

DESCRIPTION

Title of Invention

COMPOSITE-TYPE SOLID WATER TREATMENT PRODUCT

Technical Field

[0001]

The present invention relates to a composite-type solid water treatment product for simultaneously using a plurality of water treatment agents, the composite-type solid water treatment product being a water treatment product to be used in various water systems such as industrial water, cooling water, hot and cold water, boiler water, process water, and discharged water.

Background Art

[0002]

In various water systems such as industrial water, cooling water, hot and cold water, boiler water, process water, and discharged water, various types of water treatment agents such as an anticorrosive, a scale preventive, a bactericide, and an algicide are used for the purpose of preventing corrosion and scaling of metal members which are used in these water systems, and preventing occurrence of microorganisms such as bacteria and algae in the water systems, and other purposes.

The water treatment agents to be used for such purposes are required to be able to continue an effect of a chemical at a high level over a long period of time in many cases. Therefore, a method of continuing an effect of a chemical by continuously injecting a liquid water treatment agent into a water system to be treated using a chemical feed pump or the like is usually adopted.

[0003]

However, there are establishments in which injection of a water treatment agent with a chemical feed pump or the like is difficult because of capability of their facilities, and in such cases, different means for continuing the effect of a chemical is necessary.

In addition, even in a case where equipment such as a chemical feed pump can be installed, installation of these types of equipment in, for example, a small cooling tower is a big burden of cost, maintenance of equipment or the like.

[0004]

Accordingly, a method by which the effect of a chemical can be continued by simpler means has been required, and as one of such means, a solid water treatment agent having sustained-releasability by which an active substance in a water system can be gradually released is proposed in PTL1, for example.

[0005]

On the other hand, with respect to the water treatment agent in the various water systems described above, there are some cases where it is more effective that two or more types of compounds are combined and used as active substances than that only one compound is used. For example, PTLs 2 and 3 describe that a halogenated hydantoin-based compound (halogen-based oxidant) and an isothiazolone-based compound are injected as liquid water treatment agents into predetermined process water with a pump from the viewpoint of suppressing occurrence of slime due to proliferation of microorganisms.

In this way, a bactericidal action, which is excellent to *Legionella* bacteria in particular, is obtained by the use of the halogen-based oxidant and the isothiazolone-based compound together.

Citation List

Patent Literature

[0006]

PTL1: JP 2015-93260 A

PTL2: JP 11-47755 A

PTL3: JP 2007-319850 A

Summary of Invention

Technical Problem

[0007]

Therefore, it is convenient in handling that both compounds of the halogen-based oxidant and the isothiazolone-based compound can be made into one agent and used, without adding both the compounds separately.

However, as the halogen-based oxidant, a chlorine-based oxidant in particular, and the isothiazolone-based compound are brought into direct contact with each other, a chlorine gas is remarkably produced, and therefore it is not preferable to make them into one agent before use. Accordingly, it is difficult to

make the compounds into one agent even when they are formulated as the solid water treatment agent as described in PTL1.

Further, from the viewpoint of safety, it is also not preferable that the compounds come into direct contact with each other at the time of use.

[0008]

Accordingly, even in a case where two or more active substances are reactive to each other and a dangerous product is produced at the time of handling them, a water treatment product which can continue an excellent effect of a chemical by the use of these active substances together and which is also excellent in convenience of handling has been required.

[0009]

The present invention has been completed in order to solve the problems as described above, and an object of the present invention is to provide a composite-type solid water treatment product in which a halogen-based oxidant and an active substance that is reactive to the halogen-based oxidant are safely used, which can continue an excellent effect of a chemical by using these active substances together, and which is also excellent in convenience of handling.

Solution to Problem

[0010]

By separately formulating a halogen-based oxidant that is a water treatment agent and an organic bactericide that is reactive to the halogen-based oxidant, and combining them with a container in which each solid agent can be used in a predetermined form, a composite-type solid water treatment product of the present invention can safely exhibit an effect of a chemical of both the solid agents and can make both the solid agents easy to handle.

[0011]

That is, the present invention provides the following [1] to [10].

