

[Name of Document] Description

[Title of Invention] DRINKING WATER SUPPLY SYSTEM

5 [Technical Field]

 [0001]

 The present invention relates to a drinking water supply
system and more particularly to a drinking water supply
system that uses an antibacterial action of silver that
10 allows sanitary management to be suitably maintained for a
long period of time.

 [Background Art]

 [0002]

15 Drinking water supply systems are widely used in ships,
restaurants, accommodation facilities, general households,
etc. Drinking water supply systems produce drinking water
using desalted water such as distilled water or pure water
as raw water and supply the drinking water after adding
20 minerals as needed. It is known that in such drinking water
supply systems, dissolving silver ions into the water treated
by water purifiers is effective in terms of antibacterial
properties. In this context, to prevent the generation of
bacteria in the systems, a technique has been proposed that
25 uses silver-coated activated carbon to dissolve silver ions
into the treated water and control the number of viable
bacteria (Patent Document 1, Patent Document 2). Just for
reference, silver-coated activated carbon is used in water
purifiers currently on the market, and when tap water is
30 used as the raw water, the concentration of silver attached
is adjusted so that silver ions are dissolved at a
concentration of 50 µg/L immediately after the start of use.

 [Prior Art Documents]

[Patent Documents]

[0003]

[Patent Document 1] JP2018-171577A

[Patent Document 2] JP2013-56833A

5

[Summary of the Invention]

[Problems to be solved by the Invention]

[0004]

In the drinking water supply systems such as water
10 purifiers that use the silver-coated activated carbon,
however, even when adjustments are made to dissolve silver
ions at a concentration of 50 µg/L immediately after the
start of use, silver ions are excessively released from the
silver-coated activated carbon, leading to problems in that
15 not only will the replacement life of elements using silver-
coated activated carbon be shortened, but also in that at
the end of the replacement life, almost no silver ions will
be dissolved, and the systems may not be able to exhibit
sufficient antibacterial properties.

20 [0005]

The present invention has been made in view of the above
problems, and an object of the present invention is to
provide a drinking water supply system that uses an
antibacterial action of silver that allows sanitary
25 management to be suitably maintained for a long period of
time.

[Means for solving the Problems]

[0006]

To achieve the above object, the present invention
30 provides a drinking water supply system for treating desalted
water with a filter that uses silver-coated activated carbon,
the drinking water supply system including a chlorine ion
addition mechanism provided upstream the filter that uses

the silver-coated activated carbon (Invention 1).

[0007]

According to the invention (Invention 1), it is possible to provide a drinking water supply system that can suitably
5 maintain the sanitary management for a long period of time owing to the antibacterial action of silver. This is due to the following reasons. That is, as a result of the inventor's investigation into the cause of excessive dissolution of silver ions from the silver-coated activated
10 carbon, it has been found that if desalted water such as distilled water or pure water is used as the raw water, too much silver ions will be dissolved, while at the end of the replacement life, almost no silver ions may be dissolved. The amount of dissolution of silver ions depends on the
15 solubility product of silver chloride. Tap water in Japan contains 10 mg/L to 200 mg/L (the upper limit of drinking water quality standards) of chlorine ions. In this case, the silver ions are dissolved under a controlled situation. For example, if the life of the filter is 15,000 L, the
20 silver concentration can be confirmed to be 50 µg/L at the initial stage and several µg/L at the final stage of the water flow life, and the hygienic state of water may be maintained by the constant dissolution of silver ions into the water from the initial stage to the final stage. When
25 desalted water such as distilled water or pure water is used as the raw water, however, almost no chlorine ions may be contained. It has been found that when chloride ions decrease, the solubility of silver chloride increases, and an effective silver ion concentration cannot be maintained
30 at the final stage of life because silver ions are dissolved at a high concentration initially. Accordingly, by providing a chlorine ion addition mechanism upstream a filter that uses silver-coated activated carbon and supplying water

containing a certain concentration of chlorine ions to the filter that uses silver-coated activated carbon, the amount of dissolution of silver ions can be controlled.

