

DESCRIPTION

Title of Invention: ELECTRIC ANTICORROSION SYSTEM AND
SEAWATER DESALINATION PLANT PROVIDED WITH SAME

5 Technical Field

[0001]

The present invention relates to an electric
anticorrosion system and a plant which is provided with it
and particularly relates to the electric anticorrosion
10 system of an external power supply system and the plant
which is provided with it.

Background Art

[0002]

A technology which is described in Patent Literature
15 1 is known as the one which performs anticorrosion on a
surface of a metal which is immersed in an electrolytic
solution such as seawater and so forth. In Patent
Literature 1, there is described an electric anticorrosion
method of applying an anticorrosion voltage between a
20 distribution channel section (a piping, a pump) of a fluid
(the seawater) which is made of a metal and an anode which
is in contact with the fluid which passes and flows in the
distribution channel section while electrically insulating
the anode against the distribution channel section and
25 distributing an anticorrosion current through the

distribution channel section, a configuration of increasing the anticorrosion voltage in such a manner that the anticorrosion current becomes a predetermined current value or potential when the anticorrosion current becomes not more than the predetermined current value or potential. In addition, it is also disclosed in Patent Literature 1 that in a case where the anticorrosion voltage exceeds an upper limit voltage, the anode is earthed or a voltage of a direction which is opposite to that of the anticorrosion voltage is applied to the anode.

Citation List

Patent Literature

[0003]

PTL 1: Japanese Patent Application Laid-Open No.

2016-17189

Summary of Invention

Technical Problem

[0004]

However, hypochlorous acid which is generated by increasing the anticorrosion voltage is not taken into consideration in the technology which is described in Patent Literature 1. The hypochlorous acid becomes a factor of occurrence of deterioration of an RO membrane (Reverse Osmosis Membrane) in an RO membrane module which configures the seawater desalination plant.

[0005]

Accordingly, the present invention provides an electric anticorrosion system which is capable of preferably removing the hypochlorous acid even in a case
5 of applying the anticorrosion voltage which is at least a predetermined value and a seawater desalination plant which is provided with it.

Solution to Problem

[0006]

10 In order to solve the above-described problem, the anticorrosion system pertaining to the present invention includes at least, an electrode disposed via an insulating material in a piping made of a metal material in which an electrolytic solution passes and flows, an anticorrosion
15 power supply configured to apply a voltage between the electrode and the piping made of the metal material, and at least, a flowmeter installed in the piping made of the metal material and configured to measure a flow rate of the electrolytic solution which passes and flows in the
20 piping and a residual chlorine meter installed in the piping made of the metal material and configured to measure a concentration of hypochlorous acid in the electrolytic solution which passes and flows in the piping, and has a control unit configured to control so as to add
25 at least a hypochlorous acid removing agent to the

electrolytic solution which passes and flows in the piping on the basis of a measured value of the flow rate of the electrolytic solution by the flowmeter and a measured value of the hypochlorous acid concentration in the electrolytic solution by the residual chlorine meter.

In addition, the seawater desalination plant pertaining to the present invention includes a pressure pump configured to pressurize seawater which is treated by a pretreatment unit, a reverse osmosis membrane module configured to introduce the seawater which is pressurized by the pressure pump and separate it into concentrated water which is high concentration saltwater and filtered water, an energy recovery device configured to introduce the concentrated water which is discharged from the reverse osmosis membrane module and recover energy therefrom as part of power which drives the pressure pump, a piping configured to connect the pressure pump with the reverse osmosis membrane module and in which the pressurized seawater passes and flows, a piping configured to connect the reverse osmosis module with the energy recovery device and in which the concentrated water passes and flows, and an electric anticorrosion system provided with an electrode disposed via an insulating material in a piping in which the pressurized seawater passes and flows and/or a piping in which the concentrated water passes and

flows, an anticorrosion power supply configured to apply a voltage between the electrode and the piping in which the pressurized seawater passes and flows and/or the piping in which the concentrated water passes and flows, a flowmeter
5 installed in the piping in which the pressurized seawater passes and flows and/or the piping in which the concentrated water passes and flows and configured to measure a flow rate(s) of the pressurized seawater and/or the concentrated water which pass(es) and flow(s) in the
10 piping(s), and a residual chlorine meter configured to measure a hypochlorous acid concentration(s) in the pressurized seawater and/or the concentrated water, in which the electric anticorrosion system has a control unit configured to control so as to add at least a hypochlorous
15 acid removing agent to the pressurized seawater and/or the concentrated water which pass(es) and flow(s) in the piping(s) on the basis of a measured value(s) of a flow rate(s) of the pressurized seawater and/or the concentrated water by the flowmeter and a measured
20 value(s) of a hypochlorous acid concentration(s) in the pressurized seawater and/or the concentrated water by the residual chlorine meter.

Advantageous Effects of Invention

[0007]

25 According to the present invention, it becomes

possible to provide the electric anticorrosion system which is capable of preferably removing the hypochlorous acid even in a case of applying the anticorrosion voltage which is at least the predetermined value and the seawater desalination plant which is provided with it.

Problems, configurations and effects other than the above-described ones will become apparent from description of the following embodiments.

Brief Description of Drawings

[0008]

Figure 1 is an overall schematic configuration diagram of a seawater desalination plant pertaining to one embodiment of the present invention.

Figure 2 is a configuration diagram of an electric anticorrosion system of Example 1 pertaining to one example of the present invention.

Figure 3 is a longitudinal sectional diagram of an anode electrode installation part illustrated in Figure 2.

Figure 4 is a function block of a control unit illustrated in Figure 2.

Figure 5 is a schematic diagram of an electric anticorrosion system of Example 2 pertaining to another example of the present invention.

Figure 6 is a schematic diagram of an electric anticorrosion system of Example 3 pertaining to another

example of the present invention.

Description of Embodiments

[0009]

In the present specification, "electrolytic
5 solutions" include sea water (Sea Water: SW), brackish
water (Brackish Water: BW), brine, a saline solution, salt
water and so forth. Here, the brine is water which
contains salt such as sodium chloride and so forth and the
brackish water which is present at a boundary with the sea
10 water is also included in the brine. In addition, the
brine is also present in inland water such as fossil water
which was produced by confining the sea water in the past,
water which contains salt in a rock salt zone and so forth.
In addition, when classifying it by sodium chloride
15 concentration, the one which is less than 0.05% is called
fresh water, the one which is at least 0.05% and less than
0.35% is called the brackish water, the one which is at
least 0.35% and less than 0.5% is called the saline
solution and the one which is at least 0.5% is called the
20 salt water. Incidentally, the sodium chloride
concentration of the sea water ranges from 0.24% to about
2.96% and there is a difference in concentration among sea
areas. In addition, also an aqueous solution which
contains an optional ion species is included in the
25 "electrolytic solutions" in the present specification.