[1] A composite-type solid water treatment product to be used by being dissolved into water to be treated, the product comprising: a solid agent (A) of a halogen-based oxidant comprising a halogenated hydantoin-based compound as an active substance; a solid agent (B) comprising an organic bactericide that is reactive to the halogen-based oxidant; and at least one dissolution container storing the solid agent (A) and the solid agent (B) without allowing the solid agent (A) and the solid agent (B) to be in contact with each other.

[2] The composite-type solid water treatment product according to [1], wherein the halogenated hydantoin-based compound is at least one selected from the group consisting of 1-bromo-3-chloro-5,5-dimethylhydantoin and 1,3-dichloro-5,5-dimethylhydantoin.

[3] The composite-type solid water treatment product according to [1] or [2], wherein the organic bactericide comprises an isothiazoline-based compound as an active substance.

[4] The composite-type solid water treatment product according to [3], wherein the isothiazoline-based compound is at least one selected from the group consisting of 5-chloro-2-methyl-4-isothiazolin-3-one, 2-methyl-4-isothiazolin-3-one, 4,5-dichloro-2-methyl-4-isothiazolin-3-one, 2-ethyl-4-isothiazolin-3-one, 2-n-octyl-4-isothiazolin-3-one, 5-chloro-2-ethyl-4-isothiazolin-3-one, 5-chloro-2-t-octyl-4-isothiazolin-3-one, 4,5-dichloro-2-n-octyl-4-isothiazolin-3-one, 4,5-dichloro-2-cyclohexyl-4-isothiazolin-3-one, and 1,2-benzoisothiazolin-3-one.

[5] The composite-type solid water treatment product according to any one of [1] to [4], wherein: the halogen-based oxidant comprises 1-bromo-3-chloro-5,5-dimethylhydantoin as an active substance; and the organic bactericide comprises 5-chloro-2-methyl-4-isothiazolin-3-one as an active substance.

[6] The composite-type solid water treatment product according to any one of [1] to [5], wherein the solid agent (B) comprises at least one selected from the group consisting of triazole-based compounds, phosphonic acid-based compounds, and sulfamic acid-based compounds.

[0012]

[7] The composite-type solid water treatment product according to any one of [1] to [6], wherein the solid agent (A) is a tablet.

[8] The composite-type solid water treatment product according to any one of [1] to [7], wherein the solid agent (B) is a tablet.

[9] The composite-type solid water treatment product according to any one of [1] to [8], wherein the water to be treated is cooling water in a cooling tower.

[10] The composite-type solid water treatment product according to any one of [1] to [9], wherein: the solid agent (A) and the solid agent (B) are each stored in a separate dissolution container; each of the dissolution containers is disposed in a cooling tower and comprises a container body and a partition wall dividing an inside of the container body into at least one storage chamber storing the solid agent (A) or (B) being a solid chemical and a non-storage chamber not storing the

solid chemical; and the container body comprises at least one container communication path allowing cooling water to flow between an outside of the container body and the non-storage chamber, and the partition wall comprises at least one partition wall communication path allowing the cooling water to flow between the storage chamber and the non-storage chamber.

Advantageous Effects of Invention

[0013]

According to the composite-type solid water treatment product of the present invention, a halogen-based oxidant and an active substance that is reactive to the halogen-based oxidant can be safely used, and an excellent effect of a chemical by the use of these active substances together can be continued.

In addition, the composite-type solid water treatment product of the present invention is excellent in convenience in simultaneously handling chemicals which are reactive to each other.

Brief Description of Drawings

[0014]

[Fig. 1] Fig. 1 is a longitudinal section illustrating an outline of a dissolution container according to one embodiment of a composite-type solid water treatment product of the present invention.

[Fig. 2] Fig. 2 is a longitudinal section illustrating an outline of a dissolution container according to another embodiment of the composite-type solid water treatment product of the present invention.

[Fig. 3] Fig. 3 is a side view illustrating an outline of one embodiment of the composite-type solid water treatment product of the present invention.

Description of Embodiments

[0015]

Hereinafter, the present invention will be described in detail.