[0008]

5 In the above invention (Invention 1), the chlorine ion addition mechanism may be preferably attached to a free chlorine agent sterilizer (Invention 2). In the above invention or inventions (Inventions 1 and 2), the filter that uses the silver-coated activated carbon may be
10 preferably configured such that an ultrafiltration membrane or a microfiltration membrane is provided with a membrane that supports the silver-coated activated carbon (Invention 3).

[0009]

15 According to the invention or inventions (Inventions 2 and 3), a chlorine ion sterilizer is provided which can supply water containing a certain concentration of chlorine by mixing sodium hypochlorite upstream the filter such as an ultrafiltration membrane or a microfiltration membrane
20 supporting the silver-coated activated carbon, and salt is dissolved together with chlorine-based chemicals such as sodium hypochlorite that are injected into the sterilizer, so that chlorine ions can be present in the raw water, and dissolution of silver can be controlled.

25 [0010]

 In the above invention or inventions (Inventions 1 to 3), a mineral addition mechanism may be preferably provided upstream the filter that uses the silver-coated activated carbon (Invention 4).

30 [0011]

 According to the invention (Invention 4), drinking water that tastes like mineral water can be supplied.

[0012]

In the above invention or inventions (Inventions 1 to 4), it may be preferred that the filter that uses the silver-coated activated carbon can be backwashed (Invention 5).

[0013]

5 According to the invention (Invention 5), by regularly backwashing the filter, which uses silver-coated activated carbon and an ultrafiltration membrane or the like, for example, with water containing a free chlorine agent, it is possible to prevent propagation of bacteria on the secondary
10 side of the filter.

[0014]

In the above invention or inventions (Inventions 1 to 5), it may be preferred to provide a notification mechanism that notifies a time to replace the filter that uses the
15 silver-coated activated carbon, necessity of backwashing, and/or a time to replace the chlorine ion addition mechanism (Invention 6).

[0015]

20 According to the invention (Invention 6), the system can be suitably operated by notifying the necessary timing of various maintenance and checking using the notification mechanism such as a warning lamp.

[Effect of the Invention]

[0016]

25 According to the drinking water supply system of the present invention, by providing the chlorine ion addition mechanism upstream the filter that uses silver-coated activated carbon, water containing a certain concentration of chlorine ions can be supplied to the filter thereby to
30 control the amount of dissolution of silver ions, and it is therefore possible to suitably maintain the sanitary management for a long period of time owing to the antibacterial action of silver.

[Brief Description of Drawings]

[0017]

FIG. 1 is a schematic diagram illustrating a drinking
5 water supply system according to a first embodiment of the
present invention.

FIG. 2 is a schematic diagram illustrating the flow
during water supply in the drinking water supply system
according to the embodiment.

10 FIG. 3 is a schematic diagram illustrating the flow
during backwashing of a water purification filter of the
drinking water supply system according to the embodiment.

[Embodiments for Carrying out the Invention]

15 [0018]

Hereinafter, an embodiment of the drinking water supply
system of the present invention will be described in detail
with reference to FIGS. 1 to 3.

[0019]

20 {Drinking Water Supply System}

FIG. 1 illustrates a drinking water supply system
according to an embodiment of the present invention. In FIG.
1, a drinking water supply system 1 is configured by
providing a pretreatment filter 3, a booster pump 4, a
25 flowmeter 5, mineral addition modules 6, and a water
purification filter 7 in series between water supply pipes
2, 2A, 2B, 2C, and 2D and a discharge port 8. The water
purification filter 7 uses silver-coated activated carbon
and an ultrafiltration membrane. The water supply pipes 2,
30 2A, 2B, 2C, and 2D supply desalted water such as distilled
water or pure water as raw water W. The discharge port 8
includes an opening/closing mechanism such as a faucet
provided at the end of the water supply pipe 2D.