[0010]

In a case where a metal material is used as a piping material of an equipment, for example, a seawater desalination plant facility, which is used under an environment that corrosion is easy to occur such as in the sea water, any one of electric anticorrosion methods, surface coating methods and high corrosion resistance material methods of a sacrificial anode system and an external power supply system is mainly used as measures for suppressing occurrence of corrosion on the metal material. In them, the electric anticorrosion method of the external power supply system has a special feature that metal elution which induces deterioration of the RO membrane which is used for seawater desalination is little.

The electric anticorrosion method is an anticorrosion method of controlling electron transfer in a corrosive action. In the electric anticorrosion method of the external power supply system, an electrode which is adapted to generate an electric current is connected to the metal material which is used as a structure member of an equipment which is to be subjected to anticorrosion via a power supply. At this time, the electrode is brought into contact with the electrolytic solution which is used in common with the metal material in such a manner that a circuit is formed via the electrolytic solution.

A voltage is applied between the electrode and the metal material to be subjected to anticorrosion by the power supply. At this time, a case where the electrode is used as an anode (a positive electrode) by setting to an electropositive potential and the metal material is used as a cathode (a negative electrode by setting to an electronegative potential is called a cathode anticorrosion method. On the contrary, a case where the electrode is used as the cathode by setting to the electronegative potential and the metal material is used as the anode by setting to the electropositive potential is called an anode anticorrosion method. Although the present invention is applicable to both the cathode anticorrosion method and the anode anticorrosion method, description will be made in the following by using the cathode anticorrosion method which is frequently used in the seawater desalination plant and exemplifying the seawater as the electrolytic solution.

[0011]

The electrode brings about an electrochemical reaction at an interface with the electrolytic solution by being polarized to the electropositive potential by the power supply and transfers electrons to the metal material side to be subjected to anticorrosion. On that occasion, the metal material which is to be subjected to

anticorrosion is supplied with the electrons and is polarized to the electronegative potential at which an anode reaction (corrosion) is reduced.

Ferrous materials such as, for example, carbon steels, die steels, nickel cast irons, low alloy steels and so forth are given as the metal materials to be subjected to anticorrosion. In addition, stainless steels such as austenitic stainless steels and ferritic stainless steels, two phase system stainless steels, martensitic stainless steels, precipitation hardening stainless steels and so forth are given. Further, copper alloys such as bronze, brass and so forth, nickel-based alloys such as cupronickel, Monel and so forth are given. Casting, rolling, forging, plating, weld overlaying and a so-called 3D printer technology are given as manufacturing methods. In addition, also a welded part is to be subjected to anticorrosion. On the other hand, for example, noble metal oxides such as ruthenium oxide, iridium oxide, rhodium oxide and so forth, MMO (Mixed Metal Oxide) that they are mixed up, oxides such as iron oxide, titanium oxide and so forth, noble metals such as platinum, iridium and so forth, alloys such as platinum-titanium and so forth, high silicon iron, tantalum, carbon and so forth are given as materials of the electrode.

[0012]

Examples of such an anticorrosion system of the external power supply system and a seawater desalination plant which is provided with this will be described in the following by using the drawings. Figure 1 is an overall schematic configuration diagram of a seawater desalination plant pertaining to one embodiment of the present invention. In Figure 1, a solid-line arrow indicates a flow of water, a dotted-line arrow indicates a signal line, a broke-line arrow indicates a flow of a flocculant, a cleaning chemical or the like.

As illustrated in Figure 1, a seawater desalination plant 1 is configured by a raw water storage tank 3 which stores raw water (the electrolytic solution) which is taken in, an MMF (Multi Media Filter) 4, an ultrafiltration membrane (UF membrane: Ultrafiltration Membrane) 5, an intermediate tank 10, a pressure pump 11, an RO membrane module 12 which is configured by a pressure vessel which contains therein an RO membrane element, an energy recovery device (Energy Recovery Device: ERD) 15, a fresh water storage tank 16 and a concentrated water storage tank 17, which are located in the order from taking-in of sea water (raw water) which is water to be treated toward the downstream.

The sea water or the brine (the electrolytic solution) as the raw water to be taken in is stored in the

raw water storage tank 3. A flocculant is appropriately injected into the raw water storage tank 3 from a flocculant tank 6 which stores a polymetric flocculant or an inorganic flocculant via a flocculant injection pump 7.

5 Then, impurities such as organic matters and so forth which are contained in the raw water in the raw water storage tank 3 are captured in the injected flocculant and form flocs. The raw water which contains the flocs is supplied to the MMF 4 and the ultrafiltration membrane 5
10 by the pump, the flocs and impurities which are contained in the raw water are membrane-separated through the MMF 4 and the ultrafiltration membrane 5 in accordance with their pore sizes and the raw water (the electrolytic solution: water to be treated) obtained after membrane
15 separation is stored temporarily in the intermediate tank 10. The respective parts from flocculant injection to membrane separation through the ultrafiltration membrane 5 configure a pretreatment unit. Incidentally, for example, a polyacrylamide-based flocculant is used as the
20 polymetric flocculant and, for example, ferric chloride is used as the inorganic flocculant.

[0013]

The raw water (the electrolytic solution: the water to be treated) which is stored in the intermediate tank 10
25 is supplied to the RO membrane module 12 by the pressure

pump 11 as feed water (the electrolytic solution) 18. The feed water (the electrolytic solution) 18 is subjected to membrane separation into concentrated water 14 which is high-concentration salt water and filtered water (fresh water) 13 by the RO membrane module 12.

The filtered water 13 is supplied to the fresh water storage tank 16 from one end of the RO membrane module 12, and the concentrated water 14 is supplied to the concentrated water storage tank 17 via the energy recovery device 15. Energy which is recovered by the energy recovery device 15 is used as part of power which drives the pressure pump 11. The RO membrane element which is contained in the RO membrane module 12 is cleaned with a cleaning chemical which is supplied from a cleaning chemical storage tank 8 via a cleaning chemical injection pump 9 at a desired timing.

[0014]

Here, as the energy recovery device 15, for example, a DWEER (Dual Work Exchanger Energy Recovery) which introduces part of the feed water 18 and high-pressure concentrated water which is discharged from the RO membrane module 12 into two cylinders respectively and transmits a pressure of the high-pressure concentrated water to the sea water via a piston in the cylinder, the one which transmits the pressure of the high-pressure

concentrated water to the pressure pump 11 by a Turbocharger, a PX (Pressure Exchanger) which transmits the pressure of the high-pressure concentrated water to the sea water side by bringing part of the feed water 18 into contact with the high-pressure concentrated water directly, the one which rotates a Pelton turbine by increasing a flow rate through a nozzle whose tip is tightened and splashing the high-pressure concentrated water directly on a bucket of the Pelton turbine and transmits power thereof to the feed water 18 through a pump which is directly connected to a turbine shaft or the like is used.

[0015]

A monitoring control device 19 monitors a state of the RO membrane module 12 and controls the flocculant injection pump 7, the cleaning chemical injection pump 9, and the pressure pump 11.

Incidentally, the configuration of the pretreatment unit is not limited to the above-described configuration and, for example, a sand filter may be used in place of the MMF 4, in addition, it may have a configuration which has either the MMF 4 or the ultrafiltration membrane 5, and in addition, an MF membrane (Microfiltration Membrane) may be used.