A composite-type solid water treatment product of the present invention is a solid water treatment product that comprises two types of solid agents and that is used by dissolving these solid agents into water to be treated. The composite-type solid water treatment product comprises: a solid agent (A) of a halogen-based oxidant comprising a halogenated hydantoin-based compound as an active

substance; a solid agent (B) comprising an organic bactericide that is reactive to the halogen-based oxidant; and at least one dissolution container storing the solid agent (A) and the solid agent (B) without allowing the solid agent (A) and the solid agent (B) to be in contact with each other.

By making water treatment agents into a composite-type product having such constitution, the chemicals which are reactive to each other can be separately formulated and safely and simultaneously handled, and an excellent effect of a chemical by the use of both the chemicals together can be exhibited at a high level of continuity.

[0016]

[Solid Agent (A)]

The solid agent (A) is a halogen-based oxidant and performs an action of sterilization or suppression of slime in a water treatment agent. In the present invention, a halogen-based oxidant comprising a halogenated hydantoin-based compound as an active substance is used.

[0017]

The halogenated hydantoin-based compound is a solid, organic halogen-based oxidant, and, when coming into contact with water, releases an activated halogen having a strong oxidizability.

In addition, from the viewpoints of solubility to water, and the like, the halogenated hydantoin-based compound is suitable for releasing the activated halogen over a long period of time. Halogen-based oxidants which are commercially available as sustained-release tablets include halogen-based oxidants comprising calcium hypochlorite, sodium hypochlorite, dichloroisocyanuric acid, or trichloroisocyanuric acid in addition to the halogenated hydantoin-based compound as an active substance, but it has been found that among these, halogen-based oxidants comprising a halogenated hydantoin-based compound as an active substance exhibit a relatively small dissolution speed. From this finding, it can be said that the halogenated hydantoin-based compound is most suitable from the viewpoint of continuing an excellent effect of a chemical by the use of the halogenated hydantoin-based compound together with a solid agent comprising an organic bactericide. Besides, the halogenated hydantoin-based compound has relatively fewer odors generated when coming into contact with water and therefore is also preferable from the viewpoint of safety at the time of handling.

[0018]

Specific examples of the halogenated hydantoin-based compound include 1-bromo-3-chloro-5,5-dimethylhydantoin (hereinafter abbreviated as BCDMH), 1,3-dichloro-5,5-dimethylhydantoin, 1,3-dibromo-5,5-dimethylhydantoin, 1-bromo-3-chloro-5,5-diethylhydantoin, 1,3-dichloro-5,5-diethylhydantoin, and 1-bromo-3-chloro-5-methyl-5-ethylhydantoin. These may be used singly, or two or more of these may be used together. Among these, BCDMH and 1,3-dichloro-5,5-dimethylhydantoin are preferable from the viewpoints of balance with the solid agent (B) at a dissolution speed when coming into contact with water, easy availability, and the like.

[0019]

The form of the halogen-based oxidant as described above is not particularly limited, but is preferably a tablet in the form of a pellet, pill, or the like, or granules, from the viewpoints of easiness of adjusting the amount of use, easiness of handling, and the like, and is more preferably a tablet from the viewpoints of workability and the like in storage into the container. The method for producing a tablet is not particularly limited, and the tablet can be produced by a known method. The tablet is usually prepared by performing press-forming using an additive such as a diluting agent or a binder. By adjusting the type and the amount of addition of a diluting agent or a binder, the dissolution speed of a tablet into water to be treated can be regulated.

As the solid agent (A), a commercially available product can also be used.

[0020]

From the viewpoint of making the dissolution speed of the halogen-based oxidant moderate, the content of the halogen-based oxidant in the solid agent (A) is preferably 10% by mass or more, more preferably 30 to 90% by mass, and still more preferably 40 to 70% by mass in terms of effective chlorine (Cl_2) in a case where all the effective halogen components are regarded as effective chlorine.

From the viewpoint of a bactericidal action to Legionella bacteria, the effective halogen concentration (in terms of Cl_2) in water to be treated by the solid agent (A) is preferably 0.1 mg/L or more, more preferably 0.1 to 5 mg/L, and still more preferably 0.1 to 2 mg/L.

[0021]

[Solid Agent (B)]

The solid agent (B) comprises an organic bactericide that is reactive to the halogen-based oxidant. By the use of such a solid agent together with a halogen-based oxidant, a synergistic effect in the bactericidal action is obtained.

