

DESCRIPTION

Title of Invention:

INITIAL TREATMENT AGENT FOR CIRCULATING COOLING WATER AND
INITIAL TREATMENT METHOD FOR CIRCULATING COOLING WATER
SYSTEMS

Technical Field

[0001]

The present invention relates to an initial treatment agent for forming a corrosion-resistant coating on a surface of a metal member in a circulation cooling water system by an initial treatment and an initial treatment method for a circulation cooling water system.

Background Art

[0002]

In air conditioning facilities in buildings or district facilities, plants and the like, water-cooling type heat exchangers are being used to indirectly cool a variety of fluids. For a variety of members in circulation cooling water systems such as heat exchangers or pipes around heat exchangers, metal such as carbon steel or stainless steel is generally used.

[0003]

For example, when plants are newly put into operation or put back into operation after shutdown for regular maintenance or the like, such metal members have no corrosion-resistant coatings formed on the surface and are in a state where corrosion is likely to occur. Particularly, in circulation cooling water systems containing a large amount of a suspended substance (SS) and having high turbidity, metal members having no corrosion-resistant coating formed thereon is likely to corrode. When corrosion causes corrosion wastage or pitting corrosion in metal members such as pipes, there are cases where facilities are damaged or products are contaminated in plants, and furthermore, there is a concern that serious accidents may occur.

[0004]

As a method for forming an initial corrosion-resistant coating on a surface of such a metal member, the present applicant has proposed in PTL1, for

example, a method in which phosphate-based and zinc-based corrosion inhibitors are used in a foundation treatment (initial treatment) at the time of initiating a circulation cooling water system.

Citation List

Patent Literature

[0005]

PTL1: JP 2011-202243A

Summary of Invention

Technical Problem

[0006]

However, in recent years, due to the intensifying interest in environmental preservation or the tightening of wastewater regulations, there has been a demand for a reduction in the content of phosphorus or the like in wastewater. In plants and the like where no wastewater treatment facilities are installed, it has been difficult to cope with such a demand, and there have been cases where the use of phosphate-based and zinc-based corrosion inhibitors is forced to be stopped.

[0007]

Furthermore, in circulation cooling water systems containing a large amount of SS, there have been cases where a corrosion-resistant coating is not sufficiently formed on a surface of a metal member and a favorable corrosion-preventing effect cannot be obtained with an initial treatment by a conventional corrosion-preventing method.

[0008]

The present invention has been made to solve the above-described problem, and an objective of the present invention is to provide an initial treatment agent for circulation cooling water and an initial treatment method for a circulation cooling water system by which an excellent corrosion-preventing effect can be obtained in initial treatments of circulation cooling water systems with no use of a phosphate-based corrosion inhibitor.

Solution to Problem

[0009]

The present invention is based on the fact that an excellent corrosion-preventing effect can be obtained in an initial treatment of a circulation cooling water system by using a tartaric acid compound and using a slime control agent in combination.

[0010]

That is, the present invention provides the following [1] to [8].

[1] An initial treatment agent for circulation cooling water, containing one or more tartaric acid compounds selected from the group consisting of tartaric acid and tartrates and a slime control agent.

[2] An initial treatment method for a circulation cooling water system, having a step (1) of adding one or more tartaric acid compounds selected from the group consisting of tartaric acid and tartrates and a slime control agent into a circulation cooling water system.

[3] The initial treatment method for a circulation cooling water system according to [2] described above, in which a concentration of the tartaric acid compound added in the circulation cooling water system is 30 to 100 mg/L in terms of tartaric acid.

[4] The initial treatment method for a circulation cooling water system according to [2] or [3] described above, in which, in the step (1), a pH of the circulation cooling water system is adjusted to 6.0 to 9.0.

[5] The initial treatment method for a circulation cooling water system according to any one of [2] to [4] described above, in which, in the step (1), the circulation cooling water system is circulate for 20 to 30 hours in a state where no thermal load is applied.

[6] The initial treatment method for a circulation cooling water system according to any one of [2] to [5] described above, further having, after the step (1), a step (2) of adding one or more zinc compounds selected from the group consisting of zinc and zinc salts into the circulation cooling water system.

[7] The initial treatment method for a circulation cooling water system according to [6] described above, in which a concentration of the zinc compound added in the circulation cooling water system is 3 to 20 mg/L in terms of zinc.