[0016]

Inner surfaces of various pumps such as an intake pump and so forth including the pressure pump 11 are in contact with the sea water (the electrolytic solution). Therefore, they are under an environment that corrosion is easy to occur. Further, a metal piping is used for a piping section which is located downstream of the pressure pump 11 and is exposed to high pressure and the sea water (the electrolytic solution) or the concentrated water flows therein at an internal pressure of, for example, at least 5 MPa. In this metal piping, a corrosion phenomenon which depends on the salt concentration occurs with time and there are cases where high-corrosion-speed local corrosion progresses, particularly, on a flange part which is a piping coupling part and a welded part where a surface texture and a surface roughness become nonuniform. In order to prevent occurrence of the corrosion of them, an electric anticorrosion system 2 is provided as illustrated in Figure 1. Incidentally, in the following, although a case where the electric anticorrosion system 2 is installed in a piping in which the feed water (the electrolytic solution) 18 which is supplied to the RO membrane module 12 by the pressure pump 11 passes and flows will be described by way of example, it is not limited thereto and it may have a configuration that the electronic anticorrosion system 2 is installed in a piping

in which the concentrated water 14 passes and flows and, in addition, it may also have a configuration that the electric anticorrosion systems 2 are installed in both the piping in which the feed water (the electrolytic solution) 18 passes and flows and the piping in which the concentrated water 14 passes and flows. In addition, the electric anticorrosion systems 2 may be installed in various pumps whose inner surfaces are in contact with the sea water (the electrolytic solution).

In the following, examples of the present invention will be described by using the drawings.

Example 1

[0017]

Figure 2 is a schematic diagram of an electric anticorrosion system of Example 1 pertaining to one example of the present invention. The electric anticorrosion system 2 is provided with an anode electrode 21 which is installed in a piping 32 which connects the pressure pump 11 with the RO membrane module 12, an anticorrosion power supply 22, and a flowmeter 23, a residual chlorine meter 24, a pH meter 25, and an electrometer 26 which are attached to a sensor installation position A on the RO membrane module 12 side of the piping 32. The piping 32 is connected to a minus terminal of the anticorrosion power supply 22 via a cable

and the anode electrode 21 is connected to a plus terminal of the anticorrosion power supply 22 via a cable. In addition, the electric anticorrosion system 2 is provided with a hypochlorous acid removing agent storage tank 27

5 which contains a hypochlorous acid removing agent, a hypochlorous acid removing agent injection pump 29, a check valve 31a which prevents the feed water (the electrolytic solution) 18 which passes and flows in the piping 32 from the intermediate tank 10 toward the

10 pressure pump 11 from flowing backward to the hypochlorous acid removing agent injection pump 29 side, a pH adjustor storage tank 28 which contains a pH adjustor, a pH adjustor injection pump 30, a check valve 31b which prevents the feed water (the electrolytic solution) 18

15 which passes and flows in the piping 32 from the intermediate tank 10 toward the pressure pump 11 from flowing backward to the pH adjustor injection pump 30 side, and a control unit 20. Incidentally, a position where the hypochlorous acid removing agent is injected into the feed

20 water (the electrolytic solution) 18 which passes and flows in the piping 32 from the hypochlorous acid removing agent storage tank 27 via the hypochlorous acid removing agent injection pump 29 and the check valve 31a is on the upstream side of the pressure pump 11. Likewise, a

25 position where the pH adjustor is injected into the feed

water (the electrolytic solution) 18 which passes and flows in the piping 32 from the pH adjustor storage tank 28 via the pH adjustor injection pump 30 and the check valve 31b is on the upstream side of the pressure pump 11.

5 [0018]

The control unit 20 which will be described in detail later outputs an applied voltage at which conduction of a desired anticorrosion current to the anticorrosion power supply 22 is possible as a command value on the basis of measured values by the flowmeter 23, the residual chlorine meter 24, the pH meter 25, and the electrometer 26, and outputs an addition amount of the hypochlorous acid removing agent to the hypochlorous acid removing agent injection pump 29 as a command value and an addition amount of the pH adjustor to the pH adjustor injection pump 30 as a command value.

[0019]

As described above, the anode electrode 21 brings about an electrochemical reaction at an interface with the feed water 18 (the electrolytic solution) which passes and flows in the piping 32 toward the RO membrane module 12 by being polarized to the electropositive potential by the anticorrosion power supply 22 and transfers electrons to the piping 32 which is to be subjected to anticorrosion. In addition, the piping 32 which is to be subjected to

anticorrosion is supplied with the electrons and is polarized to the electronegative potential that an anode reaction (corrosion) is reduced. Generally, the anticorrosion voltage which is applied from the anticorrosion power supply 22 to the anode electrode 21 and the piping 32 is maintained constant at a predetermined value. However, when a state of the water quality and so forth of the feed water 18 (the electrolytic solution) which passes and flows in the piping 32 and which is the water to be treated changes rapidly, there are cases where the anticorrosion current is lowered to not more than a predetermined value which is enough to cancel a corrosion current. In this case, it is necessary to increase the anticorrosion voltage. In addition, in a case where active dissolution or bacterial corrosion of the metal material occurs in the piping 32, the potential of the piping 32 is increased higher than an initial potential immediately after start of electric anticorrosion. At this time, since the potential of the piping 32 exceeds a potential range that it becomes inert to corrosion and reaches an active region, it is necessary to increase the anticorrosion voltage so as to lower the potential of the piping 32 to the initial potential.

[0020]

In a case where the anticorrosion voltage is

increased as described above, that is, the anticorrosion voltage which is at least the predetermined value is applied from the anticorrosion power supply 22 to the anode electrode 21 and the piping 32, since the feed water 18 (the electrolytic solution) which passes and flows in the piping 32 toward the RO membrane module 12 and is the water to be treated is the sea water which ranges from 0.24% to about 2.96% in sodium chloride concentration, hypochlorous acid (HClO) is generated by reactions which are indicated by chemical formulae in the following formula (1) and formula (2).



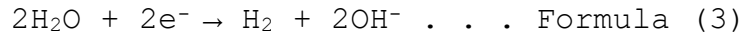
As described above, the hypochlorous acid (HClO) has a feature of accelerating deterioration of the RO membrane in the RO membrane module 12.

Accordingly, the hypochlorous acid removing agent such as, for example, NaHSO₃ (sodium bisulfite: SBS) and so forth is injected into the feed water 18 (the electrolytic solution) which passes and flows in the piping 32 and is made to chemically react with the generated hypochlorous acid (HClO) so as to remove the hypochlorous acid (HClO).

[0021]

In addition, at the time of electric anticorrosion,

hydrogen (H₂) is generated by a reaction which is indicated in the following formula (3).



Accordingly, the pH adjustor such as, for example, NaOH (sodium hydroxide), KOH (potassium hydroxide) or the like is injected into the feed water 18 (the electrolyte solution) which passes and flows in the piping 32, and the hydrogen (H₂) which is generated by neutralization is reduced.

