

WATER TREATMENT DEVICE

Technical Field

[0001]

The present invention relates to a water treatment device, and in particular, relates to a water treatment device that is used when treating water using organisms.

Background Art

[0002]

A two-phase activated sludge system that separates microbiota in an activated sludge into two phases, and treats water with the two phases, is known. The two-phase activated sludge system is provided with a first aeration tank and a second aeration tank. The first aeration tank treats dissolved organic matter in waste water using non-agglomerative bacteria (hereinafter, referred to as “dispersed bacteria”) in the absence of protozoans and metazoans in a practical sense. The second aeration tank further treats waste water treated in the first aeration tank using an activated sludge in which protozoans and metazoans that prey on the dispersed bacteria are dominant. In such a two-phase activated sludge system, it is possible to reduce the size of the tanks by treating the waste water with high efficiency, and therefore, it is possible to reduce surplus sludge (refer to Patent Document 1).

Citation List

Patent Literature

[0003]

Patent Literature 1: Japanese Patent No. 4663064

Summary of Invention

Technical Problem

[0004]

In such a two-phase activated sludge system, when an inflow load of the first aeration tank rises suddenly, dissolved organic matter flows out to the second aeration tank. In the second aeration tank, if the amount of dissolved organic matter that flows out from the first aeration tank increases, predation and decomposition of the dispersed bacteria becomes insufficient, and therefore, the treatability deteriorates. Suitable treatment of waste water even when an

inflow load rises suddenly, and an improvement in treatment capability are desired.

[0005]

An object of the present invention is to provide a water treatment device with the improved treatment capability.

Another object of the present invention is to provide a water treatment device that performs treatment suitably even when an inflow load rises suddenly.

Solution to Problem

[0006]

A water treatment device according to the present invention is provided with a dispersed bacteria treatment tank that decomposes dissolved organic matter which flows thereinto, by causing a dispersed bacteria to be dominant, and an oxygen replenishment agent addition device that supplies an oxygen replenishment agent to the dispersed bacteria treatment tank.

[0007]

Such a water treatment device can increase the dissolved oxygen concentration of the dispersed bacteria treatment tank by adding the oxygen replenishment agent to the dispersed bacteria treatment tank (a raw water measurement tank, raw water piping or the like is also possible). Such a water treatment device can take advantage of the specific growth rate of dispersed bacteria and decompose organic matter with high efficiency as a result of the dissolved oxygen concentration of a dispersed bacteria mixture liquid increasing, and therefore, can treat waste water suitably even when an inflow load rises suddenly.

[0008]

The water treatment device according to the present invention may further include a sensor that measures either one or both of a dissolved oxygen concentration and an oxidation-reduction potential of the dispersed bacteria treatment tank, and a control device that controls the oxygen replenishment agent addition device so that the oxygen replenishment agent is added to the dispersed bacteria treatment tank or added at a stage prior thereto at a timing that is calculated on the basis of changes in either one or both the dissolved oxygen concentration and the oxidation-reduction potential.

[0009]

According to such a water treatment device, since the water treatment device can supply oxygen to the dispersed bacteria without a delay relative to a

rise in load as a result of the addition of the oxygen replenishment agent at a suitable timing even when there is a sudden rise in load in the dispersed bacteria treatment tank, it is possible to prevent bulking due to oxygen deficiency from occurring, and therefore, in the dispersed bacteria treatment tank, it is possible to substantially decompose dissolved organic matter in wastewater, in which there is a fluctuation in load.

[0010]

In addition, on the rare occasion in which bulking does occur, since it is possible to supply a required amount of oxygen at a suitable timing, it is possible to speed up recovery from bulking.

[0011]

The water treatment device according to the present invention may further include an activated sludge treatment tank at a later stage than the dispersed bacteria treatment tank, the activated sludge treatment tank treating waste water using an activated sludge in which protozoans and metazoans predate on and decompose the dispersed bacteria that proliferates due to the decomposition of organic matter in the dispersed bacteria treatment tank.