[8] The initial treatment method for a circulation cooling water system according to [6] or [7] described above, in which, in the step (2), the circulation cooling water system is circulated for 20 to 30 hours in a state where no thermal load is applied.

Advantageous Effects of Invention

[0011]

According to the initial treatment agent for circulation cooling water of the present invention, an excellent corrosion-preventing effect can be obtained in initial treatments with no use of a phosphate-based corrosion inhibitor even in circulation cooling water systems containing a large amount of SS.

In addition, according to the initial treatment method for a circulation cooling water system of the present invention, it is possible to form a favorable initial corrosion-resistant coating on a surface of a metal member in circulation cooling water systems and to contribute to maintaining a cooling capability of the circulation cooling water system while coping with environmental preservation.

Brief Description of Drawings

[0012]

[Fig. 1] Fig. 1 is a graph showing changes in tartaric acid concentration over time in a test 1 in Example.

[Fig. 2] Fig. 2 is a graph showing comparison of corrosion weight losses with a slime control agent added or not added at individual turbidity in a test 2 in Example.

Description of Embodiment

[0013]

Hereinafter, an initial treatment agent for circulation cooling water and an initial treatment method for a circulation cooling water system of the present invention will be described in detail.

[0014]

Initial treatment agent for circulation cooling water

The initial treatment agent for circulation cooling water of the present invention contains one or more tartaric acid compounds selected from the group consisting of tartaric acid and tartrates and a slime control agent.

The combined use of a tartaric acid compound and a slime control agent as an initial treatment agent as described above makes it possible to form a favorable initial corrosion-resistant coating on a surface of a metal member in a circulation cooling water system with no use of a phosphate-based corrosion

inhibitor and to obtain an excellent corrosion-preventing effect.

[0015]

Circulation cooling water system

The circulation cooling water system in the present invention refers to a system in which cooling water that is used for the operation of a heat exchanger or the like circulates in air conditioning facilities of buildings, district facilities and the like, or plants and the like.

The circulation cooling water system may be either of an open circulating type or a closed circulating type. The initial treatment agent of the present invention is capable of exhibiting an excellent corrosion-preventing effect particularly in open circulation cooling water systems.

[0016]

The initial treatment agent is applied at the time of initiating the circulation cooling water system and particularly applied to an initial treatment for corrosion prevention at the time of first operation or reinitiation such as resumption of operation.

At the time of initiating a circulation cooling water system, a large amount of SS derived from a corrosion product, microbes or the like is likely to be present in the circulation cooling water system, a corrosion inhibitor that is ordinarily used during steady operation is likely to be consumed, and generally, a corrosion-preventing treatment for obtaining a sufficient corrosion-preventing effect is carried out by adding the corrosion inhibitor at a concentration added 3 to 10 times the concentration during steady operation. Such a corrosion-preventing treatment at the time of initiating a circulation cooling water system is referred to as an initial treatment and also referred to as a foundation treatment in some cases.

The initial treatment agent of the present invention is capable of exhibiting an excellent corrosion-preventing effect in such an initial treatment at a lower concentration added than conventional corrosion inhibitors.

[0017]

As long as the water quality of ordinary circulation cooling water systems is maintained in the circulation cooling water system, the corrosion-preventing effect by the addition of the initial treatment agent of the present invention is sufficiently exhibited. The pH is preferably 6.0 to 9.0, more preferably 6.5 to 8.5, still more preferably 6.5 to 8.0 and particularly preferably 6.5 to 7.5.

In addition, the calcium hardness is preferably 30 to 150 mgCaCO₃/L, more preferably 30 to 120 mgCaCO₃/L and still more preferably 30 to 100 mgCaCO₃/L.

In addition, the amount of an acid consumed is preferably 10 to 120 mgCaCO₃/L, more preferably 30 to 120 mgCaCO₃/L and still more preferably 30 to 100 mgCaCO₃/L.

[0018]

A subject of the initial treatment is a metal member in the circulation cooling water system. Examples of the metal member include metal parts in heat exchangers, refrigerating machines, a variety of pipes or valves and the like. As the kind of the metal, iron-based metals are a preferable subject, and an excellent corrosion-preventing effect can be obtained in, for example, carbon steel pipes for boilers or heat exchangers (STB steel pipes) and the like.