[0022]

Figure 3 is a longitudinal sectional diagram of an anode electrode installation part illustrated in Figure 2. As illustrated in Figure 3, the anode electrode 21 is in the form of an annular shape, is sandwiched between two insulating material 35a and insulating material 35b which are in the form of annular shapes similarly and is water-tightly clamped between a flange 34a of one piping 32 and a flange 34b of the other piping 32 with bolts 36 and nuts 37. It is desirable that an inner diameter of the annular anode electrode 21, inner diameters of the annular insulating material 35a and insulating material 35b and an inner diameter of the piping 32 be the same as one another. In addition, no flow path resistance occurs against the feed water 18 (the electrolytic water) which passes and flows in a direction indicated by a blank arrow in the

piping 32 and is the water to be treated by positioning in such a manner that an inner circumferential surface, inner circumferential surfaces and an inner circumferential surface of these anode electrode 21, annular insulating material 35a and insulating material 35b and piping 32 are contiguous to one another.

[0023]

In addition, since one piping 32 and the other piping 32 which faces it are in mutually conducted states via the bolts 36, the flanges 34a, and the flanges 34b, one piping 32 and the other piping 32 which faces it reach the same potential. Incidentally, an inner diameter of a through hole in the annular anode electrode 21 into which the bolt 36 is to be inserted is larger than an outer diameter of the bolt 36 and the anode electrode 21 and the bolt 36 are in non-contact states. For example, rubber and so forth which are insulating elastic bodies are used as the insulating material 35a and the insulating material 35b.

[0024]

Figure 4 is a function block diagram of the control unit 20 illustrated in Figure 2. As illustrated in Figure 2, the control unit 20 which configures the electric anticorrosion system 2 is provided with an input I/F 41, a measured value acquisition section 42, a storage section

43, a hypochlorous acid removing agent addition amount determination section 44, a pH adjustor addition amount determination section 45, an anticorrosion voltage control section 46, and an output I/F 47, and they are mutually
5 connected via an internal bus 48. The measured value acquisition section 42, the hypochlorous acid removing agent addition amount determination section 44, the pH adjustor addition amount determination section 45, and the anticorrosion voltage control section 46 are configured by
10 a processor such as, for example, a CPU or the like which is provided with storages such as not illustrated ROM, RAM, external storage and so forth, reads and executes various programs which are stored in the ROM and stores a result of arithmetic processing which is a result of execution
15 thereof into the RAM or the external storage.

[0025]

The input I/F 41 transfers a measured value of a flow rate of the feed water 18 (the electrolytic solution) which passes and flows in the piping 32 toward the RO
20 membrane module 12 and is the water to be treated by the flowmeter 23, and a measured value of a hypochlorous acid concentration (mg/L) in the feed water 18 (the electrolytic solution) which passes and flows in the piping 32 toward the RO membrane module 12 and is the
25 water to be treated by the residual chlorine meter 24 to

the measured value acquisition section 42 via the internal bus 48. In addition, the input I/F 41 transfers a measured value of pH of the feed water 18 (the electrolytic solution) which passes and flows in the piping 32 toward the RO membrane module 12 and is the water to be treated by the pH meter 23 and a measured value of a potential of the piping 32 by the electrometer 26 to the measured value acquisition section 42 via the internal bus 48.

10 [0026]

The measured value acquisition section 42 performs denoising, smoothing treatment or the like on the measured value of the flow rate of the feed water 18 (the electrolytic solution) which is the water to be treated, the measured value of the hypochlorous acid concentration (mg/L) in the feed water 18 (the electrolytic solution) which is the water to be treated, the measured value of the pH of the feed water 18 (the electrolytic solution) which is the water to be treated and the measured value of the potential of the piping 32 which are transferred thereto, stores them into a predetermined area(s) in the storage section 43 via the internal bus 48, transfers the measured value of the flow rate of the feed water 18 (the electrolytic solution) which is the water to be treated and the measured value of the hypochlorous acid

concentration (mg/L) in the feed water 18 (the electrolytic solution) on which the denoising, the smoothing treatment or the like is performed to the hypochlorous acid removing agent addition amount

5 determination section 44, and the measured value of the pH on which the denoising, the smoothing treatment or the like is performed to the pH adjustor addition amount determination section 45, the measured value of the potential of the piping 32 on which the denoising, the
10 smoothing treatment or the like is performed to the anticorrosion voltage control section 46 via the internal bus 48 respectively.

[0027]

The hypochlorous acid removing agent addition amount
15 determination section 44 obtains a content amount of the hypochlorous acid in the feed water 18 (the electrolytic solution) which is the water to be treated from a product of the measured value of the flow rate and the measured value of the hypochlorous acid concentration (mg/L) of the
20 feed water 18 (the electrolytic solution) which is the water to be treated which are transferred from the measured value acquisition section 42 or are stored in the storage section 43. Then, the hypochlorous acid removing agent addition amount determination section 44 determines
25 an addition amount of the hypochlorous acid removing agent

which is equivalent to the obtained content amount of the hypochlorous acid or is within a range of the hypochlorous acid content amount $\pm$ several % (in a predetermined tolerance) and outputs it to the hypochlorous acid

5 removing agent injection pump 29 as a command value via the internal bus 48 and the output I/F 47. Thereby, the hypochlorous acid removing agent injection pump 29 pumps out the hypochlorous acid removing agent of the determined addition amount from the hypochlorous acid removing agent
10 storage tank 27 and injects it into the feed water 18 (the electrolytic solution) which passes and flows in the upstream-side piping 32 and is the water to be treated by the pressure pump 11 via the check valve 31a, and thereby it becomes possible to remove the generated hypochlorous
15 acid and deterioration of the RO membrane in the RO membrane module 12 can be prevented.

[0028]

The pH adjustor addition amount determination section 45 determines an addition amount of the pH
20 adjustor for neutralization on the basis of the measured value of the pH of the feed water 18 (the electrolytic solution) which is the water to be treated which is transferred from the measured value acquisition section 42 or is stored in the storage section 43. In other words,
25 the pH adjustor addition amount determination section 45

determines, for example, the addition amount of the pH adjustor with which the measured value of the pH of the feed water 18 (the electrolytic solution) which is the water to be treated becomes neutral ($\text{pH} = 7$). Then, the pH adjustor addition amount determination section 45 outputs the determined pH adjustor addition amount to the pH adjustor injection pump 30 as a command value via the internal bus 48 and the output I/F 47.

[0029]

The anticorrosion voltage control section 46 outputs a voltage which is to be applied between the anode electrode 21 and the piping 32 as the anticorrosion voltage to the anticorrosion power supply 22 via the internal bus 48 and the output I/F 47 as a command value on the basis of the measured value of the potential of the piping 32 which is transferred from the measured value acquisition section 42 or is stored in the storage section 43. As described above, for example, in a case where the potential of the piping 32 rises higher than the initial potential immediately after start of electric anticorrosion, the potential of the piping 32 exceeds the range of potentials which are inert to corrosion and reaches the active region, and therefore it outputs an applied voltage which makes it possible to increase the anticorrosion voltage and to lower the potential of the

pipings 32 to the initial potential to the anticorrosion power supply 22 as the command value.