[0012]

According to such a water treatment device, it is possible to treat dispersed bacteria and residual dissolved organic matter suitably using an activated sludge.

[0013]

The water treatment device that is provided with the above-mentioned activated sludge treatment tank may further include another oxygen replenishment agent addition device that adds an oxygen replenishment agent to the activated sludge treatment tank.

[0014]

According to such a water treatment device, it is possible to prevent bulking due to oxygen deficiency from occurring in the activated sludge treatment tank, and therefore, it is possible to perform treatment suitably even when there is a fluctuation in load in the treatment water of the dispersed bacteria treatment tank.

[0015]

The water treatment device according to the present invention may further include a sensor that measures either one or both a dissolved oxygen concentration and an oxidation-reduction potential of the activated sludge treatment tank, and a control device that controls the other oxygen replenishment agent addition device so that the oxygen replenishment agent is

added to the activated sludge treatment tank (a returned sludge flow channel, a returned sludge measurement tank or the like is also possible) at a timing that is calculated on the basis of changes in either one or both the dissolved oxygen concentration and the oxidation-reduction potential of the activated sludge treatment tank.

[0016]

In such a water treatment device, since the water treatment device can supply oxygen to the activated sludge without a delay relative to a rise in load as a result of the addition of the oxygen replenishment agent at a suitable timing even when there is a sudden rise in load in the activated sludge treatment tank, it is possible to prevent bulking due to oxygen deficiency from occurring, and therefore, it is possible to treat suitably even when there are fluctuations in the load of carrier tank treatment water.

[0017]

In addition, on the rare occasion in which bulking does occur, since it is possible to raise the dissolved oxygen concentration of the activated sludge treatment tank appropriately through the addition of the oxygen replenishment agent, it is possible to speed up recovery from bulking.

[0018]

In such a water treatment device, by performing operation management of a dispersed bacteria treatment tank retention time so that it is not possible for protozoans and metazoans to proliferate and it is possible for only dispersed bacteria to proliferate, it is possible to maintain the number of dispersed bacteria in the dispersed bacteria treatment tank suitably, and therefore, it is possible to treat waste water suitably.

[0019]

In such a water treatment device, in order to maintain a microbial biomass inside the dispersed bacteria treatment tank and inside the activated sludge treatment tank of a later stage, suitably or at a high level, it is possible to insert a filter media to which microbes attach. Additionally, the material (a polyurethane, a polyvinyl alcohol or the like) and form (an immersion filter bed, a fluidized bed, a floating carrier, a rotating disk, a rocking bed or the like) of the filter media are not limited. In a case in which a floating carrier is used, a carrier outflow prevention screen, a carrier separation device or the like is installed at the exit of the dispersed bacteria treatment tank.

Advantageous Effects of Invention

[0020]

The water treatment device of the present invention can improve treatment capability as a result of adding the oxygen replenishment agent to the dispersed bacteria treatment tank, in which the dispersed bacteria is dispersed not forming a flock, and therefore, can treat waste water suitably even when an inflow load fluctuates greatly.

Brief Description of Drawings

[0021]

FIG. 1 is a schematic configuration diagram that illustrates a water treatment device.

Description of Embodiments

[0022]

An embodiment of a water treatment device will be described below with reference to the drawing. As illustrated in FIG. 1, the water treatment device 10 is provided with an adjustment tank 1, a dispersed bacteria treatment tank 2, an activated sludge treatment tank 3, and a sedimentation tank 5. The adjustment tank 1 is provided with a waste water supply flow channel 6, an adjustment tank main body 7, a raw water pump 49, and a raw water measurement tank 50. The waste water supply flow channel 6 supplies raw waste water discharged from an external facility to the adjustment tank main body 7. The adjustment tank main body 7 forms a storage space, and raw waste water supplied from the waste water supply flow channel 6 is stored in the storage space. The raw water pump 49 supplies adjusted waste water, which is stored by the adjustment tank main body 7, at a predetermined flow rate to the dispersed bacteria treatment tank 2 via the raw water measurement tank 50.