[0020]

The mineral addition modules 6 are each filled with a solid powder mineral agent, for which those derived from rocks or natural sources can be used. Preferred examples of
5 the mineral agent include calcium components such as seashell uncalcined calcium and coral uncalcined calcium.

[0021]

The water purification filter 7 is configured such that a filter material composed of fibrous activated carbon to
10 which silver ions are attached is held, for example, between a microfiltration membrane or an ultrafiltration membrane and a nonwoven fabric. Other than the fibrous activated carbon, a fibrous filter to which silver zeolite is added, for example, can also be used. In the present embodiment,
15 the water purification filter 7 used is configured such that a filter material composed of fibrous activated carbon to which silver ions are attached is held between an ultrafiltration membrane and a nonwoven fabric.

[0022]

20 A sodium hypochlorite addition mechanism 9 as a free chlorine disinfectant addition mechanism is connected to the water supply pipe 2 upstream the pretreatment filter 3. In the present embodiment, the sodium hypochlorite addition mechanism 9 has a sodium hypochlorite solution tank (not
25 illustrated) filled with a sodium chloride aqueous solution of a predetermined concentration, and the sodium hypochlorite is dissolved in the sodium chloride aqueous solution at a predetermined concentration. The sodium hypochlorite addition mechanism 9 may also serve as a
30 chlorine ion addition mechanism by adding the sodium hypochlorite solution using a chemical injection pump 10 such as a diaphragm pump.

[0023]

A carbon dioxide gas supply pipe 21 is connected upstream the mineral addition modules 6 and downstream the flowmeter 5. The carbon dioxide gas supply pipe 21 is provided with a regulator 22A that communicates with a carbon dioxide gas (CO₂) source 22. Reference numerals 23 and 24 represent pressure switches, reference numerals 25 and 26 represent solenoid valves, and reference numeral 27 represents a check valve. The carbon dioxide gas supply pipe 21, carbon dioxide gas (CO₂) source 22, regulator 22A, pressure switches 23 and 24, solenoid valves 25 and 26, and check valve 27 constitute a carbon dioxide gas dissolving mechanism.

[0024]

A three-way valve 31 connected to a branch pipe 32 communicating with the discharge port 8 side is provided downstream from the connection point of the carbon dioxide gas supply pipe 21, and the water flow direction can be switched between the mineral addition modules 6 side and the branch pipe 32 side. Furthermore, the water supply pipe 2 is connected to a drain pipe 41 between the mineral addition modules 6 and the water purification filter 7. Reference numerals 51 and 52 represent solenoid valves, and reference numerals 53, 54, 55, and 56 represent check valves.

[0025]

In the drinking water supply system 1 as described above, the flowmeter 5 is connected to an arithmetic and control device (not illustrated) such as a personal computer and can transmit a pulse signal to the arithmetic and control device at every fixed flow volume. The arithmetic and control device counts the cumulative flow volume of the raw water W to control the carbon dioxide gas dissolving mechanism and can notify the time to replace the water purification filter 7, the necessity of backwashing, and the time to maintain

the sodium hypochlorite addition mechanism 9 via a notification means (not illustrated) such as a lamp, buzzer, or display.

[0026]

5 {Method of Operating Drinking Water Supply System}

A method of operating the drinking water supply system 1 of the present embodiment having the configuration as described above will be described below.

[0027]

10 <Drinking Water Production Process>

First, as illustrated in FIG. 2, the three-way valve 31 closes the branch pipe 32 side and opens the mineral addition modules 6 side, and the solenoid valve 52 is closed. This allows the water supply pipe 2 to form a water channel that
15 runs from the pretreatment filter 3 through the mineral addition modules 6 and the water purification filter 7 to the discharge port 8. In FIG. 2, water does not flow through the branch pipe 32 and the drain pipe 41, so they are indicated by broken lines for descriptive purposes.