[0030]

Incidentally, although in the present example, a configuration that the electric anticorrosion system 2 is provided with the pH adjustor storage tank 28, the pH adjustor injection pump 30, and the check valve 31b, and the control unit 20 which configures the electric anticorrosion system 2 has the pH adjustor addition amount determination section 45 was described, it is not necessarily limited to this and it may not have this configuration.

[0031]

As above, according to the present example, it becomes possible to provide the electric anticorrosion system which is able to preferably remove the hypochlorous acid even in a case of applying the anticorrosion voltage which is at least the predetermined value and the seawater desalination plant which is provided with it.

In addition, since the hypochlorous acid which is generated due to an increase in anticorrosion voltage can be removed, deterioration of the RO membrane can be prevented, life extension of the RO membrane module becomes possible, and the operating cost of the seawater desalination plant can be reduced.

In addition, it becomes possible to maintain the potential of the piping which is made of the metal material or a wetted part of the pump which is to be subjected to anticorrosion constant, and even if a surface
5 state of the wetted part is changed (for example, active dissolution and so forth of the metal material), it will become possible to favorably perform anticorrosion.

Example 2

[0032]

10 Figure 5 is a schematic diagram of an electric anticorrosion system of Example 2 pertaining to another example of the present invention. The present example is different from Example 1 in that in the piping in which the feed water 18 (the electrolytic solution) which is the
15 water to be treated passes and flows from the intermediate tank 10 toward the pressure pump 11, it has a line mixer on the downstream side of the hypochlorous acid removing agent injection position and the pH adjustor injection position. The same numerals are assigned to the
20 constitutional elements which are the same as those in Example 1.

[0033]

As illustrated in Figure 5, in the electric anticorrosion system 2 of the present example, a line
25 mixer 33 is provided in the piping 32 in which the feed

water 18 (the electrolytic solution) which is the water to be treated passes and flows from the intermediate tank 10 toward the pressure pump 11. The line mixer 33 is disposed on the downstream side of a position where the
5 hypochlorous acid removing agent is injected into the feed water (the electrolytic solution) 18 which passes and flows in the piping 32 from the hypochlorous acid removing agent storage tank 27 via the hypochlorous acid removing agent injection pump 29 and the check valve 31a, and a
10 position where the pH adjustor is injected into the feed water (the electrolytic solution) 18 which passes and flows in the piping 32 from the pH adjustor storage tank 28 via the pH adjustor injection pump 30 and the check valve 31b and on the upstream side of the pressure pump 11.
15 [0034]

For example, a rotation member is provided as the line mixer 33, and the hypochlorous acid removing agent and the pH adjustor are mixed together by rotationally driving the rotation member by an external motor and
20 thereby applying a shearing force to the feed water (the electrolytic solution) 18 into which the hypochlorous acid removing agent and the pH adjustor are injected. In addition, a so-called static mixer may be used as the line mixer 33. The static mixer is provided with a first
25 helical fixed wing and a second helical fixed wing which

face each other ranging from an inflow part to an outflow part, a flow of the feed water (the electrolytic solution) 18 into which the hypochlorous acid removing agent and the pH adjustor are injected shifts to swirling flows which head in opposite directions respectively, the shearing force is applied to the feed water (the electrolytic solution) 18 into which the hypochlorous acid removing agent and the pH adjustor are injected owing to interference of these swirling flows and thereby the hypochlorous acid removing agent and the pH adjustor are mixed together. Incidentally, the control unit 20 which configures the electric anticorrosion system 2 is the same as that in the above-described Example 1 and therefore description thereof is omitted.

Although in the present example, a configuration that the electric anticorrosion system 2 is provided with the pH adjustor storage tank 28, the pH adjustor injection pump 30, and the check valve 31b, and the control unit 20 which configures the electric anticorrosion system 2 has the pH adjustor addition amount determination section 45 was described, it is not necessarily limited to this and it may not have this configuration.

[0035]

As described above, according to the present example, the hypochlorous acid removing agent which is injected

into the electrolytic solution which is the water to be treated can be mixed by the line mixer and it becomes possible to more effectively remove the hypochlorous acid in the water to be treated in comparison with Example 1.

5 Example 3

[0036]

Figure 6 is a schematic diagram of an electric anticorrosion system of Example 3 pertaining to another example of the present invention. The present example is different from Example 1 in that in the piping 32 in which the feed water (the electrolytic solution) 18 which is the water to be treated passes and flows from the pressure pump 11 toward the RO membrane module 12, it is provided with a first sensor group which is attached to a sensor installation position A on the RO membrane module 12 side and is configured by the flowmeter 23, the residual chlorine meter 24, the pH meter 25, and the electrometer 26, and a second sensor group which is attached to a sensor installation position B in the vicinity of the anode electrode 21 and on its downstream side and is configured by the flowmeter 23, the residual chlorine meter 24, the pH meter 25, and the electrometer 26. In addition, it is different from Example 1 in the points that the position where the hypochlorous acid removing agent is injected and the position where the pH adjustor

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is injected are different from those in Example 1 and it has the line mixer 33 on the downstream of the hypochlorous acid removing agent injection position and the pH adjustor injection position and on the RO membrane module 12 side. The same numerals are assigned to the constitutional elements which are the same as those in Example 1.

[0037]

As illustrated in Figure 6, in the electric anticorrosion system 2 of the present example, the control unit 20 fetches measured values from the second sensor group which is attached to the sensor installation position B in the piping 32 which connects the pressure pump 11 with the RO membrane module 12, in the vicinity of the anode electrode 21 and on its downstream side and is configured by the flowmeter 23, the residual chlorine meter 24, the pH meter 25, and the electrometer 26.

Specifically, the measured value acquisition section 42 fetches the measured value of the flow rate of the feed water 18 (the electrolytic solution) which is the water to be treated immediately after passing and flowing in the anode electrode 21 measured by the flowmeter 23 which configures the second sensor group and the measured value of the hypochlorous acid concentration (mg/L) in the feed water 18 (the electrolytic solution) which is the water to

be treated measured by the residual chlorine meter 24 which configures the second sensor group via the input I/F 41, performs denoising, smoothing treatment or the like thereon, stores them into the predetermined area(s) in the storage section 43 and transfers them to the hypochlorous acid removing agent addition amount determination section 44 via the internal bus 48. The hypochlorous acid removing agent addition amount determination section 44 obtains the content amount of the hypochlorous acid in the feed water 18 (the electrolytic solution) which is the water to be treated from the product of the measured value of the flow rate and the measured value of the hypochlorous acid concentration (mg/L) of the feed water 18 (the electrolytic solution) which is the water to be treated which are transferred from the measured value acquisition section 42 or stored in the storage section 43. Then, the hypochlorous acid removing agent addition amount determination section 44 determines the addition amount of the hypochlorous acid removing agent which is equivalent to the obtained content amount of the hypochlorous acid or is within the range of the hypochlorous acid content amount $\pm$ several % and outputs it to the hypochlorous acid removing agent injection pump 29 as the command value via the internal bus 48 and the output I/F 47.

