CLAIMS

[1] A method for treating a liquid, comprising:

a storage step comprising carrying out at least one of an aquatic organism-inactivating treatment and a physical treatment using a centrifugal force, with respect to a supply liquid to be supplied to a storage means located inside a housing, and

a discharge step comprising determining whether or not an aquatic organism-inactivating treatment is required, carrying out the treatment based on the result thus determined, and carrying out a physical treatment using a centrifugal force, with respect to a discharge liquid to be discharged outside the housing from the storage means.

[2] The method according to claim 1, wherein the inactivating treatment comprises mixing a substance capable of inactivating aquatic organisms into the supply liquid or the discharge liquid.

[3] The method according to claim 2, wherein the mixing is carried out while monitoring the concentration of the substance capable of inactivating aquatic organisms in the liquid to be treated that is mixed therewith.

[4] The method according to claim 2 or 3, wherein the substance capable of inactivating aquatic organisms is a chlorine-containing substance.

[5] The method according to claim 4, comprising electrolyzing the supply liquid or the discharge liquid to produce the chlorine-containing substance.

[6] The method according to claim 4 or 5, comprising controlling the concentration of the chlorine-containing substance to be 0.1 mg/L to 20 mg/L.

[7] The method according to any one of claims 2 to 6, wherein whether or not the inactivating treatment is required with respect to the discharge liquid is determined

based on the concentration of the substance capable of inactivating aquatic organisms in the discharge liquid.

[8] The method according to claim 7, wherein when it is determined that the inactivating treatment is required with respect to the discharge liquid, the aquatic organism-inactivating treatment is carried out with respect to the discharge liquid.

[9] The method according to any one of claims 1 to 8, wherein the physical treatment comprises separating aquatic organisms with a shell whose height is at least 50 μm from the supply liquid or the discharge liquid using a centrifugal force or stirring the supply liquid or the discharge liquid using a centrifugal force.

[10] The method according to claim 9, wherein the flow rate of the liquid flowing into a device for carrying out the separating or stirring is 1 to 10 m/sec.

[11] The method according to any one of claims 1 to 10, wherein the discharge step comprises adding, to the discharge liquid, a neutralizer that neutralizes the substance capable of inactivating aquatic organisms.

[12] A method for treating a liquid, comprising carrying out a physical treatment using a centrifugal force with respect to a supply liquid to be supplied to a storage means located inside a housing and storing it in the storage means disposed in the housing,

wherein the flow rate of the supply liquid flowing into a device for carrying out the physical treatment is 1 to 10 m/sec.

[13] The method according to claim 12, wherein the physical treatment using a centrifugal force is carried out with respect to a discharge liquid to be discharged outside the housing from the storage means.

[14] The method according to claim 12 or 13, wherein the physical treatment comprises separating aquatic organisms with a shell whose height is at least 50 μm

from the supply liquid or the discharge liquid using a centrifugal force, or stirring the supply liquid or the discharge liquid using a centrifugal force.

[15] The method according to any one of claims 12 to 14, comprising carrying out an aquatic organism-inactivating treatment with respect to the supply liquid and/or the discharge liquid.

[16] The method according to claim 15, wherein the substance capable of inactivating aquatic organisms is a chlorine-containing substance.

[17] The method according to claim 16, comprising electrolyzing the supply liquid or the discharge liquid to produce the chlorine-containing substance.

[18] The method according to any one of claims 15 to 17, comprising determining the addition of a neutralizer that neutralizes the substance capable of inactivating aquatic organisms based on the concentration of the substance capable of inactivating aquatic organisms in the discharge liquid.

[19] The method according to claim 18, comprising measuring the concentration of the substance capable of inactivating aquatic organisms in the discharge liquid.

[20] A method for treating a liquid, comprising carrying out a physical treatment using a centrifugal force with respect to a discharge liquid to be discharged outside a housing from a storage means located inside the housing, and discharging the discharge liquid that has been subjected to the treatment outside the housing,

wherein the flow rate of the discharge liquid flowing into a device for carrying out the physical treatment is 1 to 10 m/sec.

[21] The method according to claim 20, wherein the physical treatment comprises separating aquatic organisms with a shell whose height is at least 50 μm from a supply liquid or the discharge liquid using a centrifugal force, or stirring the supply liquid or the discharge liquid using a centrifugal force.

[22] The method according to claim 20 or 21, comprising carrying out an aquatic organism-inactivating treatment with respect to the supply liquid and/or the discharge liquid.

[23] The method according to claim 22, wherein the substance capable of inactivating aquatic organisms is a chlorine-containing substance.

[24] The method according to claim 23, comprising electrolyzing the supply liquid or the discharge liquid to produce the chlorine-containing substance.

[25] The method according to any one of claims 22 to 24, comprising determining the addition of a neutralizer that neutralizes the substance capable of inactivating aquatic organisms based on the concentration of the substance capable of inactivating aquatic organisms in the discharge liquid.

[26] The method according to claim 25, comprising measuring the concentration of the substance capable of inactivating aquatic organisms in the discharge liquid.

[27] The method according to any one of claims 1 to 26, wherein the storage means is a ballast tank.