20 [0028]

(Step of Adjusting and Adding Sodium Hypochlorite for Sterilization)

Then, when the raw water W is supplied from the water supply pipe 2, a sodium hypochlorite solution for
25 sterilization in which sodium chloride is dissolved in the raw water W is injected from the sodium hypochlorite addition mechanism 9 via the chemical injection pump 10. By operating the chemical injection pump 10 in response to the flow rate signal, it is possible to add the sodium hypochlorite
30 solution at a stable concentration even when it does not flow continuously.

[0029]

The concentration of sodium hypochlorite in the sodium

hypochlorite solution for sterilization depends on the amount of injection into the raw water W, but the effective chlorine concentration may be about 0.1-10 wt%. If the effective chlorine concentration is less than 0.1 wt%, the sterilizing effect may be unduly low, and the amount added to the raw water W will have to be increased, while if the effective chlorine concentration exceeds 10 wt%, the required amount of sodium hypochlorite may increase, and the handling property of the sodium hypochlorite addition mechanism 9 will be poor. In particular, the effective chlorine concentration may be preferably about 0.5-5 wt%.

[0030]

The amount of sodium chloride dissolved in the sodium hypochlorite solution for sterilization is approximately 1-30 wt%, depending on the amount of injection into the raw water W. If the concentration of sodium chloride is less than 1 wt%, the effect of suppressing dissolution of silver in the water purification filter 7 using activated carbon to be described later will not be sufficient, while if the concentration of sodium chloride exceeds 50 wt%, the required amount of sodium chloride may increase, and the handling property of the sodium hypochlorite addition mechanism 9 will be poor. In particular, the sodium chloride concentration may be preferably about 5-20 wt%.

[0031]

The sodium hypochlorite solution for sterilization in which sodium chloride is dissolved as described above may be preferably added to the raw water W so that the free residual chlorine concentration in the raw water W becomes 0.5-5 mg/L and particularly 1-3 mg/L. Additionally or alternatively, sodium chloride may be preferably added so that Cl^- in the raw water W becomes 5-50 mg/L and particularly 10-30 mg/L.

[0032]

(Turbidity Removal Step)

The raw water W to which the sodium hypochlorite solution for sterilization containing dissolved sodium chloride is added may be treated with the pretreatment filter 3 to remove fine particulates and suspended solids. At this time, by making the housing of the pretreatment filter 3 have a volume larger than a predetermined value, the raw water W can be accumulated in the housing so that the fluctuations in the residual chlorine concentration can be reduced.

[0033]

(Step of Adding Mineral Components)

After treating the raw water W with the pretreatment filter 3 to remove fine particulates and suspended solids, the booster pump 4 is driven to boost the pressure of the raw water W in a state in which the solenoid valve 25 is opened and the solenoid valve 26 is closed, and the flow volume is then measured by the flowmeter 5. When the raw water W reaches a set cumulative flow volume, the solenoid valve 26 is opened, and the carbon dioxide gas from the carbon dioxide gas source 22 is mixed to and dissolved in the raw water W. This generates carbon dioxide gas-dissolved water with a controlled carbon dioxide gas concentration. Here, by controlling the carbon dioxide gas concentration in the raw water W to about 100-500 ppm, the bicarbonate hardness component concentration of the water containing bicarbonate hardness components can be adjusted to a desired concentration in the mineral addition modules 6, which will be described later.

[0034]

Subsequently, the raw water W in which carbon dioxide gas is dissolved reaches the three-way valve 31. At this time, the three-way valve 31 closes the branch pipe 32 side

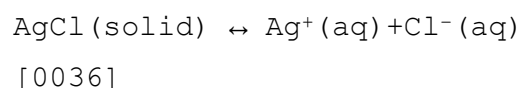
and opens the mineral addition modules 6 side, and the raw water W therefore flows into the mineral addition modules 6 from the water supply pipe 2A. Then, when the raw water W passes through the mineral addition modules 6, calcium in
5 the mineral agent in the mineral addition modules 6 is dissolved as calcium bicarbonate in proportion to the carbon dioxide concentration due to the previously described dissolution of carbon dioxide gas. When other mineral components are present, they are also dissolved as
10 bicarbonates. In particular, by using shell uncalcined calcium, coral uncalcined calcium, or the like as a solid powder mineral agent, not only calcium carbonate but also magnesium carbonate components can be dissolved to obtain mineral water containing these components. The flow rate of
15 the raw water W in which carbon dioxide gas is dissolved may be set so that the mineral water has a desired total hardness by passing through the mineral addition modules 6. However, if the total hardness of mineral water exceeds 100 mg/L, mineral components tend to precipitate, so the mineral
20 addition modules 6 may be filled with mineral components so that the total hardness is about 100 mg/L and at most 200 mg/L or less.