[0038]

In addition, the measured value acquisition section 42 fetches the measured value of the pH of the feed water 18 (the electrolytic solution) which is the water to be treated immediately after passing and flowing in the anode electrode 21 from the pH meter 25 which configures the second sensor group via the input I/F 41, performs the denoising, the smoothing treatment or the like thereon, and stores it into the predetermined area in the storage section 43 and transfers it to the pH adjustor addition amount determination section 45 via the internal bus 48. The pH adjustor addition amount determination section 45 determines the addition amount of the pH adjustor for neutralization on the basis of the measured value of the pH of the feed water 18 (the electrolytic solution) which is the water to be treated which is transferred from the measured value acquisition section 42 or is stored in the storage section 43. In other words, the pH adjustor addition amount determination section 45 determines, for example, the addition amount of the pH adjustor with which the measured value of the pH of the feed water 18 (the electrolytic solution) which is the water to be treated becomes neutral ($\text{pH} = 7$). Then, the pH adjustor addition amount determination section 45 outputs the determined pH adjustor addition amount to the pH adjustor injection pump 30 as the command value via the internal bus 48 and the

output I/F 47.

[0039]

The measured value acquisition section 42 fetches the measured value of the potential of the piping 32 from the electrometer 26 which configures the second sensor group via the input I/F 41, performs the denoising, the smoothing treatment or the like thereon, and stores it into the predetermined area in the storage section 43 and transfers it to the anticorrosion voltage control section 46 via the internal bus 48.

The anticorrosion voltage control section 46 outputs the voltage to be applied between the anode electrode 21 and the piping 32 as the anticorrosion voltage to the anticorrosion power supply 22 as the command value via the internal bus 48 and the output I/F 47 on the basis of the measured value of the potential of the piping 32 which is transferred from the measured value acquisition section 42 or is stored in the storage section 43.

[0040]

The feed water 18 (the electrolytic solution) into which the hypochlorous acid removing agent and the pH adjustor are injected and which is the water to be treated flows into the line mixer 33, when passing and flowing in the line mixer 33, the searing force is applied to the feed water 18 (the electrolytic solution) into which the

hypochlorous acid removing agent and the pH adjustor are injected and which is the water to be treated as indicated in the above-described Example 2, and thereby the hypochlorous acid removing agent and the pH adjustor are mixed together. With regard to the feed water (the electrolytic solution) 18 in which the hypochlorous acid removing agent and the pH adjustor are mixed together and which is the water to be treated, the control unit 20 fetches the measured values from the first sensor group which is attached to the sensor installation position A on the RO membrane module 1 side and is configured by the flowmeter 23, the residual chlorine meter 24, the pH meter 25, and the electrometer 26.

Specifically, the measured value acquisition section 42 fetches the measured value of the flow rate of the feed water (the electrolytic solution) 18 in which the hypochlorous acid removing agent and the pH adjustor are mixed together by the line mixer 33 and which is the water to be treated measured by the flowmeter 23 which configures the first sensor group and the measured value of the hypochlorous acid concentration (mg/L) in the feed water 18 (the electrolytic solution) which is the water to be treated measured by the residual chlorine meter 24 which configures the first sensor group via the input I/F 41, performs the denoising, the smoothing treatment or the

like thereon, stores them into the predetermined area(s) in the storage section 43 and transfers them to the hypochlorous acid removing agent addition amount determination section 44 via the internal bus 48. The hypochlorous acid removing agent addition amount determination section 44 obtains the content amount of the hypochlorous acid in the feed water 18 (the electrolytic solution) which is the water to be treated from the product of the measured value of the flow rate and the measured value of the hypochlorous acid concentration (mg/L) of the feed water (the electrolytic solution) to be treated which are transferred from the measured value acquisition section 42 or are stored in the storage section 43. Then, the hypochlorous acid removing agent addition amount determination section 44 determines the addition amount of the hypochlorous acid removing agent which is equivalent to the obtained content amount of the hypochlorous acid or is within the range of the hypochlorous aid content amount $\pm$ several % and outputs it as the command value to the hypochlorous acid removing agent injection pump 29 via the internal bus 48 and the output I/F 47. That is, feedback control is executed in relation to injection of the hypochlorous acid removing agent.

In addition, the measured value acquisition section 42 fetches the measured value of the pH of the feed water (the electrolytic solution) 18 in which the hypochlorous acid removing agent and the pH adjustor are mixed together by the line mixer 33 and which is the water to be treated from the pH meter 25 which configures the first sensor group via the input I/F 41, performs the denoising, the smoothing treatment or the like thereon, and stores it into the predetermined area in the storage section 43 and transfers it to the pH adjustor addition amount determination section 45 via the internal bus 48. The pH adjustor addition amount determination section 45 determines the addition amount of the pH adjustor for neutralization on the basis of the measured value of the pH of the feed water 18 (the electrolytic solution) which is the water to be treated which is transferred from the measured value acquisition section 42 or is stored in the storage section 43. In other words, the pH adjustor addition amount determination section 45 determines, for example, the addition amount of the pH adjustor with which the measured value of the pH of the feed water 18 (the electrolytic solution) which is the water to be treated becomes neutral ($\text{pH} = 7$). Then, the pH adjustor addition amount determination section 45 outputs the determined pH adjustor addition amount to the pH adjustor injection pump

30 as the command value via the internal bus 48 and the output I/F 47. That is, the feedback control is executed in relation to pH adjustor injection.

[0042]

5 The measured value acquisition section 42 fetches the measured value of the potential of the piping 32 from the electrometer 26 which configures the first sensor group via the input interface I/F 41, performs the denoising, the smoothing treatment or the like thereon,
10 and stores it into the predetermined area in the storage section 43 and transfers it to the anticorrosion voltage control section 46 via the internal bus 48.

 The anticorrosion voltage control section 46 outputs the voltage to be applied between the anode electrode 21
15 and the piping 32 as the anticorrosion voltage to the anticorrosion power supply 22 via the internal bus 48 and the output I/F 47 as the command value on the basis of the measured value of the potential of the piping 32 which is transferred from the measured value acquisition section 42
20 or is stored in the storage section 43.

 In the electric anticorrosion system 2 of the present example, the feed water (the electrolytic solution) 18 which is the water to be treated immediately after passing and flowing in the anode electrode 21 is
25 monitored by the flowmeter 23, the residual chlorine meter

24, the pH meter 25, and the electrometer 26 which
configure the second sensor group and control of injection
of the hypochlorous acid removing agent and the pH
adjustor and control of the anticorrosion voltage are
5 executed. Moreover, further, the feed water (the
electrolytic solution) 18 in which the hypochlorous acid
removing agent and the pH adjustor are mixed together and
which is the water to be treated is monitored by the
flowmeter 23, the residual chlorine meter 24, the pH meter
10 25, and the electrometer 26 which configure the second
sensor group and thereby the feedback control is executed.
[0043]

Incidentally, although in the present example, a
configuration that the electric anticorrosion system 2 is
15 provided with the pH adjustor storage tank 28, the pH
adjustor injection pump 30, and the check valve 31b and
the control unit 20 which configures the electric
anticorrosion system 2 has the pH adjustor addition amount
determination section 45 was described, it is not
20 necessarily limited to this and it may not have this
configuration. In addition, the line mixer 33 may not be
necessarily provided.
[0044]

As described above, according to the present example,
25 it becomes possible to control the addition amount of the

hypochlorous acid removing agent and the anticorrosion voltage with higher accuracy by monitoring the water to be treated (the electrolytic solution) which flows into the RO membrane module and the water to be treated (the electrolytic solution) immediately after passing and flowing in the anode electrode and thereby performing the feedback control from the viewpoint of overall control, in addition to the effect of Example 1.

