exceeds a predetermined value, the valve 65 is opened to discharge at least a part of the dilute water sent from the pump 32 into the raw water tank 1 through the pipes 63 and 64, the valve 65 and the pipe 66. Into the dilute water tank 31, a new dilute water with a volume corresponding to the volume of discharged water is introduced from a replenishment line 30 by using a ball tap or the like. As the water quality monitor 31b, an electrical conductivity meter, a colorimetric analysis, an ion electrode and the like are suitable.

[0035]

In the method for operating the desalting apparatus, while continuing the operation of producing permeated water in one desalting series, the operation of passing dilute water maintained at a low concentration through another desalting series is performed. As a result, the flux of the desalting series is recovered, so that decrease in recovery ratio can be prevented without stopping the desalting apparatus. Further, since the entire amount of the dilute water used for cleaning is returned to the dilute water tank 31, the consumption of the dilute water is low.

[0036]

[Timing for switching from normal operation to recovery operation]

In the present invention, although it is possible to switch to the recovery operation when the normal operation is performed for a predetermined time, it is preferable to switch to the recovery operation at the timing when the scale is generated in the second desalting apparatus. For example, in the case of Fig. 1 where a reverse osmosis membrane is used as the desalting apparatus, switching is performed when the permeation flux of the second RO apparatus 10 decreases by a set ratio

Q_{pa}: Permeated water volume under actual operating conditions (m^3/d)

P_{fa}: Operating pressure under actual operating conditions (kPa)

ΔP_{fba}: Differential pressure of module under actual operating conditions (kPa)

P_{pa}: Pressure on the permeated water side under actual operating conditions (kPa)

Π_{fba}: Osmotic pressure of the average solute concentration on the supply side and concentration side under actual operating conditions (kPa)

TCF_a: Temperature conversion coefficient under actual operating conditions

P_{fs}: Operating pressure under standard operating conditions (kPa)

ΔP_{fbs}: Differential pressure of module under standard operating conditions (kPa)

P_{ps}: Pressure on the permeated water side under standard operating conditions (kPa)

Π_{fbs}: Osmotic pressure of average solute concentration on the supply side and concentration side under standard operating conditions (kPa)

TCF_s: Temperature conversion coefficient under standard operating conditions.

[0042]

[Direction of passing of dilute water]

As shown in Fig. 1, it is preferable that the dilute water is passed from the feed water side of the second RO apparatus. However, in the

(6) As shown in Test Examples 5, 10 and 11, a dilute water having an excessively high F concentration (≥20 mg/L) allows a high recovery ratio not to be achieved even at a low pH.

[0058]

Among the following conditions (i) the water quality of dilute water is dilute, (ii) the pH of the dilute water is 3.2 or less, and (iii) a scale preventing agent is added, satisfying conditions (i) and (ii) or (iii) allows the effect of improving Flux to be higher in comparison with satisfying condition (i) alone. Further, lowering the pH of a dilute water, even the dilute water having poor water quality allows the effect of improving Flux to be maintained.

[0059]

Although the present invention has been described in detail with reference to specific embodiments, it will be apparent to those skilled in the art that various modifications can be made without departing from the intent and scope of the present invention.

The present application is based on JP 2020-153862 filed on September 14, 2020, which is incorporated by reference in its entirety.

Reference Signs List

[0060]

1: Raw water tank

7, 10, 37 and 40: RO apparatus

31: Dilute water tank