[0035]

(Step of Adding Silver Ions)

25 The mineral-added raw water W is then passed through the water purification filter 7 that uses fibrous activated carbon to which silver ions are attached, to remove organic substances, miscellaneous flavor components, and turbidity components contained in the raw water W due to the addition
30 of minerals, etc., and antibacterial properties are given by silver ions. For example, silver chloride (AgCl) is kneaded in this silver-coated activated carbon. Silver chloride is insoluble, but the raw water W is desalted water such as

distilled water or pure water, so there are very few ionic components other than Ag. It is known that when other ionic components are less in this way, a large amount of silver, 1.55 mg/L, is dissolved. The dissolution of such a large amount of silver not only shortens the replacement life of elements using silver-coated activated carbon, but at the end of the replacement life, almost no silver ions are dissolved, thus causing a problem in which sufficient antibacterial properties cannot be exhibited. Strictly speaking, in the dissolution of silver, the dissolution rate is balanced with the precipitation rate, resulting in dissolution equilibrium.



In this situation, when conditions such as concentration, pressure, and temperature change due to external influences, the equilibrium moves in a direction that softens the change. Such a kind of regularity is called Le Chatelier's principle. The presence of other ions in the solution changes the solubility, which transitions to a solid state, and precipitation occurs. In general, this can be expressed as a solubility product, and its K_{sp} is demonstrated below.

$$K_{sp} \text{ of AgCl} = 1.77 \times 10^{-10} = [\text{Ag}^+][\text{Cl}^-] (\text{mol}^2/\text{L}^2)$$

[0037]

Precipitation begins to occur when the product of ion concentrations exceeds a value of K_{sp} . Here, assuming that the molecular weight of silver is 107.9 and the molecular weight of chlorine (Cl) is 35.5, the necessary chloride ion concentration can be calculated using the following formula in order to keep Ag^+ below 100 $\mu\text{g/L}$ ($=9.26 \times 10^{-5} (\text{mol/L})$), which is the WHO guideline.

$$1.77 \times 10^{-10} (\text{mol}^2/\text{L}^2) / 9.26 \times 10^{-5} (\text{mol/L})$$

= 1.923×10^{-4} (mol/L) = 6.826 (mg/L)

[0038]

Thus, by adding a chloride salt (e.g., NaCl) so that the chloride ion concentration becomes 7 mg/L or more, the
5 silver ion concentration can be made 100 µg/L or less.

[0039]

To this end, in the present embodiment, the step of adding the sodium hypochlorite for sterilization includes adding sodium chloride as previously described thereby to
10 suppress the dissolution of silver from the fibrous activated carbon, to which silver ions are attached, while imparting antibacterial properties owing to silver ions, and it is thus possible to extend the life of the water purification filter 7.

15 [0040]

<Washing Step>

Then, if the drinking water supply system 1 has been operated for a predetermined time or has been stopped for a long time, the water purification filter 7 is washed and the
20 accumulated water is discharged. In this washing, as illustrated in FIG. 3, the three-way valve 31 closes the mineral addition modules 6 side and opens the branch pipe 32 side, and the discharge port 8 is closed. This can form a water channel that runs from the water supply pipe 2 through
25 the pretreatment filter 3 and passes through the water purification filter 7 in the reverse direction to reach the drain pipe 41. In FIG. 3, water does not flow through the water supply pipes 2B and 2C, so they are indicated by broken lines for descriptive purposes.