[0023]

The dispersed bacteria treatment tank 2 is provided with a dispersed bacteria treatment tank main body 11 and an air diffusion device 12. The dispersed bacteria treatment tank main body 11 forms a storage space, and waste water supplied from the adjustment tank 1 is decomposed and treated by non-agglomerative dispersed bacteria. The dispersed bacteria proliferates as a result of the metabolic decomposition of organic matter using oxygen in air that is supplied from the air diffusion device 12.

[0024]

The dispersed bacteria treatment tank 2 is filled with microbe immobilizing carriers. The plurality of microbe immobilizing carriers are

each formed from a porous material, and are formed in a nearly spherical shape. The microbe immobilizing carriers maintain the dispersed bacteria. Such microbe immobilizing carriers are publicly known, and an example includes “KURAGEL (registered trademark)”, manufactured by Kuraray Co., Ltd.

[0025]

Examples of the air diffusion device 12 include a blower, air piping, and an air diffusion device (an air diffusion cylinder, an air diffusion disk, an underwater aerator or the like). The air diffusion device 12 supplies oxygen that is required in order for the dispersed bacteria to decompose organic matter.

[0026]

The activated sludge treatment tank 3 is provided with an activated sludge treatment tank main body 16 and an air diffusion device 17. The activated sludge treatment tank main body 16 forms a storage space, and dispersed bacteria treatment water supplied from the dispersed bacteria treatment tank 2 is decomposed and treated by an activated sludge. The activated sludge proliferates as a result of the metabolic decomposition of the dispersed bacteria and dissolved organic matter using oxygen in air that is supplied from the air diffusion device 17.

[0027]

Examples of the air diffusion device 17 include a blower, air piping, and an air diffusion device (an air diffusion cylinder, an air diffusion disk, an underwater aerator or the like). The diffusion device 17 supplies oxygen that is required in order for the microbes to decompose organic matter.

[0028]

The sedimentation tank 5 is provided with a sedimentation tank main body 21, a treatment water flow channel 22, and a returned sludge flow channel 23. The sedimentation tank main body 21 forms a storage space, and performs solid-liquid separation of a mixed liquid of the activated sludge and treatment water, which is supplied to the sedimentation tank 5 from the activated sludge treatment tank 3, into treatment water and activated sludge as a result of gravitational separation. The returned sludge flow channel 23 returns the activated sludge, which is separated by the sedimentation tank main body 21, to the activated sludge treatment tank 3 at a predetermined flow rate via a sludge measurement tank 51. Surplus sludge, which has proliferated, is discharged outside the system.

[0029]

The water treatment device 10 is further provided with a first oxidation-reduction potential (ORP) meter 31, a first dissolved oxygen (DO)

meter 32, a first oxygen replenishment agent addition device 33, a second ORP meter 34, a second DO meter 35, a second oxygen replenishment agent addition device 36, and a control device 37. The first ORP meter 31 measures the oxidation-reduction potential of a dispersed bacteria mixed liquid that is stored by the dispersed bacteria treatment tank main body 11. The first DO meter 32 measures the dissolved oxygen concentration of the dispersed bacteria mixed liquid that is stored by the dispersed bacteria treatment tank main body 11. The second ORP meter 34 measures the oxidation-reduction potential of the activated sludge that is stored by the activated sludge treatment tank main body 16. The second DO meter 35 measures the dissolved oxygen concentration of an activated sludge mixed liquid that is stored by the activated sludge treatment tank main body 16.