[0045]

Incidentally, the present invention is not limited to the above-described examples and various modifications are included.

For example, the abovementioned examples are described in detail for easy understanding of the present invention, and examples are not necessarily limited to the one which is provided with all the configurations which are described.

Reference Signs List

[0046]

1 ... seawater desalination plant, 2 ... electric anticorrosion system, 3 ... raw water storage tank, 4 ... MMF, 5 ... ultrafiltration membrane, 6 ... flocculant tank, 7 ... flocculant injection pump, 8 ... cleaning chemical storage tank, 9 ... cleaning chemical injection pump, 10 ... intermediate tank, 11 ... pressure pump, 12 ... RO membrane

module, 13 ... filtered water (freshwater), 14 ...
concentrated water, 15 ... energy recovery device, 16 ...
freshwater storage tank, 17 ... concentrated water storage
tank, 18 ... feed water, 19 ... monitoring control device, 20
5 ... control unit, 21 ... anode electrode, 22 ... anticorrosion
power supply, 23 ... flowmeter, 24 ... residual chlorine meter,
25 ... pH meter, 26 ... electrometer, 27 ... hypochlorous acid
removing agent storage tank, 28 ... pH adjustor storage tank,
29 ... hypochlorous acid removing agent injection pump, 30 ...
10 pH adjustor injection pump, 31a, 31b ... check valve, 32 ...
piping, 33 ... line mixer, 34a, 34b ... flange, 35a, 35b ...
insulating material, 36 ... bolt, 37 ... nut, 41 ... input I/F,
42 ... measured value acquisition section, 43 ... storage
section, 44 ... hypochlorous acid removing agent addition
15 amount determination section, 45 ... pH adjustor addition
amount determination section, 46 ... anticorrosion voltage
control section, 47 ... output I/F, 48 ... internal bus

CLAIMS

[Claim 1]

An electric anticorrosion system comprising:

at least, an electrode disposed via an insulating
5 material in a piping made of a metal material in which an
electrolytic solution passes and flows;

an anticorrosion power supply configured to apply a
voltage between the electrode and the piping made of the
metal material; and

10 at least, a flowmeter installed in the piping made
of the metal material and configured to measure a flow
rate of the electrolytic solution which passes and flows
in the piping and a residual chlorine meter installed in
the piping made of the metal material and configured to
15 measure a concentration of hypochlorous acid in the
electrolytic solution which passes and flows in the piping,
and

the electric anticorrosion system having a control
unit configured to control so as to add at least a
20 hypochlorous acid removing agent to the electrolytic
solution which passes and flows in the piping on the basis
of a measured value of the flow rate of the electrolytic
solution by the flowmeter and a measured value of the
hypochlorous acid concentration in the electrolytic
25 solution by the residual chlorine meter.

[Claim 2]

The electric anticorrosion system according to claim 1, comprising:

a pH meter installed in the piping made of the metal material and configured to measure pH of the electrolytic solution which passes and flows in the piping,

wherein the control unit configured to control so as to add a pH adjustor to the electrolytic solution which passes and flows in the piping on the bases of a measured value of the pH meter.

[Claim 3]

The electric anticorrosion system according to claim 2, comprising:

a hypochlorous acid removing agent storage tank which contains the hypochlorous acid removing agent;
a hypochlorous acid removing agent injection pump;
a first check valve;
a pH adjustor storage tank which contains the pH adjustor;
a pH adjustor injection pump; and
a second check valve,

wherein the hypochlorous acid removing agent is injected into the electrolytic solution which passes and flows in the piping by the hypochlorous acid removing agent injection pump via the first check valve, and the pH

adjustor is injected into the electrolytic solution which passes and flows in the piping by the pH adjustor injection pump via the second check valve, on the basis of a command from the control unit.

5 [Claim 4]

The electric anticorrosion system according to claim 3,

wherein the control unit has a hypochlorous acid removing agent addition amount determination section which
10 obtains a content amount of the hypochlorous acid in the electrolytic solution from a product of the measured value of the electrolytic solution flowrate by the flowmeter and the measured value of the hypochlorous acid concentration in the electrolytic solution by the residual chlorine
15 meter, determines a hypochlorous acid removing agent addition amount which is equivalent to the obtained hypochlorous acid content amount or is within a predetermined tolerance, and outputs it to the hypochlorous acid removing agent injection pump as a
20 command value.

[Claim 5]

The electric anticorrosion system according to claim 4,

wherein the control unit has a pH adjustor addition
25 amount determination section which determines an addition

amount of the pH adjustor with which the pH measured value of the electrolytic solution by the pH meter becomes neutral and outputs it to the pH adjustor injection pump as a command value.

5 [Claim 6]

The electric anticorrosion system according to claim 5, comprising:

an electrometer configured to measure a potential of the piping made of the metal material in which the
10 electrolytic solution passes and flows,

wherein the control unit has an anticorrosion voltage control section which outputs a voltage to be applied between the electrode and the piping made of the metal material to the anticorrosion power supply as a
15 command value on the basis of a measured value of the potential of the piping made of the metal material by the electrometer in such a manner that the potential of the piping made of the metal material becomes a predetermined potential.

20 [Claim 7]

The electric anticorrosion system according to claim 6, comprising:

a line mixer disposed on the downstream side of a position where the hypochlorous acid removing agent is
25 injected into the electrolytic solution which passes and

flows in the piping and a position where the pH adjustor is injected into the electrolytic solution which passes and flows in the piping,

wherein the line mixer is configured to apply a shearing force to the electrolytic solution into which the hypochlorous acid removing agent and the pH adjustor are injected and mix them together.

[Claim 8]

The electric anticorrosion system according to claim 6, comprising:

a first sensor group disposed on the downstream side of the electrode and on the downstream side of a position where the hypochlorous acid removing agent is injected into the electrolytic solution which passes and flows in the piping and a position where the pH adjustor is injected into the electrolytic solution which passes and flows in the piping, and configured by the flowmeter, the residual chlorine meter, the pH meter, and the electrometer; and

a second sensor group disposed on the upstream side of the position where the hypochlorous acid removing agent is injected into the electrolytic solution which passes and flows in the piping and the position where the pH adjustor is injected into the electrolytic solution which passes and flows in the piping, and in the vicinity of and

on the downstream side of the electrode, and configured by the flowmeter, the residual chlorine meter, the pH meter, and the electrometer,

wherein the control unit is configured to inject at least the hypochlorous acid removing agent and the pH adjustor into the electrolytic solution which passes and flows in the piping on the basis of a measured value from the second sensor group, and further to perform feedback control on the hypochlorous acid removing agent injection pump, the pH adjustor injection pump and the anticorrosion power supply on the basis of a measured value from the first sensor group.