[0019]

Tartaric acid compound

The tartaric acid compound is a compound selected from the group consisting of tartaric acid and tartrates. The tartaric acid compound is considered to impart a corrosion-preventing effect to a metal member by forming an adsorption coating through the adsorption of a hydroxy group in the molecule to the surface of the metal member. Compared with precipitate coatings that are corrosion-resistant coatings attributed to phosphate-based corrosion inhibitors, such an adsorption coating has a high coating-forming rate and easily provides a favorable corrosion-preventing effect.

[0020]

The tartaric acid may be any of L-tartaric acid, D-tartaric acid, meso-tartaric acid or racemic tartaric acid.

The tartrate refers to a compound in which a tartaric acid ion (negative ion) formed by the dissociation from tartaric acid of one or more hydrogen atoms selected from the group consisting of hydrogen atoms in two hydroxy groups and hydrogen atoms in two carboxy groups in the molecule of tartaric acid and a positive ion derived from a base ionically bond to each other. Examples of the positive ion include an alkali metal ion, an alkaline-earth metal ion, a magnesium ion, a zinc ion, an aluminum ion, an iron (II) ion, and an ammonium ion.

Specific examples of the tartrate include sodium hydrogen tartrate, potassium hydrogen tartrate, lithium tartrate, sodium tartrate, potassium

tartrate, sodium potassium tartrate, calcium tartrate, iron (II) tartrate, zinc tartrate, and ammonium tartrate. Among these, sodium tartrate, potassium tartrate and potassium sodium tartrate are preferable from the viewpoint of a favorable corrosion-preventing effect, easy procurement or the like.

One of the above-described tartaric acid compounds may be used singly or two or more thereof may be used in combination.

[0021]

The details of a mechanism by which the corrosion-preventing effect can be obtained from the tartaric acid compound are not clear, but are assumed as follows.

A tartaric acid ion that is generated from the tartaric acid compound and a calcium ion that is present in circulation cooling water bond to each other to form an adsorption coating containing a calcium salt that is poorly soluble in water as a main component on the surface of the metal member. In addition, the tartaric acid compound is also capable of forming an adsorption coating attributed to iron (II) tartrate by a reaction with an iron component of the metal member. Such adsorption coatings (initial corrosion-resistant coatings) are considered to hinder the direct contact between the metal member and dissolved oxygen or a corrosion factor that is contained in the circulation cooling water system such as a chloride ion or a sulfuric acid ion and to decrease a corrosion rate on the surface of the metal member.

[0022]

However, when a large amount of SS is contained in a circulation cooling water system, the tartaric acid compound is decomposed and consumed by microbes or the like in SS, and the concentration of the tartaric acid compound that forms corrosion-resistant coatings in the circulation cooling water system decreases. Therefore, in the initial treatment agent of the present invention, the tartaric acid compound and a slime control agent are used in combination to exhibit an excellent corrosion-preventing effect even in circulation cooling water systems containing a large amount of SS.

[0023]

Slime control agent

In the initial treatment agent, it is possible to suppress a decrease in the concentration of the tartaric acid compound that forms corrosion-resistant coatings in circulation cooling water systems by using a slime control agent in

combination with the tartaric acid compound as described above.

[0024]

The slime control agent is not particularly limited; however, ordinarily, a slime control agent that is known as a chemical agent for suppressing the generation of a microbe-derived adherend or deposit on the surfaces of metal members in circulation cooling water systems or a chemical agent for peeling such adherend or deposit from the surfaces is preferably used. Examples thereof include stabilized halogen-based oxidants, nitrogen compounds and the like.

[0025]

Examples of the halogen-based oxidants include hypochlorous acid, hypobromous acid, and salts thereof. One of the above-described halogen-based oxidants may be used singly or two or more thereof may be used in combination. Among these, hypochlorous acid and/or salts thereof are preferable, and hypochlorous acid is more preferably used. Examples of the salts of hypochlorous acid and hypobromous acid include sodium salts, potassium salts, calcium salts, and barium salts. Among these, sodium salts are preferable and sodium hypochlorite is more preferably from the viewpoint of water solubility, economic efficiency and the like.

Since the halogen-based oxidant is easily accelerated to decompose by ultraviolet rays, it is preferable to stabilize the halogen by suppressing the decomposition with the following stabilizer in order to use the halogen-based oxidant as the slime control agent.