30 [0041]

Then, the raw water W is supplied from the water supply pipe 2. At this time, the booster pump is driven to feed the raw water W in a state in which the sodium hypochlorite

addition mechanism 9 remains activated and the solenoid valve 26 of the carbon dioxide gas supply pipe 21 is closed. This allows the raw water W, which is imparted with sterilizing properties by the addition of sodium hypochlorite, to reach
5 the three-way valve 31. At this time, the three-way valve 31 closes the mineral addition modules 6 side and opens the branch pipe 32 side, and the raw water W therefore passes in the reverse direction from the branch pipe 32 through the water purification filter 7 that uses silver-coated
10 activated carbon and an ultrafiltration membrane, so that impurities and turbidity components accumulated in the water purification filter 7 can be discharged together with the raw water W as the drain water D from the drain pipe 41. Moreover, by performing the backwashing with the raw water
15 W that is given sterilizing properties owing to addition of sodium hypochlorite, it is possible to sterilize the passage and at the same time prevent bacterial growth on the secondary side of the water purification filter 7 that uses an ultrafiltration membrane.

20 [0042]

In such a washing step, the control mechanism (not illustrated) may preferably flash a lamp as the notification mechanism thereby to perform control so as to encourage draining of the drain water D by backwashing, such as when
25 the drinking water supply system 1 is operated for a predetermined period of time or before the start of use in the morning with a timer. This backwashing may be controlled in an automated manner. Additionally or alternatively, when maintenance is required, such as when it is time to replace
30 the pretreatment filter 3 and the purification filter 7 or when the amount of chemical remaining in the sodium hypochlorite addition mechanism 9 becomes small, the lamp may be flashed to prompt the checking.

[0043]

After backwashing the water purification filter 7, it is sufficient to return to the drinking water production process illustrated in FIG. 2. By backwashing the water purification filter 7 in this way, it is possible to clean up inside of the passage of the drinking water supply system 1, maintain the water quality of the drinking water W1 in good condition, and further extend the life of the water purification filter 7.

10 [0044]

While the drinking water supply system 1 of the present invention has been heretofore described based on the above embodiments, the present invention is not limited to the above embodiments, and various modifications are possible. For example, the notification mechanism is not limited to a lamp, and may also be an alarm, a display, or a combination of both. Moreover, not only sodium chloride but also various chlorides capable of supplying chloride ions can be used, provided that there is no adverse effect on the human body. Furthermore, in the carbon dioxide gas dissolving device, not only carbon dioxide gas but also other gas components may be mixed and supplied.

[Examples]

[0045]

25 The present invention will be described in more detail with reference to the following specific examples.

[0046]

«Example 1»

(Raw Water W)

30 Ultrapure water was prepared as the raw water W through subjecting city water to desalting treatment using a reverse osmosis membrane (RO membrane), then removing anions and cations using a mixed bed ion exchange device, further

decomposing organic substances using an ultraviolet oxidation device, and thereafter removing fine particle components using an ultrafiltration membrane (UF membrane).

[0047]

5 (Preparation of Sodium Hypochlorite Solution for Sterilization)

A sodium hypochlorite solution for sterilization was prepared through using as the dilution water a saline solution in which 340 g of salt was dissolved in 2.7 L of
10 ultra-pure water that was the same as the raw water W, adding 300 mL of Purelox (sodium hypochlorite solution available from OYALOX Co., Ltd.) having an effective chlorine concentration of 6% to the dilution water, and stirring them well, and the sodium hypochlorite solution for sterilization
15 was stored in the tank of the sodium hypochlorite addition mechanism 9.

[0048]

(Step of Adding Sodium Hypochlorite for Sterilization)

Using the drinking water supply system 1 illustrated in
20 FIG. 2, the raw water W was supplied from the water supply pipe 2, and the hypochlorite solution containing the added sodium chloride was injected from the sodium hypochlorite addition mechanism 9 into the raw water W using a diaphragm pump (available from IWAKI CO., LTD.) whose stroke was
25 adjusted to 50% with the maximum pulse set. Injection of the sodium hypochlorite solution was performed via a siphon check valve in the raw water W by outputting a pump operation signal for 3 seconds every time 1L of water was counted with a signal from the flowmeter 5 in the system 1. Through this
30 operation, 1.5 mg/L of free residual chlorine and 15 mg/L of Cl^- were added to the raw water W.