[0030]

The first oxygen replenishment agent addition device 33 is provided with a first oxygen replenishment agent tank 41 and a first oxygen replenishment agent pump 42. An oxygen replenishment agent is stored in the first oxygen replenishment agent tank 41. The first oxygen replenishment agent pump 42 mixes the oxygen replenishment agent stored in the first oxygen replenishment agent tank 41 with raw water using the raw water measurement tank 50, and supplies the mixture to the dispersed bacteria treatment tank main body 11. The oxygen replenishment agent is formed from an aqueous solution in which hexametaphosphoric acid, an enzyme agent (peroxidase), dehydroacetic acid, a nucleic acid, glycerin, and a stabilizer are dissolved in water, and is prepared so as to be neutral. The hexametaphosphoric acid is specified by CAS Registry Number: 010124-56-8. The enzyme agent is specified by CAS Registry Number: 9001-05-2. The dehydroacetic acid is specified by CAS Registry Number: 520-45-6. The glycerin is specified by CAS Registry Number: 56-81-5. Such an oxygen replenishment agent is publicly known, and examples include “Malox SE (registered trademark)”, manufactured by Seinen Co. Ltd.

[0031]

The second oxygen replenishment agent addition device 36 is provided with a second oxygen replenishment agent tank 43 and a second oxygen replenishment agent pump 44. The second oxygen replenishment agent tank 43 stores the same oxygen replenishment agent as the oxygen replenishment agent stored in the first oxygen replenishment agent tank 41. The second oxygen replenishment agent pump 44 mixes the oxygen replenishment agent stored in the second oxygen replenishment agent tank 43 with returned sludge

using the sludge measurement tank 51, and supplies the mixture to the activated sludge treatment tank 3.

[0032]

The control device 37 calculates a first addition amount and a first oxygen replenishment agent supply timing on the basis of the oxidation-reduction potential measured by the first ORP meter 31 and the dissolved oxygen concentration measured by the first DO meter 32. The control device 37 controls the first oxygen replenishment agent addition device 33 so that the first addition amount of the oxygen replenishment agent is supplied to the dispersed bacteria treatment tank 2 at the first oxygen replenishment agent supply timing. For example, the addition of the oxygen replenishment agent is implemented with a condition of the oxidation-reduction potential of the dispersed bacteria mixed liquid, which is stored in the dispersed bacteria treatment tank 2, being from 0 to 50 mV, or the dissolved oxygen concentration of the dispersed bacteria mixed liquid being 1 mg/L or less. Alternatively, the control device 37 controls the first oxygen replenishment agent addition device 33 so that both of the above-mentioned conditions are satisfied.

[0033]

The control device 37 calculates a second addition amount and a second oxygen replenishment agent supply timing on the basis of changes in the oxidation-reduction potential measured by the second ORP meter 34 and the dissolved oxygen concentration measured by the second DO meter 35. The control device 37 controls the second oxygen replenishment agent addition device 36 so that the second addition amount of the oxygen replenishment agent is supplied to the activated sludge treatment tank main body 16 at the second oxygen replenishment agent supply timing. For example, the addition of the oxygen replenishment agent is implemented with a condition of the oxidation-reduction potential of the activated sludge mixed liquid, which is stored in the activated sludge treatment tank 3, being from 0 to 50 mV, or the dissolved oxygen concentration of the activated sludge mixed liquid being 1 mg/L or less. Alternatively, the control device 37 controls the second oxygen replenishment agent addition device 36 so that both of the above-mentioned conditions are satisfied.

[0034]

The water treatment device 10 is used to treat raw waste water discharged from an external facility. Firstly, the adjustment tank 1 stores the raw waste water discharged from an external facility. The raw water pump 49

supplies adjusted waste water, which is formed from the raw waste water, to the dispersed bacteria treatment tank 2 at a predetermined flow rate. By storing the raw waste water, the adjustment tank 1 can minimize fluctuations in the flow rate and the concentration of the adjusted waste water supplied to the dispersed bacteria treatment tank 2 even if the flow rate and concentration of the raw waste water fluctuates.