[0026]

As the stabilizer for the halogen-based oxidant, a known stabilizer can be used, and specific examples thereof include sulfamic acid and salts thereof, azole-based compounds, urea, thiourea, creatinine, cyanuric acid, alkyl hydantoin, mono or diethanolamine, organic sulfonamides, biuret, sulfamic acid derivatives, melamine and the like. One of the above-described stabilizers may be used singly or two or more thereof may be used in combination. Among these, sulfamic acid and/or salts thereof are preferable.

Examples of the salts of sulfamic acid include a sodium salt, a potassium salt, a calcium salt, a strontium salt, a barium salt, an iron salt, and a zinc salt. Among these, sodium sulfamate is preferable from the viewpoint of water solubility, economic efficiency and the like.

[0027]

Examples of the stabilized halogen-based oxidants include halogen-based oxidants obtained by reacting hypochlorous acid and sulfamic acid, and the reaction of these generates monochlorosulfamic acid or dichlorosulfamic acid and stabilize chlorine, which is effective as the slime control agent.

The stabilized halogen-based oxidant may be added as a compound in a previously stabilized state or may be generated in the initial treatment agent or circulation cooling water systems to which the initial treatment agent is added.

[0028]

In addition, examples of the nitrogen compounds include organic nitrogen compounds such as carbonylhydrazide and 5-chloro-2-methyl-4-isothiazolin-3-one; and inorganic nitrogen compounds such as hydrazine.

[0029]

The content of the slime control agent in the initial treatment agent varies depending on the kind of the slime control agent, the content of SS in circulation cooling water systems or the like and thus cannot be collectively specified. The content is preferably an amount at which a decrease in the concentration (in terms of tartaric acid) of the tartaric acid compound that forms initial corrosion-resistant coatings in circulation cooling water systems to 1/2 or less of the concentration added (in terms of tartaric acid) is suppressed for at least two days.

[0030]

For example, when hypochlorite such as sodium hypochlorite is used as the slime control agent, the content of the hypochlorite in the initial treatment agent is preferably 0.1 to 5.0 parts by mass, more preferably 0.5 to 2.5 parts by mass, still more preferably 0.6 to 2.0 parts by mass and particularly preferably 1.0 to 2.0 parts by mass in terms of chlorine with respect to 100 parts by mass of the tartaric acid compound in terms of tartaric acid.

In addition, when a halogen compound stabilized with sulfamic acid such as monochlorosulfamic acid is used as the slime control agent, the content of the stabilized halogen compound in the initial treatment agent is preferably 1.0 to 20.0 parts by mass, more preferably 1.2 to 15.0 parts by mass, still more preferably 1.5 to 15.0 parts by mass and particularly preferably 2.0 to 10.0 parts by mass in terms of halogen with respect to 100 parts by mass of the tartaric acid compound in terms of tartaric acid.

In addition, when a nitrogen compound such as carbonylhydrazide is used as

the slime control agent, the content of the organic nitrogen compound in the initial treatment agent is preferably 10.0 to 150.0 parts by mass, more preferably 10.0 to 100.0 parts by mass, still more preferably 20.0 to 90.0 parts by mass and particularly preferably 30.0 to 85.0 parts by mass with respect to 100 parts by mass of the tartaric acid compound in terms of tartaric acid.

[0031]

Other components

The initial treatment agent contains the tartaric acid compound and the slime control agent as essential components and may contain other components, for example, a low molecular weight polymer (molecular weight of 1000 to 20000), as long as the formation of the initial corrosion-resistant coating is not impaired.

From the viewpoint of exhibiting an excellent corrosion-preventing effect of the initial treatment agent, the total content of the tartaric acid compound and the slime control agent in 100% by mass of the initial treatment agent is preferably 90 to 100% by mass, more preferably 95 to 100% by mass and still more preferably 100% by mass. Here, a solvent to be described below is not contained in 100% by mass of the initial treatment agent.

[0032]

The initial treatment agent may be a one-component type treatment agent in which the tartaric acid compound and the slime control agent have been blended in advance or may be a two or more-component type treatment agent composed of a plurality of chemical agents that are to be separately blended when the initial treatment agent is used in circulation cooling water systems.

In addition, the initial treatment agent may be prepared as a liquid agent such as an aqueous solution in which the initial treatment agent has been dissolved in a solvent such as water in advance from the viewpoint of favorable solubility.

[0033]

Initial treatment method for circulation cooling water system

An initial treatment method for a circulation cooling water system of the present invention has a step (1) of adding one or more tartaric acid compounds selected from the group consisting of tartaric acid and tartrates and a slime control agent into a circulation cooling water system.

