comprising:

a sewage-associated reverse osmosis membrane processing step of subjecting sewage to membrane separation treatment for generating sewage-associated permeate and sewage-associated concentrate;

a seawater-associated reverse osmosis membrane processing step of subjecting a water mixture of the sewage-associated concentrate and collected seawater to membrane separation treatment for generating seawater-associated permeate and seawater-associated concentrate;

a salt concentration measuring step of measuring the salt concentration of the seawater-associated permeate; and

a seawater-associated permeate recycling step of returning the seawater-associated permeate to the sewage-associated reverse osmosis membrane processing step according to the salt concentration of the seawater-associated permeate.

8. The seawater desalination method of Claim 7 characterized in that it comprises a continuation determination step of determining continuation of the sewage-associated reverse osmosis membrane processing step and the seawater-associated reverse osmosis membrane processing step according to the salt concentration of the seawater-associated permeate.

9. The seawater desalination method of Claim 8 characterized in that it comprises a seawater-associated permeate recycling step of returning the seawater-associated permeate to the sewage-associated reverse osmosis membrane processing step according to the salt concentration of the seawater-associated permeate,

wherein the sewage-associated reverse osmosis membrane processing step is a step of subjecting a water mixture of the sewage and the seawater-associated permeate returned to the seawater-associated permeate recycling step to membrane separation treatment.

10. A seawater desalination method characterized by comprising:

a sewage-associated reverse osmosis membrane processing step of subjecting sewage to membrane separation treatment for generating sewage-associated permeate and sewage-associated concentrate;

a seawater-associated reverse osmosis membrane processing step of subjecting seawater to membrane separation treatment for generating seawater-associated permeate and seawater-associated concentrate;

a reserving step of reserving a permeate mixture of the sewage-associated permeate and the seawater-associated permeate in a tank;

a water level measuring step of measuring the water level of the permeate mixture reserved in the tank; and

a determining step of determining whether or not to carry out the seawater-associated reverse osmosis membrane processing step according to the water level measured in the water level measuring step.

11. The seawater desalination method of Claim 10 characterized in that it comprises:

a first salt concentration measuring step of measuring the salt concentration of the permeate mixture reserved in the tank;

a second salt concentration measuring step of measuring the salt concentration of the sewage-associated permeate generated in the sewage-associated reverse osmosis membrane processing step; and

a third salt concentration measuring step of measuring the salt concentration of the seawater-associated permeate generated in the seawater-associated reverse osmosis membrane processing step,

wherein the determining step determines whether or not to carry out the seawater-associated reverse osmosis membrane processing step according to the salt concentration of the seawater-associated permeate, the salt concentration of the sewage-associated permeate, and the salt concentration of the permeate mixture.

CLAIMS

1. A seawater desalination system comprising:

a sewage-associated reverse osmosis membrane processing means that subjects sewage to membrane separation treatment for generating sewage-associated permeate and sewage-associated concentrate; and

a seawater-associated reverse osmosis membrane processing means that subjects a water mixture of the sewage-associated concentrate and collected seawater to membrane separation treatment for generating seawater-associated permeate and seawater-associated concentrate and that has a salt concentration measuring means for measuring the salt concentration of the generated seawater-associated permeate,

wherein the generated seawater-associated permeate is supplied to the sewage-associated reverse osmosis membrane processing means if the salt concentration of the seawater-associated permeate measured by the salt concentration measuring means does not meet a predetermined reference value therefor.

2. A seawater desalination system comprising:

a sewage-associated reverse osmosis membrane processing means that subjects sewage to membrane separation treatment for generating sewage-associated permeate and sewage-associated concentrate;

the system further comprising:

a seawater-associated reverse osmosis membrane processing means that pressurizes a water mixture of the sewage-associated concentrate and collected seawater using a pressure pump and subjects the pressurized water mixture to membrane separation treatment for generating seawater-associated permeate and seawater-associated concentrate wherein the seawater-associated reverse osmosis membrane processing means has a salt concentration measuring means for measuring the salt concentration of the generated seawater-associated permeate; and

a control means that slows down the operation of the pressure pump of the seawater-associated reverse osmosis membrane processing means if the salt concentration of the seawater-associated permeate measured by the salt concentration measuring means does not meet a predetermined reference value therefor,

wherein the control means controls to supply the seawater-associated permeate to the sewage-associated reverse osmosis membrane processing means according to the salt concentration of the seawater-associated permeate measured by the salt concentration measuring means, and

the sewage-associated reverse osmosis membrane processing means subjects a water mixture of sewage and the seawater-associated permeate supplied from the seawater-associated reverse osmosis membrane processing means to membrane separation treatment.

3. The seawater desalination system of Claim 2 further comprising a second seawater-associated reverse osmosis membrane processing means that subjects the seawater-associated permeate to membrane separation treatment,

wherein the control means supplies the seawater-associated permeate to the second seawater-associated reverse osmosis membrane processing means according to the salt concentration of the seawater-associated permeate measured by the salt concentration measuring means.

4. The seawater desalination system of Claim 2 or 3 wherein the seawater-associated reverse osmosis membrane processing means includes a reverse osmosis membrane having a desalination rate predetermined based on:

the quantity and the salt concentration of the sewage supplied to the sewage-associated reverse osmosis membrane processing means;

the quantity and the salt concentration of the seawater supplied to the seawater-associated reverse osmosis membrane processing means; and

a preset quantity and a preset salt concentration of the seawater-associated permeate to be generated by the seawater-associated reverse osmosis membrane processing means.

5. A seawater desalination method comprising:

a sewage-associated reverse osmosis membrane processing step of subjecting sewage to membrane separation treatment for generating sewage-associated permeate and sewage-associated concentrate;

a seawater-associated reverse osmosis membrane processing step of subjecting a water mixture of the sewage-associated concentrate and collected seawater to membrane separation treatment for generating seawater-associated permeate and seawater-associated concentrate;

a salt concentration measuring step of measuring the salt concentration of the seawater-associated permeate; and

a seawater-associated permeate recycling step of returning the seawater-associated permeate to the sewage-associated reverse osmosis membrane processing step according to the salt concentration of the seawater-associated permeate.

6. A seawater desalination method comprising:

a sewage-associated reverse osmosis membrane processing step of subjecting sewage to membrane separation treatment for generating sewage-associated permeate and sewage-associated concentrate;

a seawater-associated reverse osmosis membrane processing step of pressurizing a water mixture of the sewage-associated concentrate and collected seawater using a pressure pump and subjecting the pressurized water mixture to membrane separation treatment for generating seawater-associated permeate and seawater-associated concentrate;

a salt concentration measuring step of measuring the salt concentration of the seawater-associated permeate;

a continuation determination step of stopping continuation of the operation of the pressure pump in the seawater-associated reverse osmosis membrane processing step if the salt concentration of the seawater-associated permeate does not meet a predetermined reference value therefor; and

a seawater-associated permeate recycling step of returning the seawater-associated permeate to the sewage-associated reverse osmosis membrane processing step according to the salt concentration of the seawater-associated permeate measured in the salt concentration measuring step,

wherein the sewage-associated reverse osmosis membrane processing step is a step of subjecting a water mixture of sewage and the seawater-associated permeate

returned in the seawater-associated permeate recycling step to membrane separation treatment.

7. The seawater desalination method of Claim 6 further comprising a second seawater-associated reverse osmosis membrane processing step of subjecting the seawater-associated permeate to membrane separation treatment,

wherein in the second seawater-associated reverse osmosis membrane processing step, the seawater-associated permeate is treated according to the salt concentration of the seawater-associated permeate measured in the salt concentration measuring step.