[28] A device for treating a liquid, comprising:

an inactivating means for carrying out an aquatic organism-inactivating treatment with respect to a supply liquid to be supplied to a storage means located inside a housing and/or a discharge liquid to be discharged outside the housing from the storage means,

a physical means for carrying out a physical treatment using a centrifugal force with respect to the supply liquid to be supplied to the storage means located inside the housing and/or the discharge liquid to be discharged outside the housing from the storage means, and

a control unit for determining whether or not the aquatic

organism-inactivating treatment is required with respect to the discharge liquid.

[29] The device according to claim 28, wherein the inactivating means comprises a means for mixing a substance capable of inactivating aquatic organisms.

[30] The device according to claim 29, further comprising a monitoring means for monitoring the concentration of the substance capable of inactivating aquatic organisms in the supply liquid and the storage means,

wherein the control unit controls the mixing means based on the concentration obtained by the monitoring means.

[31] The device according to claim 29 or 30, wherein the substance capable of inactivating aquatic organisms is a chlorine-containing substance.

[32] The device according to claim 31, wherein the inactivating means is provided with a treatment tank for producing the chlorine-containing substance from the supply liquid or the discharge liquid.

[33] The device according to claim 32, wherein the treatment tank is provided with an electrolytic cell for electrolyzing the supply liquid or the discharge liquid to produce the chlorine-containing substance.

[34] The device according to any one of claims 29 to 33, further comprising a neutralizing means for adding, to the discharge liquid, a neutralizer that neutralizes the substance capable of inactivating aquatic organisms.

[35] The device according to any one of claims 28 to 34, wherein the physical means is a separation or stirring means using a centrifugal force.

[36] A device for treating a liquid, comprising a physical means for carrying out a physical treatment using a centrifugal force at an inlet flow rate of 1 to 10 m/sec with respect to a supply liquid to be supplied to a storage means located inside a housing

and/or a discharge liquid to be discharged outside the housing from the storage means.

[37] The device according to claim 36, wherein the physical means is a separation or stirring means using a centrifugal force.

[38] The device according to claim 36 or 37, further comprising an inactivating means for carrying out an aquatic organism-inactivating treatment with respect to the supply liquid to be supplied to the storage means located inside the housing and/or the discharge liquid to be discharged outside the housing from the storage means.

[39] The device according to claim 38, wherein the inactivating means comprises a means for mixing a substance capable of inactivating aquatic organisms.

[40] The device according to claim 39, wherein the substance capable of inactivating aquatic organisms is a chlorine-containing substance.

[41] The device according to claim 40, wherein the inactivating means is provided with a treatment tank for producing the chlorine-containing substance from the supply liquid or the discharge liquid.

[42] The device according to claim 41, wherein the treatment tank is provided with an electrolytic cell for electrolyzing the supply liquid or the discharge liquid to produce the chlorine-containing substance.

[43] The device according to any one of claims 39 to 42, further comprising a neutralizing means for adding, to the discharge liquid, a neutralizer that neutralizes the substance capable of inactivating aquatic organisms.

[44] A method for treating a liquid, comprising:

carrying out an aquatic organism-inactivating treatment by electrolyzing a liquid taken in from outside a housing to produce a chlorine-containing substance,

carrying out a separation treatment using a centrifugal force with respect to

the treated liquid that has been subjected to the inactivating treatment, and

storing a supernatant obtained by the separation treatment in a storage means located inside the housing.

[45] A method for treating a liquid, comprising:

carrying out an aquatic organism-inactivating treatment by discharging a liquid stored in a storage means located inside a housing from the storage means and electrolyzing the liquid thus discharged to produce a chlorine-containing substance,

carrying out a separation treatment using a centrifugal force with respect to the treated liquid that has been subjected to the inactivating treatment, and

discharging a supernatant obtained by the separation treatment to the outside of the housing,

wherein the method comprises, between the inactivating treatment and the separation treatment or between the separation treatment and the discharging to the outside of the housing, mixing a neutralizer that neutralizes the chlorine-containing substance.

[46] A method for treating a liquid, comprising:

a storage step comprising:

carrying out an aquatic organism-inactivating treatment A by electrolyzing a liquid taken in from outside a housing to produce a chlorine-containing substance,

carrying out a separation treatment A using a centrifugal force with respect to the treated liquid that has been subjected to the inactivating treatment A, and

storing a supernatant obtained by the separation treatment A in a storage means located inside the housing, and

a discharge step comprising:

carrying out an aquatic organism-inactivating treatment B by electrolyzing the liquid discharged from the storage means located inside the housing to produce a chlorine-containing substance,

carrying out a separation treatment B using a centrifugal force with respect to the treated liquid that has been subjected to the inactivating treatment B that has been carried out with respect to the liquid discharged from the storage means,

discharging a supernatant obtained by the separation treatment B to the outside of the housing, and

mixing a neutralizer that neutralizes the chlorine-containing substance, between the inactivating treatment B and the separation treatment B or between the separation treatment B and the discharging to the outside of the housing.