[0035]

In the dispersed bacteria treatment tank 2, dispersed bacteria, which are dispersed, and dispersed bacteria, which are maintained on the microbe immobilizing carriers, proliferate as a result of the metabolic decomposition of organic matter in the adjusted waste water, which flows into the dispersed bacteria treatment tank 2, using oxygen that is dissolved in the dispersed bacteria mixed liquid as a result of aeration. Furthermore, the dispersed bacteria treatment tank 2 supplies dispersed bacteria treatment water, in which the microbe immobilizing carriers have been removed from the dispersed bacteria mixed liquid, to the activated sludge treatment tank 3 at a predetermined flow rate.

[0036]

In the activated sludge treatment tank 3, the activated sludge proliferates as a result of the predation and metabolic decomposition of organic matter and the dispersed bacteria in carrier tank treatment water, which flows into the activated sludge treatment tank 3, using oxygen that is dissolved in the activated sludge as a result of aeration. Furthermore, the activated sludge treatment tank 3 supplies a mixed liquid of the activated sludge and treatment water to the sedimentation tank 5 at a predetermined flow rate.

[0037]

The sedimentation tank 5 performs solid-liquid separation of the mixed liquid of the activated sludge and the treatment water, which is supplied from the activated sludge treatment tank 3, into treatment water and activated sludge as a result of gravitational separation. The sedimentation tank 5 discharges the separated treatment water to outside at a predetermined flow rate. Furthermore, the sedimentation tank 5 returns the activated sludge to the activated sludge treatment tank 3 at a predetermined flow rate via the activated sludge measurement tank. Surplus sludge, which has proliferated, is discharged outside the system.

[0038]

The control device 37 calculates the first addition amount and the first oxygen replenishment agent supply timing on the basis of the

oxidation-reduction potential and the dissolved oxygen concentration of the dispersed bacteria treatment tank 2, which are measured by the first ORP meter 31 and the first DO meter 32, respectively. The control device 37 controls the first oxygen replenishment agent addition device 33 so that the first addition amount of the oxygen replenishment agent is supplied to the dispersed bacteria treatment tank 2 at the first oxygen replenishment agent supply timing.

[0039]

Since the specific proliferation rate of the dispersed bacteria is faster than those of protozoans and metazoans, the dispersed bacteria can decompose organic matter more quickly. Therefore, the dispersed bacteria treatment tank 2 can decompose organic matter more efficiently than a water treatment device of a comparative example (a standard activated sludge treatment method) in which the dispersed bacteria treatment tank 2 is not provided and which treats water with the activated sludge treatment tank 3 only.

[0040]

The response capability of the dispersed bacteria treatment tank 2 to fluctuations in load is high in comparison with a standard activated sludge method, but it is not possible to treat waste water suitably in circumstances in which severe conditions for the microbes such as those below occur.

- (1) Decreases in water temperature in winter
- (2) Sudden rises in load (a biological oxygen demand (BOD) volume load or a biological oxygen demand-suspended solid (BOD-SS) load)
- (3) Oxygen deficiency
- (4) Nutrient salt (nitrogen, phosphorous or the like) deficiency
- (5) Cases in which (1) to (4) occur simultaneously

In some cases, a bulking state occurs in both the dispersed bacteria treatment tank 2 and the activated sludge treatment tank 3.

[0041]

In the dispersed bacteria mixed liquid stored in the dispersed bacteria treatment tank 2, the dissolved oxygen concentration increases as a result of the oxygen replenishment agent being added. Even when a BOD load amount, which flows into the dispersed bacteria treatment tank 2, rises greatly and the oxygen supply capability of the blower becomes insufficient, it is possible to treat waste water suitably as a result of the dissolved oxygen concentration of the dispersed bacteria mixed liquid increasing, and therefore, it is possible to handle fluctuations in load easily.