The combined use of the tartaric acid compound and the slime control agent in an initial treatment of circulation cooling water systems makes it

possible for an excellent corrosion-preventing effect to be obtained even when a large amount of SS is contained in the circulation cooling water system.

[0034]

The meanings of "circulation cooling water system" and "initial treatment" in the initial treatment method for a circulation cooling water system of the present invention are the same as the descriptions in the above-described initial treatment agent of the present invention. In addition, "tartaric acid compound" and "slime control agent" are also the same as those that are used in the above-described initial treatment agent of the present invention and thus will not be described in detail.

[0035]

Step (1)

In the step (1), a tartaric acid compound and a slime control agent are added into a circulation cooling water system.

When a large amount of SS is contained in the circulation cooling water system, as described above, the tartaric acid compound is decomposed and consumed by microbes or the like in SS, and the concentration of the tartaric acid compound that forms a corrosion-resistant coating in the circulation cooling water system decreases.

In contrast, when the slime control agent is used and added in combination with the tartaric acid compound, it is possible to suppress a decrease in the concentration of the tartaric acid compound that is caused by SS in the circulation cooling water system and to sufficiently form an initial corrosion-resistant coating on a surface of a metal member in the circulation cooling water system, and an excellent corrosion-preventing effect can be obtained.

[0036]

The order of adding the tartaric acid compound and the slime control agent into the circulation cooling water system is not particularly limited, and either of them may be added earlier or both of them may be added at the same time. From the viewpoint of suppressing a decrease in the concentration of the tartaric acid compound in a circulation cooling water system containing a large amount of SS, the interval at the time of adding the tartaric acid compound and the slime control agent is preferably not excessively long, and the interval is preferably 30 minutes or shorter, more preferably 20 minutes or shorter and still more preferably 10 minutes or shorter.

In addition, the above-described initial treatment agent of the present invention is preferably used.

[0037]

The concentration of the tartaric acid compound added in the circulation cooling water system is preferably 30 to 100 mg/L, more preferably 40 to 90 mg/L and still more preferably 50 to 70 mg/L in terms of tartaric acid.

When the concentration added is 30 mg/L or more, a favorable corrosion-preventing effect can be obtained. In addition, when the concentration added is 100 mg/L or less, it is possible to suppress the occurrence of corrosion attributed to a chelate action of a tartaric acid ion in the metal member.

[0038]

The concentration of the slime control agent added in the circulation cooling water system varies depending on the kind of the slime control agent, the content of SS in the circulation cooling water system or the like, but is preferably set to a concentration at which the concentration (in terms of tartaric acid) of the tartaric acid compound that forms initial corrosion-resistant coatings in the circulation cooling water system does not decrease to 1/2 or less of the concentration added (in terms of tartaric acid) for at least two days.

The concentration of the slime control agent added in the circulation cooling water system is preferably 0.001 to 1 time, more preferably 0.002 to 0.95 times and still more preferably 0.005 to 0.9 times by mass in terms of the active substance with respect to the concentration of the tartaric acid compound added in terms of tartaric acid. The amount in terms of active substance refers to the amount in terms of chlorine when the slime control agent is sodium hypochlorite or monochlorosulfamic acid.

[0039]

For example, when hypochlorite such as sodium hypochlorite is used as the slime control agent, the concentration of the hypochlorite added in the circulation cooling water system is preferably 0.1 to 3.0 mg/L, more preferably 0.2 to 2.0 mg/L, still more preferably 0.3 to 1.5 mg/L and particularly preferably 0.7 to 1.5 mg/L in terms chlorine.

In addition, when a halogen compound stabilized with sulfamic acid such as monochlorosulfamic acid is used as the slime control agent, the concentration of the halogen compound added in the circulation cooling water system is preferably 0.1 to 10.0 mg/L, more preferably 0.2 to 8.0 mg/L, still more preferably

0.5 to 7.0 mg/L and particularly preferably 1.5 to 7.0 mg/L in terms of halogen.

In addition, when an organic nitrogen compound such as carbohydrazide is used as the slime control agent, the concentration of the organic nitrogen compound added in the circulation cooling water system is preferably 5 to 100 mg/L, more preferably 10 to 80 mg/L and still more preferably 15 to 50 mg/L.
[0040]

The pH of the circulation cooling water system in the step (1) is preferably 6.0 to 9.0, more preferably 6.5 to 8.5, still more preferably 6.5 to 8.0 and particularly preferably 6.5 to 7.5.