The organic bactericide is reactive to the halogen-based oxidant. A toxic halogen-based substance such as a chlorine gas is produced through a reaction with a halogen-based oxidant, and therefore making the organic bactericide into one agent through mixing with the halogen-based oxidant is difficult. Therefore, to formulate an organic bactericide, there is a need for making the organic bactericide into a separate chemical from the halogen-based oxidant. Accordingly, in the present invention, the solid agent (B) which has been formulated separately from the solid agent (A) is used.

[0022]

The active substance in the organic bactericide preferably comprises an isothiazoline-based compound from the viewpoint of bactericidal performance by the use together with a halogen-based oxidant.

Specific examples of the isothiazoline-based compound include 5-chloro-2-methyl-4-isothiazolin-3-one (hereinafter abbreviated as Cl-MIT), 2-methyl-4-isothiazolin-3-one, 4,5-dichloro-2-methyl-4-isothiazoline-3-one, 2-ethyl-4-isothiazolin-3-one, 2-n-octyl-4-isothiazolin-3-one, 5-chloro-2-ethyl-4-isothiazolin-3-one, 5-chloro-2-t-octyl-4-isothiazolin-3-one, 4,5-dichloro-2-n-octyl-4-isothiazolin-3-one, 4,5-dichloro-2-cyclohexyl-4-isothiazolin-3-one, and 1,2-benzoisothiazolin-3-one. These may be used singly, or two or more of these may be used together. Among these, Cl-MIT is preferable from the viewpoints of solubility to water, bactericidal performance, and easy availability. Particularly, from the viewpoint of a bactericidal action to Legionella bacteria, a combination of a solid agent (A) of a halogen-based oxidant comprising BCDMH as an active substance and a solid agent (B) comprising an organic bactericide comprising Cl-MIT as an active substance is preferable.

[0023]

With respect to the amount of dissolution of the solid agent (B) of the organic bactericide which is an active substance, in a case for example where the active substance is Cl-MIT, and the active substance of the halogen-based oxidant in the solid agent (A) is BCDMH, the concentration (unit: mg/L) of Cl-MIT in water to be treated is preferably 0.00001 to 100 times, more preferably 0.01 to 30 times, and still more preferably 0.1 to 1 times the effective halogen

concentration (in terms of Cl_2) (unit: mg/L) of BCDMH in water to be treated from the viewpoint of obtaining an excellent bactericidal action. It is to be noted that the concentration of Cl-MIT in water to be treated is preferably 0.0001 to 5 mg/L, more preferably 0.001 to 3 mg/L, and still more preferably 0.001 to 2 mg/L. [0024]

In addition to the organic bactericide described above, the solid agent (B) may comprise an additional known compound that is used in a water treatment agent from the viewpoints of preventing corrosion and scaling, and the like. Examples of the additional known compound include triazole-based compounds, phosphonic acid-based compounds, sulfamic acid-based compounds, ametrine, 2,2-dibromo-3-nitrilopropionamide, bronopol, zinc pyrithione, thiabendazole, and flocculating agents using an acrylic acid-based or maleic acid-based low molecular weight polymer. These may be used singly, or two or more of these may be used. However, the amount of addition of these compounds is set in a range where the bactericidal action by the solid agents (A) and (B) is not inhibited. [0025]

The form of the solid agent (B) as well as the form of the solid agent (A) is not particularly limited, but is preferably a tablet in the form of a pellet, pill, or the like, or granules from the viewpoints of easiness of adjusting the amount of use, easiness of handling, and the like, and is more preferably a tablet from the viewpoints of workability and the like in storage into the container. The method for producing a tablet is not particularly limited, and the tablet can be produced by a known method. The tablet is usually prepared by performing press-forming using an additive such as a diluting agent or a binder. By adjusting the type and the amount of addition of a diluting agent or a binder, the dissolution speed of a tablet into water to be treated can be regulated. For example, magnesium stearate, silica, magnesium oxide, and the like can be used as these additives.

As the solid agent (B) comprising as an active substance the organic bactericide as described above, a commercially available product can also be used. [0026]

From the viewpoint of making the dissolution speed of the organic bactericide moderate, the content of the organic bactericide in the solid agent (B) is preferably 1 to 40% by mass, more preferably 2 to 35% by mass, and still more preferably 5 to 30% by mass.