[0042]

As a result of bulking occurring in the dispersed bacteria treatment tank 2, an oxygen amount that is required in the dispersed bacteria treatment tank 2 becomes greater than an amount for the treatment of an inflow BOD load amount. In addition, when bulking occurs in the dispersed bacteria treatment tank 2, the treatability in the activated sludge treatment tank 3 deteriorates, and the treatability of the water treatment device 10 becomes unfavorable.

[0043]

The water treatment device 10 can increase the dissolved oxygen concentration of the dispersed bacteria treatment tank 2 over a saturated oxygen concentration in a condition in which oxygen of a gas is dissolved in water, by adding the oxygen supply agent to the dispersed bacteria treatment tank 2, thereby improving the treatment capability. The dispersed bacteria treatment tank 2 can prevent or minimize the occurrence of bulking by maintaining the dissolved oxygen concentration suitably, and therefore, can treat waste water suitably.

[0044]

When viscous bulking occurs in the dispersed bacteria treatment tank 2, supplying the oxygen replenishment agent including oxygen acid makes it possible to rapidly resolve the viscous bulking as a result of the oxygen acid contributing to the decomposition of polymer polysaccharides, which the dispersed bacteria secretes during viscous bulking, and the oxygen amount, which is required in the biological decomposition of the polymer polysaccharides, being available simultaneously.

[0045]

The oxidation-reduction potential and the dissolved oxygen concentration of the dispersed bacteria treatment tank 2 suitably indicate the behavior of the dispersed bacteria that is dispersed in the dispersed bacteria treatment tank. Therefore, the water treatment device 10 can improve the capability with which the dispersed bacteria treatment tank 2 treats water at a suitable timing by adding the oxygen replenishment agent, which includes oxygen acid, to the dispersed bacteria treatment tank at a timing that is calculated on the basis of either one or both the oxidation-reduction potential and the dissolved oxygen concentration. For example, even when there is a sudden rise in the load to the dispersed bacteria treatment tank 2, the water treatment device 10 can add the oxygen replenishment agent at a suitable timing. In the water treatment device 10, since the water treatment device 10 can supply oxygen to the dispersed bacteria without a delay relative to a rise in load, it is

possible to perform treatment suitably even when there are fluctuations in the load to carrier tank treatment water.

[0046]

The control device 37 calculates the second addition amount and the second oxygen replenishment agent supply timing on the basis of the oxidation-reduction potential and the dissolved oxygen concentration of the activated sludge treatment tank 3, which are measured by the second ORP meter 34 and the second DO meter 35. The control device 37 controls the second oxygen replenishment agent addition device 36 so that the second addition amount of the oxygen replenishment agent is supplied to the activated sludge treatment tank main body 3 at the second oxygen replenishment agent supply timing.

[0047]

The dissolved oxygen concentration increases as a result of the oxygen replenishment agent being supplied to the activated sludge treatment tank 3. As a result of an increase in the dissolved oxygen concentration, it is possible to decompose organic matter including the dispersed bacteria, which flows into the activated sludge treatment tank 3, with high efficiency. Therefore, by adding the oxygen replenishment agent to the activated sludge treatment tank, the water treatment device 10 can treat waste water suitably even when the BOD load amount of the dispersed bacteria treatment water supplied to the activated sludge treatment tank 3 fluctuates greatly.

[0048]

The water treatment device 10 can improve the capability of the activated sludge treatment tank 3 by adding the oxygen replenishment agent to the activated sludge treatment tank 3. The activated sludge treatment tank can prevent or minimize the occurrence of bulking by maintaining the dissolved oxygen concentration suitably, and therefore, can treat waste water suitably.