When the pH is 6.0 or more, it is possible to suppress the occurrence of acid corrosion in the metal member. In addition, when the pH is 9.0 or less, a tartaric ion reacts with a metal ion (for example, an iron ion) that is eluted from the surface of the metal member, which makes it easy for a corrosion-resistant coating to be formed.

The pH in the present invention refers to a value measured by a glass electrode method based on JIS Z 8802: 2011.

Depending on the water quality of the circulation cooling water system, it is possible to select any of tartaric acid and a tartrate as the tartaric acid compound to be used such that the pH falls into the above-described range. In addition, the pH may be adjusted using an ordinary pH adjuster, for example, sulfuric acid, sodium hydroxide or potassium hydroxide.

[0041]

In the step (1), it is preferable to circulate the circulation cooling water system for 20 to 30 hours in a state where no thermal load is applied.

"The state where no thermal load is applied" mentioned in the present specification means a state before steady operation where a high-temperature fluid that is cooled by circulation cooling water is not introduced into a surface in contact with the circulation cooling water system and the circulation cooling water is not heated by the high-temperature fluid, that is, a state where no heat is transferred.

A specific temperature in the state where no thermal load is applied is preferably 10°C to 40°C, more preferably 15°C to 35°C and still more preferably 20°C to 30°C.

When the temperature is within the above-described range, fluctuations in the concentration of the tartaric acid compound in association with the

evaporation of water in the circulation cooling water system is suppressed, which is preferable.

[0042]

The circulation time of the circulation cooling water system is preferably 20 to 30 hours, more preferably 20 to 28 hours and still more preferably 20 to 24 hours.

When the contact time is 20 hours or longer, a favorable corrosion-preventing effect can be obtained. In addition, when the circulation time exceeds 30 hours, since it is not possible to expect enhancement of the corrosion-preventing effect that is proportional to the time, the circulation time is preferably 30 hours or shorter from the viewpoint of the corrosion-preventing effect.

[0043]

Step (2)

In the initial treatment method, it is preferable to provide a step (2) of adding one or more zinc compounds selected from the group consisting of zinc and zinc salts into the circulation cooling water system after the step (1).

The zinc compound has an effect of suppressing a cathode reaction on the surface of the metal member in the circulation cooling water system as opposed to the tartaric acid compound has an effect of suppressing an anode reaction on the surface of the metal member. Therefore, the step (2) provided after the step (1) makes it easy for a more excellent corrosion-preventing effect to be obtained by a synergistic effect of the tartaric acid compound and the zinc compound.

When the tartaric acid compound and the zinc compound are added at the same time, a tartaric acid ion acts as a dispersant on a zinc ion, which makes it difficult to obtain a favorable corrosion-preventing effect.

[0044]

The zinc compound is a compound selected from the group consisting of zinc and zinc salts. Examples of the zinc salts include zinc chloride and zinc sulfate. One of the above-described zinc compounds may be used singly or two or more thereof may be used in combination.

[0045]

The concentration of the zinc compound added in the circulation cooling water system is preferably 1 to 50 mg/L, more preferably 2 to 30 mg/L, still more preferably 3 to 20 mg/L and particularly preferably 3 to 10 mg/L in terms of zinc.

The concentration added within the above-described range makes it easy to obtain a favorable corrosion-preventing effect. However, when the concentration added becomes high, scale is likely to adhere to the metal member. Therefore, the upper limit of the concentration added is preferably 50 mg/L or less, more preferably 30 mg/L or less, still more preferably 20 mg/L or less and particularly preferably 10 mg/L or less from the viewpoint of suppressing scale.

[0046]

In the step (2) as well, similar to the step (1), it is preferable to circulate the circulation cooling water system for 20 to 30 hours in a state where no thermal load is applied.

A specific temperature in the state where no thermal load is applied is preferably the same as in the step (1) from the viewpoint of suppressing fluctuations in the concentration of the zinc compound in association with the evaporation of water in the circulation cooling water system.

The circulation time of the circulation cooling water system is also preferably the same as that in the step (1) from the viewpoint of obtaining an excellent corrosion-preventing effect.

[0047]

After the initial treatment method is carried out on the circulation cooling water system, steady operation is started.