[Claim 9]

A seawater desalination plant comprising:

a pressure pump configured to pressurize seawater which is treated by a pretreatment unit;

a reverse osmosis membrane module configured to introduce the seawater which is pressurized by the pressure pump and separate it into concentrated water which is high concentration saltwater and filtered water;

an energy recovery device configured to introduce the concentrated water which is discharged from the reverse osmosis membrane module and recover energy therefrom as part of power which drives the pressure pump;

a piping configured to connect the pressure pump

with the reverse osmosis membrane module and in which the pressurized seawater passes and flows;

a piping configured to connect the reverse osmosis module with the energy recovery device and in which the concentrated water passes and flows; and

an electric anticorrosion system provided with an electrode disposed via an insulating material in a piping in which the pressurized seawater passes and flows and/or a piping in which the concentrated water passes and flows, an anticorrosion power supply configured to apply a voltage between the electrode and the piping in which the pressurized seawater passes and flows and/or the piping in which the concentrated water passes and flows, a flowmeter installed in the piping in which the pressurized seawater passes and flows and/or the piping in which the concentrated water passes and flows and configured to measure a flow rate(s) of the pressurized seawater and/or the concentrated water which pass(es) and flow(s) in the piping(s), and a residual chlorine meter configured to measure a hypochlorous acid concentration(s) in the pressurized seawater and/or the concentrated water,

wherein the electric anticorrosion system has a control unit configured to control so as to add at least a hypochlorous acid removing agent to the pressurized seawater and/or the concentrated water which pass(es) and

flow(s) in the piping(s) on the basis of a measured value(s) of a flow rate(s) of the pressurized seawater and/or the concentrated water by the flowmeter and a measured value(s) of a hypochlorous acid concentration(s) in the pressurized seawater and/or the concentrated water by the residual chlorine meter.

[Claim 10]

The seawater desalination plant according to claim 9, comprising:

a pH meter installed in the piping in which the pressurized seawater passes and flows and/or the piping in which the concentrated water passes and flows and configured to measure pH of the pressurized seawater and/or the concentrated water which pass(es) and flow(s) in the piping(s),

wherein the control unit configured to control so as to add a pH adjustor to the pressurized seawater and/or the concentrated water which pass(es) and flow(s) in the piping(s) on the basis of a measured value(s) of the pH meter.

[Claim 11]

The seawater desalination plant according to claim 10, comprising:

a hypochlorous acid removing agent storage tank which contains a hypochlorous acid removing agent;

a hypochlorous acid removing agent injection pump;
a first check valve;
a pH adjustor storage tank which contains the pH
adjustor;

5 a pH adjustor injection pump; and
a second check valve,
wherein the hypochlorous acid removing agent is
injected into the pressurized seawater and/or the
concentrated water which pass(es) and flow(s) in the
10 piping(s) by the hypochlorous acid removing agent
injection pump via the first check valve, and the pH
adjustor is injected into the pressurized seawater and/or
the concentrated water which pass(es) and flow(s) in the
piping(s) by the pH adjustor injection pump via the second
15 check valve, on the basis of a command from the control
unit.

[Claim 12]

The seawater desalination plant according to claim
11,

20 wherein the control unit has a hypochlorous acid
removing agent addition amount determination section which
obtains a content amount(s) of the hypochlorous acid in
the pressurized seawater and/or the concentrated water
from a product(s) of the measured value(s) of the flow
25 rate(s) of the pressurized seawater and/or the

concentrated water by the flowmeter and the measured value(s) of the concentration(s) of the hypochlorous acid in the pressurized seawater and/or the concentrated water by the residual chlorine meter, determines an addition
5 amount of the hypochlorous acid which is equivalent to the obtained hypochlorous acid content amount or is within a predetermined tolerance, and outputs it to the hypochlorous acid removing agent injection pump as a command value.

10 [Claim 13]

The seawater desalination plant according to claim 12,

wherein the control unit has a pH adjustor addition amount determination section which determines an addition
15 amount of the pH adjustor with which the pH measured value(s) of the pressurized seawater and/or the concentrated water become(s) neutral by the pH meter, and outputs it to the pH adjustor injection pump as a command value.

20 [Claim 14]

The seawater desalination plant according to claim 13, comprising:

an electrometer configured to measure a potential(s) of the piping(s) in which the pressurized seawater and/or
25 the concentrated water pass(es) and flow(s),

wherein the control unit has an anticorrosion voltage control section which outputs the voltage to be applied between the electrode and the piping(s) in which the pressurized seawater and/or the concentrated water pass(es) and flow(s) to the anticorrosion power supply as a command value on the basis of a measured value(s) of the potential(s) of the piping(s) in which the pressurized seawater and/or the concentrated water pass(es) and flow(s) by the electrometer in such a manner that the potential(s) of the piping(s) in which the pressurized seawater and/or the concentrated water pass(es) and flow(s) become(s) a predetermined potential(s).

[Claim 15]

The seawater desalination plant according to claim 14, comprising:

a line mixer disposed on the downstream side of a position where the hypochlorous acid removing agent is injected into the pressurized seawater and/or the concentrated water which pass(es) and flow(s) in the piping(s) and a position where the pH adjustor is injected into the pressurized seawater and/or the concentrated water which pass(es) and flow(s) in the piping(s),

wherein the line mixer is configured to apply a shearing force to the pressurized seawater and/or the concentrated water into which the hypochlorous acid

removing agent and the pH adjustor are injected and mix them together.

[Claim 16]

The seawater desalination plant according to claim
5 14, comprising:

a first sensor group disposed on the downstream side of the electrode and on the downstream side of a position where the hypochlorous acid removing agent is injected into the pressurized seawater and/or the concentrated
10 water which pass(es) and flow(s) in the piping(s) and a position where the pH adjustor is injected into the pressurized seawater and/or the concentrated water which pass(es) and flow(s) in the piping(s), and configured by the flowmeter, the residual chlorine meter, the pH meter,
15 and the electrometer; and

a second sensor group disposed on the upstream side of the position where the hypochlorous acid removing agent is injected into the pressurized seawater and/or the concentrated water which pass(es) and flow(s) in the
20 piping(s) and the position where the pH adjustor is injected into the pressurized seawater and/or the concentrated water which pass(es) and flow(s) in the piping(s), and in the vicinity of and on the downstream side of the electrode, and configured by the flowmeter,
25 the residual chlorine meter, the pH meter, and the

electrometer,

wherein the control unit is configured to inject at least the hypochlorous acid removing agent and the pH adjustor into the pressurized seawater and/or the concentrated water which pass(es) and flow(s) in the piping(s) on the basis of a measured value from the second sensor group, and further to perform feedback control on the hypochlorous acid removing agent injection pump, the pH adjustor injection pump, and the anticorrosion power supply on the basis of a measured value from the first sensor group.