[0027]

[Dissolution Container]

The container storing the solid agent (A) and the solid agent (B) can store the two inside without allowing the two to be in contact with each other. When the water treatment is performed in a state in which the solid agent (A) and the solid agent (B) are in contact with each other, a toxic halogen-based substance such as a chlorine gas is produced as described above. Accordingly, the solid agent (A) and the solid agent (B) are stored in the container, such that a state in which the two do not come into contact with each other can be kept when the two are dissolved into water to be treated.

The solid agent (A) and the solid agent (B) may be in a state in which the two do not come into contact with each other, and the solid agent (A) and the solid agent (B) may be stored in one container comprising a partition wall, or may be stored in two or more separate containers.

In addition, by storing the solid agent (A) and the solid agent (B) in the dissolution container, an effect of a chemical of each active substance can be continued over a longer period of time than in a case where the solid agent (A) and the solid agent (B) are each put into water to be treated in an exposed state, and further, a synergistic effect of a chemical, such as a bactericidal action, by the use of the two together can be continued.

[0028]

The composite-type solid water treatment product can be suitably used for a water treatment of the cooling water in a cooling tower.

In this case, each of the solid agent (A) and the solid agent (B) is preferably stored in a separate dissolution container, and each of the dissolution containers is preferably disposed in the cooling tower. The form of the dissolution container is not particularly limited, but, for example, the forms as illustrated in Fig. 1 and Fig. 2 are preferable. The dissolution containers 10, 20 illustrated in Fig. 1 and Fig. 2 each comprise a container body 1 and a partition wall 2 dividing the inside of the container body 1. The inside of the container body 1 is divided into at least one storage chamber 3 storing a solid chemical 11, 21 (solid agent (A) or (B)) and a non-storage chamber 4 not storing a solid water treatment agent by the partition wall 2.

The container body 1 comprises at least one container communication path 5 allowing cooling water to flow between the outside of the container body 1 and

the non-storage chamber 4. On the other hand, the partition wall 2 comprises at least one partition wall communication path 6 allowing the cooling water to flow between the storage chamber 3 and the non-storage chamber 4.

[0029]

The dissolution container 20 illustrated in Fig. 2 comprises two storage chambers 3 storing the solid chemicals 21. In addition, the container communication path 5 is formed such that the total sectional area of the dissolution container 20 is smaller than that of the dissolution container 10, making the structure adequate in a case where the dissolution speed of the solid chemical is desired to be more suppressed.

It is to be noted that the forms such as the shape of the container body 1, and the shapes, the layout, and the numbers of the storage chamber 3, the non-storage chamber 4, the container communication path 5, and the partition wall communication path 6 are not limited to only those described in Fig. 1 and Fig. 2. These can be appropriately determined according to the forms, the bactericidal performance, and the dissolution speeds of the solid agent (A) and the solid agent (B) to be used, the disposed environment of the composite-type solid water treatment product in a cooling tower, and the like.

The dissolution container is preferably transparent such that the storage state of the solid agent (A) or (B) can be visually observed from the outside. In addition, the dissolution container is preferably made of plastic from the viewpoints of easiness of handling, cost, and the like.

[0030]

Fig. 3 illustrates one example of the composite-type solid water treatment product in which the dissolution container 10 as illustrated in Fig. 1 and the dissolution container 20 as illustrated in Fig. 2 are used to make a set in such a way as to integrate these containers.

For example, in a case where each of the solid agent (A) and the solid agent (B) is a tablet of a predetermined size, and the solid agent (A) is more easily dissolved than the solid agent (B) when coming into contact with water, the solid agent (B) is stored in the dissolution container 10, and the solid agent (A) is stored in the dissolution container 20 by which the dissolution speed is more easily suppressed from the viewpoint of controlling the dissolution speeds of the two.

The composite-type solid water treatment product illustrated in Fig. 3 is constituted such that the dissolution containers 10, 20 are fitted into a frame 30, and the two can be thereby held. In Fig. 3, two dissolution containers 10 and one dissolution container 20 are integrated.