[0049]

(Turbidity Removal Step)

The raw water to which the sodium hypochlorite solution for sterilization containing the dissolved sodium chloride was added was treated with the pretreatment filter 3 to remove fine particulates and suspended solids.

5 [0050]

(Step of Adding Mineral Components)

After adding carbon dioxide gas from the carbon dioxide gas source 22 to the raw water W treated with the pretreatment filter 3, the total hardness component was added
10 as calcium bicarbonate by passing the raw water W through the mineral addition modules 6. The amount of carbon dioxide gas injected at that time was set to an amount assuming a total hardness of 150 mg/L.

[0051]

15 (Step of Adding Silver Ions)

Subsequently, drinking water W1 was produced through passing the mineral-added raw water W through the water purification filter 7 that uses fibrous activated carbon to which silver ions were attached, to impart antibacterial
20 properties by silver ions, and further removing organic substances, miscellaneous flavor components, and turbidity components mixed in the raw water W due to the addition of minerals, etc.

[0052]

25 The drinking water W1 was discharged from the discharge port 8, and 500 mL of water was sampled every 2 minutes when the water flow was 50 L, 1,000 L, 5,000 L, 10,000 L, and 15,000 L. For the 15th sampling water, the chlorine ion (Cl^-) concentration, silver ion (Ag^+) concentration, total
30 hardness (TH), and free residual chlorine concentration (FAC) were measured. In addition, the drinking water W1 was subjected to evaluation of taste (flavor) and viable bacteria. The results are listed in Table 1. Furthermore, Table 2

lists the results of the same measurements conducted on the water accumulated downstream the water purification filter 7 (accumulated water) during respective water flows.

[0053]

5 Here, the chloride ion (Cl^-) concentration and the total hardness were measured by ion chromatography, the silver ion (Ag^+) concentration was measured by ICP/MS, and the free residual chlorine concentration was measured by DPD method. For viable bacteria, a Petri film available from 3M Company
10 was used, and the number of colonies ($n=2$) was counted after culturing at 36°C for 48 hours using the first sample water at each water flow rate.

[0054]

When measuring the accumulated water, the accumulated
15 water was sampled and measured through adding sodium hypochlorite to the raw water W using an automated backwashing function, flowing the raw water W through a microfiltration membrane from its secondary side for 1 minute at 7:00 every morning thereby to enable a function of
20 preventing back contamination, and when resuming the operation that morning, flashing a lamp to prompt drainage until the water was replaced with mineral water and discharged.

[0055]

25 Indicators for the chloride ion (Cl^-) concentration, silver ion (Ag^+) concentration, flavor, and viable bacteria are as listed in Table 3.

[0056]

[Table 1]

Flow volume (L)	Continuous water flow					Viable bacteria	
	Cl	Ag+	Flavor	TH	FAC	n1	n2

	(mg/L)	(µg/L)		(mg/L)	(mg/L)		
50	28.3	29.7	E	167	0.00	1	2
1,000	30.0	50.4	E	158	0.00	1	2
5,000	25.3	7.5	E	135	0.03	8	10
10,000	27.1	0.8	E	128	0.00	11	8
15,000	29.4	0.2	E	153	0.01	1	2

[0057]

[Table 2]

Flow volume (L)	Accumulated water				
	Cl (mg/L)	Ag+ (µg/L)	Flavor	TH (mg/L)	FAC (mg/L)
50	16.9	27.3	E	150	0.01
1,000	17.6	64.5	E	164	0.03
5,000	18.2	24.3	E	139	0.01
10,000	21.2	5.9	E	137	0.01
15,000	28.9	4.7	E	151	0.01