During the steady operation, the tartaric acid compound, the slime control agent and the zinc compound added in the step (1) and the step (2) may remain in the circulation cooling water system. In addition, during the steady operation, it is possible to add a known water treatment chemical agent, for example, a slime control agent, a scale inhibitor or a corrosion inhibitor to the circulation cooling water system.

Examples

[0048]

Hereinafter, the present invention will be described in detail based on Examples, but the present invention is not limited by the following Examples.

Water that was used in each of the following tests is tap water (pH 7.0) of Nogi town, Shimotsuga district, Tochigi prefecture.

[0049]

Test 1

Example 1

Water was fed into a 1 L beaker, and filtration backwash water of industrial water was added thereto, thereby preparing test water (pH 7.5) containing SS corresponding to a turbidity of 10.

The turbidity is a value measured using a spectrophotometer ("Ratio Beam Spectrophotometer U-5100", manufactured by Hitachi High-Tech Science Corporation, wavelength: 660 nm, standard substance: kaolin) based on a method described in "9.2 Transmitted-light turbidity" of JIS K 0101: 1998. In the present test, the content of SS in the test water is indicated by turbidity that serves as an index of the content of SS (which is also true in the following test 2).

Sodium tartrate and monochlorosulfamic acid, as a slime control agent, were added to 950 mL of this test water at concentrations added of approximately 60 mg/L in terms of tartaric acid and 5 mg/L in terms of chlorine, respectively, water was added thereto until the total volume reached 1 L, and then the test water was stirred with a stirrer at 300 rpm in a constant-temperature bath (30°C). The concentrations of tartaric acid after one day and after two days in the test water were measured with an ion chromatography system ("Dionex (registered trademark) ICS-2100", manufactured by Thermo Fisher Scientific).
[0050]

Examples 2 to 6

Changes in the concentration of tartaric acid over time were measured in the same manner as in Example 1 except that the kind and concentration added of the slime control agent in Example 1 were changed as shown in the following table 1.

[0051]

Comparative Example 1

For a blank prepared in the same manner as in Example 1 except that the slime control agent was not added in Example 1, a change in the concentration of tartaric acid over time was measured.

[0052]

The measurement results of the changes in the concentration of tartaric acid over time in the respective Examples and the Comparative Example are shown in the following table 1 and also shown as a graph in Fig. 1.

[0053]

Table 1

	Slime control agent	Tartaric acid concentration [mg/L]			
		Concentration added [mg/L]	At first	After one day	After two days
Example 1	Monochlorosulfamic acid	5.0 (in terms of chlorine)	61.4	56.3	58.7
Example 2		1.0 (in terms of chlorine)	61.4	58.3	41.7
Example 3	Sodium hypochlorite	1.0 (in terms of chlorine)	58.3	56.1	52.2
Example 4		0.5 (in terms of chlorine)	60.0	57.0	37.3
Example 5	Carbohydrazide	50	61.4	56.3	53.5
Example 6		20	58.7	55.2	54.4
Comparative Example 1	Not added	0	58.3	43.4	22.4

[0054]

As is clear from Table 1 and the graph in Fig. 1, it was found that a decrease in the concentration of the tartaric acid was suppressed by the combined use of the slime control agent with sodium tartrate. From this fact, it can be said that the combined use of a tartaric acid compound and a slime control agent makes it possible to sufficiently form an initial corrosion-resistant coating from the tartaric acid compound.

In addition, from the comparison between Examples 1 and 2 and the comparison between Examples 3 and 4, it was found that the decrease in the concentration of tartaric acid tends to be further suppressed as the concentration of the chlorine-based slime control agent added increases.

[0055]

Test 2

A steel plate cold commercial (SPCC) that was 30 mm x 50 mm and 1 mm in thickness was immersed in nitric acid at a concentration of 10% by mass for 30 seconds and then immersed in sulfuric acid at a concentration of 10% by mass for 60 seconds, thereby preparing an etched steel plate as a test piece. This test piece was washed with water and then dried, and the weight before a test (W1) was measured.

[0056]

950 mL of water was fed into a 1 L beaker, and a calcium chloride aqueous

solution and a sodium bicarbonate aqueous solution were added thereto to adjust the calcium hardness and the amount of an acid consumed to 100 mgCaCO₃/L and 100 mgCaCO₃/L, respectively. Filtration backwash water of industrial water was added to this water, thereby preparing individual test waters containing SS corresponding to turbidities of 0, 5, 10 and 20 (the pHs were 8.3, the calcium hardness was 100 mgCaCO₃/L and the amounts of an acid consumed were 100 mgCaCO₃/L in all of the test waters). The filtration backwash water was not added in the case of the turbidity of 0.