The frame 30 is preferably made of a foamed plastic such as styrene foam. Thereby, the lightweight, composite-type solid water treatment product can be easily carried around as an integrated product and can also be used by being floated on a cooling water pit in a cooling tower.

[0031]

According to such a composite-type solid water treatment product, cooling water flows into the non-storage chamber 4 through the container communication path 5 and flows out of the non-storage chamber 4 into the storage chamber 3 through the partition wall communication path 6. The solid chemical 11, 21 (solid agent (A) or (B)) in the storage chamber 3 comes into contact with the cooling water that has been flown in to be dissolved. The cooling water into which the solid chemical 11 or 21 has been dissolved (dissolved solution) flows outside the dissolution container through the container communication path 5. Thereby, the solid agents (A) and (B) can be used together in a state in which a constant interval between the two is retained and can be dissolved into cooling water in a cooling tower.

Example

[0032]

Hereinafter, the present invention will be described more specifically with reference to Example, but the present invention is not limited by the following Example.

[0033]

[Continuity Evaluation Test]

A continuity evaluation test was conducted using a dissolution container of a type as illustrated in Fig. 2 for each halogen-based oxidant described below.

A dissolution container storing the halogen-based oxidant was placed on a sound absorbing matt in a counterflow-type (round) open cooling tower having a refrigeration capacity of 20 USRT, operated for 8 hours/day, and having a water temperature of cooling water of 30°C, the halogen-based oxidant left in the container was taken out every predetermined, elapsed day to measure the weight,

and the change in the residual weight with the elapsed days was checked, thereby conducting the continuity evaluation test.

The details on the container and the halogen-based oxidant used were as follows.

(Container)

A container made of polypropylene, the container of a type having two storage chambers as illustrated in Fig. 2.

- Overall size: major diameter of 12.7 cm, minor diameter of 8.0 cm
- Container communication path 5 (however, some positions are different from those described in Fig. 2):

Eight round holes each having diameter of 5.5 mm at a top portion, total area of holes of 1.9 cm²

Six round holes each having diameter of 5 mm at a side periphery, center positions of the round holes are 12 mm in height from a bottom inner surface,

Two round holes each having diameter of 2.5 mm at a bottom portion

- Partition wall communication path 6: Clearance of 7 mm between a lower end of a cylindrical partition wall 2 and the bottom inner surface

(Halogen-Based Oxidant)

Round tablet having diameter of 31 mm, height of 17.5 mm, and 20 g; three tablets are stacked per storage chamber

- Solid chemical 1: BCDMH
- Solid chemical 2: calcium hypochlorite
- Solid chemical 3: trichloroisocyanuric acid

[0034]

As a result of the test, the halogen-based oxidants in the container completely dissolved in about two days with respect to calcium hypochlorite (solid chemical 2) and in about 25 days with respect to trichloroisocyanuric acid (solid chemical 3). It is to be noted that trichloroisocyanuric acid (solid chemical 3) had strong odors during the test.

In contrast, it was recognized that 1-bromo-3-chloro-5,5-dimethylhydantoin (solid chemical 1) was gradually dissolved over about three months. In addition, 1-bromo-3-chloro-5,5-dimethylhydantoin (solid chemical 1) had fewer odors than trichloroisocyanuric acid (solid chemical 3).

Thus, BCDMH is excellent in sustained release, and therefore it can be said that BCDMH is suitable as a halogen-based oxidant from the viewpoint of

achieving balance of the dissolution speed for continuing an effect of a chemical by the use of the halogen-based oxidant together with a solid agent containing an active substance that is reactive to the halogen-based oxidant.

[0035]

[Test for Confirming Bactericidal Action]

A test for confirming a bactericidal action to Legionella bacteria by the use of BCDMH and Cl-MIT together was conducted under the following conditions.

(Test Conditions)

- Initial number of bacteria generated: 1×10^6 to 1×10^7 CFU/100 mL
- Contact time: 24 hours
- pH of test water: 7.0 (phosphate buffer solution)
- Amount of test water: 100 mL
- Incubation temperature: 36°C
- BCDMH: aqueous solution having effective halogen concentration (in terms of Cl_2) of 0.0005% by mass
- Cl-MIT: 0.01% by mass aqueous solution

[0036]

The bactericidal rate was determined based on the number of bacteria, 1.2×10^9 CFU/100 mL, in the test water after the test of 24 hours in a case where a chemical was not added (blank).

