Citation List

Patent Literature

[0004]

PTL 1: JP 2006-22097 A

PTL 2: JP 2015-63475 A

Summary

Technical Problem

[0005]

In the antibacterial composition described in PTL 1, it is claimed that an antibacterial effect of MIT or Cl-MIT is enhanced when it is combined with a stabilized hypochlorite salt added with a bromide source. However, the bromide as mentioned above is readily volatilized so that it is difficult to maintain the composition of chemical components therein when this bromide is added to the chemicals; on the other hand, a possible countermeasure to it by previously adding a large quantity thereof or the like can lead to increase in the chemical cost. In addition, it is not clear how much of the isothiazoline compound remains after 24 hours in the water system added with it.

[0006]

On the other hand, the method described in PTL 2 is a sterilizing method of algae, wherein an isothiazoline compound is further added in order to remove algae by effectively sterilizing those algae that are generated in a cooling water system. Specifically, described therein is only an example in which a decrease in algae is recognized 3 days after addition of 2 mg/L or more of Cl-MIT; and thus, in order to sterilize the algae, more amount of the isothiazoline compound needs to be added. In addition, neither the durability of the antibacterial activity nor the residual rate of the isothiazoline compound is clear.

[0007]

The isothiazoline compound can maintain an excellent effect to suppress adhesion of a biofilm, when concentration of an active ingredient in an aqueous system is kept sufficiently well. However, in an actual water system, the isothiazoline compound added therein is rapidly exhausted. In the case that the isothiazoline compound is added with a low concentration, especially when the concentration thereof is limited to less than 1 mg/L, it has been difficult to

maintain sufficient quantity thereof so as to sustain the effect to suppress adhesion of a biofilm after 24 hours without additional feed thereof.

[0008]

The present disclosure was made in order to solve the problem as mentioned above. An object thereof is to provide a method for suppressing a decrease in the concentration of an isothiazoline compound, wherein even if an addition concentration of the isothiazoline compound used as an antibacterial agent is low in a water system, a decrease in the concentration thereof can be suppressed so that the residual rate thereof after 24 hours can be raised.

Solution to Problem

[0009]

The present disclosure is based on the finding that when an isothiazoline compound and a combined chlorine agent were caused to coexist with respective given concentrations in a water system, a decrease in concentration of the isothiazoline compound with time could be suppressed.

[0010]

In one aspect, the present invention refers to a method for suppressing a decrease in concentration of an isothiazoline compound, wherein to a water system, the isothiazoline compound is fed with an addition concentration of 0.2 mg/L or more and less than 1 mg/L, and a combined chlorine agent being a reaction product formed of a chlorine stabilizer and a chlorine-based oxidant or a mixture of the chlorine stabilizer and the chlorine-based oxidant is added so as to maintain a concentration thereof at 0.3 mg/L as Cl_2or more and 6 mg/L as Cl_2 or less therein; the chlorine stabilizer is at least one compound selected from the group consisting of sulfamic acid, N-methyl sulfamic acid, N,N-dimethyl sulfamic acid, N-phenyl sulfamic acid, and salts of them; and the chlorine-based oxidant is at least one compound selected from the group consisting of hypochlorous acid, chlorinated isocyanuric acid, and salts of them.

In a further aspect, the present invention refers to a method for suppressing a decrease in concentration of an isothiazoline compound, wherein into a water system in which a combined chlorine agent being a reaction product formed of a chlorine stabilizer and a chlorine-based oxidant is included with a concentration thereof of 0.3 mg/L as Cl_2 or more and 6 mg/L as Cl_2 or less, an isothiazoline compound is fed with an addition concentration of 0.2 mg/L or more and less than 1 mg/L; the chlorine stabilizer is at least one compound selected from the group consisting of sulfamic acid, N-methyl sulfamic acid,

N,N-dimethyl sulfamic acid, N-phenyl sulfamic acid, and salts of them; and the chlorine-based oxidant is at least one compound selected from the group consisting of hypochlorous acid, chlorinated isocyanuric acid, and salts of them.

Namely, the present disclosure provides following [1] to [6].

[1] A method for suppressing a decrease in concentration of an isothiazoline compound, wherein to a water system, the isothiazoline compound is fed with an addition concentration of 0.2 mg/L or more and less than 1 mg/L, and a combined chlorine agent consisting of a chlorine stabilizer and a chlorine-based oxidant is added so as to maintain a concentration thereof at 0.3 mg/L as Cl_2 or more and 6 mg/L as Cl_2 or less therein.

[2] A method for suppressing a decrease in concentration of an isothiazoline compound, wherein into a water system in which a combined chlorine agent consisting of a chlorine stabilizer and a chlorine-based oxidant is included with a concentration thereof of 0.3 mg/L as Cl_2 or more and 6 mg/L as Cl_2 or less, an isothiazoline compound is fed with an addition concentration of 0.2 mg/L or more and less than 1 mg/L.