CLAIMS

[1] A method for treating a liquid, comprising:

electrolyzing a supply liquid to be supplied to a storage means located inside a housing to produce a chlorine-containing substance;

introducing the supply liquid in which the chlorine-containing substance has been produced into a liquid cyclone;

carrying out a physical treatment using a centrifugal force by the liquid cyclone with respect to the supply liquid in which the chlorine-containing substance has been produced so that the chlorine-containing substance is stirred in the supply liquid, and the supply liquid is separated into a supernatant and a concentrated liquid; and

storing the supernatant in the storage means disposed in the housing,

wherein the flow rate of the supply liquid flowing into a device for carrying out the physical treatment is 1 to 10 m/sec.

[2] The method according to claim 1, wherein the physical treatment using a centrifugal force is carried out by the liquid cyclone with respect to a discharge liquid to be discharged outside the housing from the storage means.

[3] The method according to claim 1 or 2, comprising stirring a discharge liquid to be discharged outside the housing from the storage means by the liquid cyclone.

[4] The method according to any one of claims 1 to 3, wherein the concentrated liquid contains aquatic organisms with a shell whose height is at least 50 μm.

[5] The method according to any one of claims 1 to 4, comprising electrolyzing a discharge liquid to be discharged outside the housing from the storage means to produce the chlorine-containing substance.

[6] The method according to any one of claims 1 to 5, comprising determining the addition of a neutralizer that neutralizes the chlorine-containing substance based on the concentration of the chlorine-containing substance in a discharge liquid to be discharged outside the housing from the storage means.

[7] The method according to claim 2, comprising measuring the concentration of the chlorine-containing substance in the discharge liquid.

[8] The method according to any one of claims 1 to 8, wherein the storage means is a ballast tank.

[9] A device for treating ballast water, comprising:

an inactivating means for carrying out an aquatic organism-inactivating treatment with respect to a supply liquid to be supplied to a storage means located inside a housing; and

a physical means for carrying out a physical treatment using a centrifugal force at an inlet flow rate of 1 to 10 m/sec with respect to a supply liquid to be supplied to a storage means located inside a housing

wherein the inactivating means is provided with an electrolytic cell that is configured to have a plurality of electrodes and to electrolyze the supply liquid to produce a chlorine-containing substance,

the physical means is a liquid cyclone, and

the inactivating means and the physical means are arranged so that the supply liquid treated by the inactivating means can be introduced into the physical means.

[10] The device according to claim 9, further comprising a neutralizing means for adding, to a discharge liquid to be discharged outside the housing from the storage means, a neutralizer that neutralizes the chlorine-containing substance.

[11] A method for treating a liquid, comprising:

carrying out an aquatic organism-inactivating treatment by electrolyzing a liquid taken in from outside a housing to produce a chlorine-containing substance,

carrying out a physical treatment using a centrifugal force by a liquid cyclone with respect to the treated liquid that has been subjected to the inactivating treatment so that the chlorine-containing substance is stirred in the treated liquid, and the treated liquid is separated into a supernatant and a concentrated liquid, and

storing the supernatant obtained by the physical treatment in a storage means located inside the housing.

[12] A method for treating a liquid, comprising:

carrying out an aquatic organism-inactivating treatment by discharging a liquid stored in a storage means located inside a housing from the storage means and electrolyzing the liquid thus discharged to produce a chlorine-containing substance,

carrying out a physical treatment using a centrifugal force by a liquid cyclone with respect to the treated liquid that has been subjected to the inactivating treatment so that the chlorine-containing substance is stirred in the treated liquid, and the treated liquid is separated into a supernatant and a concentrated liquid, and

discharging the supernatant obtained by the physical treatment to the outside of the housing,

wherein the method comprises mixing a neutralizer that neutralizes the chlorine-containing substance between the inactivating treatment and the physical treatment or adding the neutralizer to a supernatant outlet of the liquid cyclone.

[13] A method for treating a liquid, comprising:

a storage step comprising:

carrying out an aquatic organism-inactivating treatment A by electrolyzing a liquid taken in from outside a housing to produce a chlorine-containing substance,

carrying out a physical treatment A using a centrifugal force by a liquid cyclone with respect to the treated liquid that has been subjected to the inactivating treatment A so that the chlorine-containing substance is stirred in the treated liquid, and the treated liquid is separated into a supernatant and a concentrated liquid, and

storing the supernatant obtained by the physical treatment A in a storage means located inside the housing, and

a discharge step comprising:

carrying out an aquatic organism-inactivating treatment B by electrolyzing the liquid discharged from the storage means located inside the housing to produce a chlorine-containing substance,

carrying out a physical treatment B using a centrifugal force by a liquid cyclone with respect to the treated liquid that has been subjected to the inactivating treatment B so that the chlorine-containing substance is stirred in the treated liquid, and the treated liquid is separated into a supernatant and a concentrated liquid,

discharging the supernatant obtained by the physcial treatment B to the outside of the housing, and

mixing a neutralizer that neutralizes the chlorine-containing substance

between the inactivating treatment B and the physical treatment B or adding the neutralizer to a supernatant outlet of the liquid cyclone.