As a result, the bactericidal rate in a case where only Cl-MIT (0.5 mg/L) was added was 97.4%, and in contrast, in a case where BCDMH (1 mg/L) and Cl-MIT (0.5 ml/L) were used together, the bactericidal rate was 100%. From this fact, an effect of improving the bactericidal action to Legionella bacteria by the use of BCDMH and Cl-MIT together was confirmed.

Reference Signs List

[0037]

- 1 Container body
- 2 Partition wall
- 3 Storage chamber
- 4 Non-storage chamber
- 5 Container communication path
- 6 Partition wall communication path
- 10, 20 Dissolution container

11, 21 Solid chemical
30 Frame

CLAIMS

[Claim 1]

A composite-type solid water treatment product to be used by being dissolved into water to be treated, the product comprising:

a solid agent (A) of a halogen-based oxidant comprising a halogenated hydantoin-based compound as an active substance;

a solid agent (B) comprising an organic bactericide that is reactive to the halogen-based oxidant; and

at least one dissolution container storing the solid agent (A) and the solid agent (B) without allowing the solid agent (A) and the solid agent (B) to be in contact with each other.

[Claim 2]

The composite-type solid water treatment product according to claim 1, wherein the halogenated hydantoin-based compound is at least one selected from the group consisting of 1-bromo-3-chloro-5,5-dimethylhydantoin and 1,3-dichloro-5,5-dimethylhydantoin.

[Claim 3]

The composite-type solid water treatment product according to claim 1 or 2, wherein the organic bactericide comprises an isothiazoline-based compound as an active substance.

[Claim 4]

The composite-type solid water treatment product according to claim 3, wherein the isothiazoline-based compound is at least one selected from the group consisting of 5-chloro-2-methyl-4-isothiazolin-3-one, 2-methyl-4-isothiazolin-3-one, 4,5-dichloro-2-methyl-4-isothiazolin-3-one, 2-ethyl-4-isothiazolin-3-one, 2-n-octyl-4-isothiazolin-3-one, 5-chloro-2-ethyl-4-isothiazolin-3-one, 5-chloro-2-t-octyl-4-isothiazolin-3-one, 4,5-dichloro-2-n-octyl-4-isothiazolin-3-one, 4,5-dichloro-2-cyclohexyl-4-isothiazolin-3-one, and 1,2-benzoisothiazolin-3-one.

[Claim 5]

The composite-type solid water treatment product according to any one of claims 1 to 4, wherein:

the halogen-based oxidant comprises 1-bromo-3-chloro-5,5-dimethylhydantoin as an active substance; and

the organic bactericide comprises 5-chloro-2-methyl-4-isothiazolin-3-one as an active substance.

[Claim 6]

The composite-type solid water treatment product according to any one of claims 1 to 5, wherein the solid agent (B) comprises at least one selected from the group consisting of triazole-based compounds, phosphonic acid-based compounds, and sulfamic acid-based compounds.

[Claim 7]

The composite-type solid water treatment product according to any one of claims 1 to 6, wherein the solid agent (A) is a tablet.

[Claim 8]

The composite-type solid water treatment product according to any one of claims 1 to 7, wherein the solid agent (B) is a tablet.

[Claim 9]

The composite-type solid water treatment product according to any one of claims 1 to 8, wherein the water to be treated is cooling water in a cooling tower.

[Claim 10]

The composite-type solid water treatment product according to any one of claims 1 to 9, wherein:

the solid agent (A) and the solid agent (B) are each stored in a separate dissolution container;

each of the dissolution containers is disposed in a cooling tower and comprises a container body and a partition wall dividing an inside of the container body into at least one storage chamber storing the solid agent (A) or (B) being a solid chemical and a non-storage chamber not storing the solid chemical; and

the container body comprises at least one container communication path allowing cooling water to flow between an outside of the container body and the non-storage chamber, and the partition wall comprises at least one partition wall communication path allowing the cooling water to flow between the storage chamber and the non-storage chamber.