[3] The method for suppressing the decrease in concentration of the isothiazoline compound according to [1] or [2], wherein the isothiazoline compound is at least one compound selected from the group consisting of 5-chloro-2-methyl-4-isothiazoline-3-one, 2-methyl-4-isothiazoline-3-one, 4,5-dichloro-2-methyl-4-isothiazoline-3-one, 2-ethyl-4-isothiazoline-3-one, 2-n-octyl-4-isothiazoline-3-one, 5-chloro-2-ethyl-4-isothiazoline-3-one, 5-chloro-2-t-octyl-4-isothiazoline-3-one, 4,5-dichloro-2-n-octyl-4-isothiazoline-3-one, 4,5-dichloro-2-cyclohexyl-4-isothiazoline-3-one, and 1,2-benzoisothiazoline-3-one.

[4] The method for suppressing the decrease in concentration of the isothiazoline compound according to any one of [1] to [3], wherein the chlorine stabilizer is at least one compound selected from the group consisting of sulfamic acid and derivatives thereof.

[5] The method for suppressing the decrease in concentration of the isothiazoline compound according to any one of [1] to [4], wherein the chlorine-based oxidant is a hypochlorite salt.

[6] The method for suppressing the decrease in concentration of the isothiazoline compound according to any one of [1] to [5], wherein the water

system is an open circulation cooling water system or a membrane concentrating water system.

Advantageous Effects of Invention

[0011]

According to the present invention, in a water system, a decrease in concentration of the isothiazoline compound with time can be suppressed.

Therefore, according to the present invention, in a water system, the isothiazoline compound can raise a residual rate after 24 hours even if the addition concentration thereof is low, so that durability of the effect to suppress adhesion of a biofilm due to its antibacterial activity can be enhanced, thereby especially in an antibacterial action to microorganisms included in water such as legionella bacteria, excellent durable effect can be expressed. Therefore, the present invention also has the advantage of cost reduction in water treatment because a use amount of the isothiazoline compound as an antibacterial agent can be reduced.

Description of Embodiments

[0012]

[Method of First Embodiment]

The first embodiment of the method for suppressing a decrease in concentration of the isothiazoline compound in the present invention is characterized by that to a water system, the isothiazoline compound is fed with

CLAIMS

[Claim 1]

A method for suppressing a decrease in concentration of an isothiazoline compound, wherein to a water system, the isothiazoline compound is fed with an addition concentration of 0.2 mg/L or more and less than 1 mg/L, and a combined chlorine agent being a reaction product formed of a chlorine stabilizer and a chlorine-based oxidant or a mixture of the chlorine stabilizer and the chlorine-based oxidant is added so as to maintain a concentration thereof at 0.3 mg/L as Cl_2or more and 6 mg/L as Cl_2 or less therein;

the chlorine stabilizer is at least one compound selected from the group consisting of sulfamic acid, N-methyl sulfamic acid, N,N-dimethyl sulfamic acid, N-phenyl sulfamic acid, and salts of them; and

the chlorine-based oxidant is at least one compound selected from the group consisting of hypochlorous acid, chlorinated isocyanuric acid, and salts of them.

[Claim 2] A method for suppressing a decrease in concentration of an isothiazoline compound, wherein into a water system in which a combined chlorine agent being a reaction product formed of a chlorine stabilizer and a chlorine-based oxidant is included with a concentration thereof of 0.3 mg/L as Cl_2 or more and 6 mg/L as Cl_2 or less, an isothiazoline compound is fed with an addition concentration of 0.2 mg/L or more and less than 1 mg/L;

the chlorine stabilizer is at least one compound selected from the group consisting of sulfamic acid, N-methyl sulfamic acid, N,N-dimethyl sulfamic acid, N-phenyl sulfamic acid, and salts of them; and

the chlorine-based oxidant is at least one compound selected from the group consisting of hypochlorous acid, chlorinated isocyanuric acid, and salts of them.

[Claim 3]

The method for suppressing the decrease in concentration of the isothiazoline compound according to claim 1 or 2, wherein the isothiazoline compound is at least one compound selected from the group consisting of 5-chloro-2-methyl-4-isothiazoline-3-one, 2-methyl-4-isothiazoline-3-one, 4,5-dichloro-2-methyl-4-isothiazoline-3-one, 2-ethyl-4-isothiazoline-3-one, 2-n-octyl-4-isothiazoline-3-one, 5-chloro-2-ethyl-4-isothiazoline-3-one, 5-chloro-2-t-octyl-4-isothiazoline-3-one, 4,5-dichloro-2-n-octyl-4-isothiazoline-3-one, 4,5-dichloro-2-cyclohexyl-4-isothiazoline-3-one, and 1,2-benzoisothiazoline-3-one.

[Claim 4]

The method for suppressing the decrease in concentration of the isothiazoline compound according to any one of claims 1 to 3, wherein the water system is an open circulation cooling water system or a membrane concentrating water system.