[0057]

Comparative Example

Sodium tartrate was added to the test waters with individual turbidity at a concentration added of 50 mg/L in terms of tartaric acid.

The test piece was immersed for 24 hours in each of these test waters with a rotational corrosion testing device (manufactured by Shinwa Chemical Industries Ltd.; a test solution temperature of 30°C, a test piece rotation rate of 150 rpm), then, zinc chloride was added to the test water at a concentration added of 5 mg/L in terms of zinc, and furthermore, the test piece was continuously immersed therein for 24 hours. This test water was exchanged with water, and the test piece was further immersed therein. After that, the test piece was lifted, washed with hydrochloric acid (concentration: 10% by mass) to which a corrosion-suppressing agent ("IBIT (registered trademark)" manufactured by Asahi Chemical Co., Ltd., a concentration added of 0.3% by mass with respect to hydrochloric acid) had been added to remove rust, and then dried, and the weight after the test (W2) was measured.

A value (W1 - W2) obtained by subtracting the weight after the test (W2) from the weight before the test (W1) was obtained as a corrosion weight loss.

[0058]

Example

Sodium tartrate and monochlorosulfamic acid, as a slime control agent, were added to the test waters with individual turbidity at concentrations added of 50 mg/L in terms of tartaric acid and 5 mg/L in terms of chlorine, respectively.

The test waters of the Comparative Examples were changed to these individual test waters to which the slime control agent had been added, and the corrosion weight losses of the test pieces in the case of being immersed in the test waters were obtained in the same manner as in the Comparative Example except

for the above-described fact.

[0059]

The measurement results of the corrosion weight losses with no slime control agent added (Comparative Example) and the corrosion weight losses with the slime control agent added (Example) at individual turbidity are shown in the following Table 2. In addition, the comparison of both is shown in Fig. 2 as a graph.

[0060]

Table 2

Corrosion weight loss [mg]	Turbidity			
	0	5	10	20
Comparative Example (no slime control agent added)	16.4	21.1	24.4	25.7
Example (slime control agent added)	16.2	16.8	17.2	17.0

[0061]

As is clear from Table 2 and the graph in Fig. 2, it was confirmed that the same corrosion-preventing effect as in the case of turbidity of 0 can be obtained even in the water system containing SS corresponding to a turbidity of 20 by adding the slime control agent. This is considered to be because sodium tartrate sufficiently formed the initial corrosion-resistant coating on the test piece.

CLAIMS

[Claim 1]

An initial treatment agent for circulation cooling water, comprising:
one or more tartaric acid compounds selected from the group consisting of tartaric acid and tartrates; and
a slime control agent.

[Claim 2]

An initial treatment method for a circulation cooling water system, comprising:
a step (1) of adding one or more tartaric acid compounds selected from the group consisting of tartaric acid and tartrates and a slime control agent into a circulation cooling water system.

[Claim 3]

The initial treatment method for a circulation cooling water system according to claim 2,
wherein a concentration of the tartaric acid compound added in the circulation cooling water system is 30 to 100 mg/L in terms of tartaric acid.

[Claim 4]

The initial treatment method for a circulation cooling water system according to claim 2 or 3,
wherein, in the step (1), a pH of the circulation cooling water system is adjusted to 6.0 to 9.0.

[Claim 5]

The initial treatment method for a circulation cooling water system according to any one of claims 2 to 4,
wherein, in the step (1), the circulation cooling water system is circulated for 20 to 30 hours in a state where no thermal load is applied.

[Claim 6]

The initial treatment method for a circulation cooling water system according to any one of claims 2 to 5, further comprising, after the step (1):
a step (2) of adding one or more zinc compounds selected from the group consisting of zinc and zinc salts into the circulation cooling water system.

[Claim 7]

The initial treatment method for a circulation cooling water system

according to claim 6,

wherein a concentration of the zinc compound added in the circulation cooling water system is 3 to 20 mg/L in terms of zinc.

[Claim 8]

The initial treatment method for a circulation cooling water system according to claim 6 or 7,

wherein, in the step (2), the circulation cooling water system is circulated for 20 to 30 hours in a state where no thermal load is applied.