[0049]

The oxidation-reduction potential and the dissolved oxygen concentration of the activated sludge treatment tank 3 suitably indicate the behavior of the activated sludge treatment tank 3. Therefore, the water treatment device 10 can improve the capability with which the activated sludge treatment tank 3 performs treatment at a suitable timing by adding the oxygen replenishment agent, which includes oxygen acid, to the activated sludge treatment tank 3 at a timing that is calculated on the basis of either one or both the oxidation-reduction potential and the dissolved oxygen concentration of the activated sludge treatment tank 3, and furthermore, can prevent bulking that

occurs in the activated sludge mixed liquid suitably. For example, even when there is a sudden rise in the load to the activated sludge treatment tank 3, the water treatment device 10 can add the oxygen replenishment agent at a suitable timing. Since the water treatment device 10 can supply oxygen to the activated sludge without a delay relative to a rise in load, it is possible to perform treatment suitably even when there are fluctuations in the load to the dispersed bacteria treatment tank 2. In addition, on the rare occasion in which bulking does occur, since it is possible to raise the dissolved oxygen concentration of the activated sludge treatment tank 3 appropriately through the addition of the oxygen replenishment agent, it is possible to speed up recovery from bulking.

[0050]

The first oxygen replenishment agent tank 41 and the second oxygen replenishment agent tank 43 may store the same oxygen replenishment agent or may respectively store two oxygen replenishment agents with different concentrations of the oxygen replenishment agent. In such an instance, the water treatment device 10 may supply an oxygen replenishment agent with a suitable concentration to the dispersed bacteria treatment tank 2 and the activated sludge treatment tank 3. Additionally, in a case in which a single type of oxygen replenishment agent is supplied to the dispersed bacteria treatment tank 2 and the activated sludge treatment tank 3, the first oxygen replenishment agent tank 41 and the second oxygen replenishment agent tank 43 may be substituted for a single oxygen replenishment agent tank. In such a water treatment device, it is possible to reduce the number of components in comparison with the water treatment device of the above-mentioned embodiment, and therefore, it is possible to prepare the water treatment device more easily.

[0051]

Additionally, the first oxygen replenishment agent addition device 33 may be substituted for another oxygen replenishment agent addition device, which adds the oxygen replenishment agent to the adjustment tank 1, which is at a stage that is prior to the dispersed bacteria treatment tank 2. A water treatment device provided with such an oxygen replenishment agent addition device can also improve the capability of the dispersed bacteria treatment tank 2 as a result of the oxygen replenishment agent, which is supplied in the adjustment tank 1, being added to the dispersed bacteria mixed liquid in the same manner as the water treatment device in the above-mentioned embodiment, and therefore, can perform water treatment suitably.

[0052]

Additionally, the oxygen replenishment agent may be substituted for another oxygen supply agent, which has a function of increasing a saturation concentration of dissolved oxygen. An oxygen acid, and an oxoate can be used as such an oxygen replenishment agent, and an example includes the oxygen replenishment agent “High O²(registered trademark)”, manufactured by Nippon Steel & Sumikin Eco-Tech Corporation. The water treatment device can also improve the capability of the dispersed bacteria treatment tank 2 in the same manner in a case in which such an oxygen replenishment agent is used, and therefore, can treat water suitably.

[0053]

Additionally, in the water treatment device 10, in a case in which it is possible for an operator to suitably operate the first oxygen replenishment agent addition device 33 and the second oxygen replenishment agent addition device 36, the control device 37 may be omitted. In such a case, in the same manner as the control device 37, the operator operates the first oxygen replenishment agent addition device 33 on the basis of the oxidation-reduction potential measured by the first ORP meter 31 and the dissolved oxygen concentration measured by the first DO meter 32. Furthermore, in the same manner as the control device 37, the operator operates the second oxygen replenishment agent addition device 36 on the basis of the oxidation-reduction potential measured by the second ORP meter 34 and the dissolved oxygen concentration measured by the second DO meter 35.