5 [0058]

[Table 3]

Topic	Note	Reference value (ground)
Cl-	Chloride ion concentration (mg/L)	>7 (set originally)
Ag+	Silver ion concentration (µg/L)	≤100 (WHO guideline)
Flavor	Flavor	Subjective view (E/G/F/NG) *
Viable bacteria	Viable bacterial	≤100 (drinking water quality standard)

[0059]

*) E: Excellent (very delicious)
G: Good (delicious)
F: Fair (acceptable (not delicious, but not bad))
NG: No Good (unacceptable (not delicious))

5 [0060]

«Comparative Example 1»

Drinking water W1 was produced in the same manner as in Example 1 except that ultrapure water was used as substitute for the sodium chloride aqueous solution to prepare the sodium hypochlorite solution for sterilization. When the water flow was 1,000 L, 5,000 L, 10,000 L, and 15,000 L, 500 mL of water was sampled every 2 minutes, and the silver ion (Ag⁺) concentration in the 10th sampling water was measured in the same manner as in Example 1. The results are listed in Table 4.

[0061]

[Table 4]

Flow volume (L)	Ag ⁺ (μg/L)
1,000	109
5,000	46
10,000	0
15,000	0

[0062]

20 As apparent from Tables 1 to 4, in the drinking water supply system 1 of Example 1 in which sodium chloride was present in the sodium hypochlorite solution for sterilization, even when the amount of treated water increased, Cl⁻ was controlled at 16.9–30.0 mg/L, and Ag⁺ was controlled at 100 μg/L or less. Even after passing 15,000 L of water, 4.7 μg/L of Ag⁺ was observed during accumulation, and the number of viable bacteria was maintained below 100/L, indicating that antibacterial properties can be exhibited

for a long period of time. On the other hand, in Comparative Example 1 in which sodium chloride was not present, Ag^+ sometimes exceeded 100 $\mu\text{g/L}$ at the initial stage, and almost no Ag^+ was observed after passing 10,000 L of water.

5

[Description of Reference Numerals]

[0063]

- 1 Drinking water supply system
- 2, 2A, 2B, 2C, 2D Water supply pipe
- 10 3 Pretreatment filter
- 4 Booster pump
- 5 Flowmeter
- 6 Mineral addition module
- 7 Water purification filter
- 15 8 Discharge port
- 9 Sodium hypochlorite addition mechanism
- 10 Chemical injection pump
- 21 Carbon dioxide gas supply pipe
- 22 Carbon dioxide gas (CO_2) source
- 20 22A Regulator
- 23, 24 Pressure switch
- 25, 26 Solenoid valve
- 27 Check valve
- 31 Three-way valve
- 25 32 Branch pipe
- 41 Drain pipe
- 51, 52 Solenoid valve
- 53, 54, 55, 56 Check valve
- W Raw water
- 30 W1 Drinking water
- D Drain water

1. A drinking water supply system for treating desalted water with a filter that uses silver-coated activated carbon,
5 the drinking water supply system including a chlorine ion addition mechanism provided upstream the filter that uses the silver-coated activated carbon.
2. The drinking water supply system according to claim 1,
10 wherein the chlorine ion addition mechanism is attached to a free chlorine agent sterilizer.
3. The drinking water supply system according to claim 1 or 2, wherein the filter that uses the silver-coated
15 activated carbon is configured such that an ultrafiltration membrane or a microfiltration membrane is provided with a membrane that supports the silver-coated activated carbon.
4. The drinking water supply system according to any one
20 of claims 1 to 3, comprising a mineral addition mechanism provided upstream the filter that uses the silver-coated activated carbon.
5. The drinking water supply system according to any one
25 of claims 1 to 4, wherein the filter that uses the silver-coated activated carbon can be backwashed.
6. The drinking water supply system according to any one
30 of claims 1 to 5, comprising a notification mechanism that notifies a time to replace the filter that uses the silver-coated activated carbon, necessity of backwashing, and/or a time to replace the chlorine ion addition mechanism.