[0054]

Furthermore, in the water treatment device 10 in a case in which it is not necessary to remove the dispersed bacteria from the dispersed bacteria treatment water, which is treated by the dispersed bacteria treatment tank 2, the activated sludge treatment tank 3 and the sedimentation tank 5 may be omitted. That is, a water treatment device that is formed from the dispersed bacteria treatment tank 2 and the first oxygen replenishment agent addition device 33 can also improve the capability of the dispersed bacteria treatment tank 2 as a result of adding the oxygen replenishment agent suitably to the dispersed bacteria treatment tank 2 in the same manner as the water treatment device 10 mentioned above, and therefore, can treat waste water suitably using dispersed bacteria.

[0055]

Furthermore, the microbe immobilizing carrier may be substituted with a filter media that can maintain the dispersed bacteria. The material and form of

the filter media is not limited. For example, a polyurethane, a polyvinyl alcohol or the like can be used as the material thereof, and an immersion filter bed, a fluidized bed, a floating carrier, a rotating disk, a rocking bed, an immobilized filter, or the like can be used as the form thereof. In a case in which a floating carrier is used, the floating carrier may be prevented from flowing out to the activated sludge treatment tank 3 by installing a carrier outflow prevention screen, or the like at the exit of the dispersed bacteria treatment tank 2. The filling of the dispersed bacteria treatment tank main body 11 with the microbe immobilizing carrier may be substituted for another method for causing the dispersed bacteria to be dominant. An example of such a method includes a method of adding a dispersed bacteria preparation to the dispersed bacteria mixed liquid. A water treatment device in which such a method is adopted can also improve the capability of the dispersed bacteria treatment tank 2 in the same manner, and therefore, can treat water suitably.

Reference Signs List

[0056]

- 1: Adjustment tank
- 2: Dispersed bacteria treatment tank
- 3: Activated sludge treatment tank
- 5: Sedimentation tank
- 6: Discharge water supply flow channel
- 10: Water treatment device
- 31: First ORP meter
- 32: First DO meter
- 33: First oxygen replenishment agent addition device
- 34: Second ORP meter
- 35: Second DO meter
- 36: Second oxygen replenishment agent addition device
- 37: Control device

Claims

[Claim 1]

A water treatment device comprising:
a dispersed bacteria treatment tank in which dispersed bacteria are dominant, and which treats inflow organic matter; and
an oxygen replenishment agent addition device that supplies an oxygen replenishment agent to the dispersed bacteria treatment tank.

[Claim 2]

The water treatment device according to claim 1, further comprising:
a sensor that measures either one or both a dissolved oxygen concentration and an oxidation-reduction potential of the dispersed bacteria treatment tank; and
a control device that controls the oxygen replenishment agent addition device so that the oxygen replenishment agent is added to the dispersed bacteria treatment tank or added at a stage prior thereto at a timing that is calculated on the basis of changes in either one or both the dissolved oxygen concentration and the oxidation-reduction potential.

[Claim 3]

The water treatment device according to claim 1 or claim 2, wherein
a filter media is inserted or installed in the dispersed bacteria treatment tank.

[Claim 4]

The water treatment device according to any one of claims 1 to 3, further comprising an activated sludge treatment tank at a later stage than the dispersed bacteria treatment tank, the activated sludge treatment tank aerating an activated sludge liquid containing a protozoan which predates on and decomposes the dispersed bacteria.

[Claim 5]

The water treatment device according to claim 4, further comprising
another oxygen replenishment agent addition device that adds an oxygen replenishment agent to the activated sludge treatment tank.

[Claim 6]

The water treatment device according to claim 5, further comprising:

a sensor that measures either one or both a dissolved oxygen concentration and an oxidation-reduction potential of the activated sludge treatment tank; and
a control device that controls the other oxygen replenishment agent addition device so that the oxygen replenishment agent is added to the activated sludge treatment tank at a timing that is calculated on the basis of changes in either one or both the dissolved oxygen concentration and the oxidation-reduction potential of the activated sludge treatment tank.

[Claim 7]

The water treatment device according to any one of claims 4 to 6, wherein
a filter media for increasing a microbial biomass into the tank, is inserted or installed in the activated sludge treatment tank.