[0004] [Patent Document 1] JP 4478159 B

[Patent Document 2] JP 4723647 B

Disclosure of Invention

Problem to be Solved by the Invention

[0005] As described above, International Convention for the Control and Management of Ships' Ballast Water and Sediments was adopted and requires installation of a device for treating ballast water, which resulted in more demand for new technologies that can treat ballast water. Therefore, a novel method and device for treating a liquid, which can be used for treating ballast water, are provided.

Means for Solving Problem

[0005a] In one aspect, the present invention refers to a method for treating a liquid, comprising: electrolyzing a supply liquid to be supplied to a storage means located inside a ship 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 ship, wherein the electrolysis and the physical treatment are carried out inside the ship, the electrolysis is carried out with respect to the whole amount of supply liquid and, the flow rate of the supply liquid flowing into a device for carrying out the physical treatment is 1 to 10 m/sec.

In another aspect, the present invention refers to 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 ship; 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 ship 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, 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 the physical means and the inactivating

means are located inside the ship, and the inactivating means is arranged so as to carry out the electrolysis with respect to the whole amount of supply liquid. In another aspect, the present invention refers to a method for treating a liquid, comprising: carrying out an aquatic organism-inactivating treatment by electrolyzing a liquid taken in from outside a ship 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 ship wherein the electrolysis and the physical treatment are carried out inside the ship, and the electrolysis is carried out with respect to the whole amount of supply liquid. In another aspect, the present invention refers to 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 B 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 B in a storage means located inside the housing, and a discharge step comprising: carrying out an aquatic organism-inactivating treatment C by electrolyzing the liquid discharged from the storage means located inside the housing to produce a chlorine-containing substance, carrying out a physical treatment D using a centrifugal force by a liquid cyclone with respect to the treated liquid that has been subjected to the inactivating treatment C 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 physical treatment D to the outside of the housing, and mixing a neutralizer that neutralizes the chlorine-containing substance between the inactivating treatment C and the physical treatment D or adding the neutralizer to a supernatant outlet of the liquid cyclone.

[0006] In one or more examples, the present disclosure relates to a method for treating a liquid, which includes a storage step including 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 including 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.

[0007] In one or more examples, the present disclosure relates to a method for treating a liquid, which includes 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.

[0008] In one or more examples, the present disclosure relates to a method for treating a liquid, which includes 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.

[0009] In one or more examples, the present disclosure relates to a device for treating a liquid, which is provided with 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.

[0010] In one or more examples, the present disclosure relates to a device for treating a liquid, which is provided with 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.

Effects of the Invention

[0011] The present disclosure can provide, in one or more embodiments, a novel method and device for treating a liquid, which can be used for treating ballast water.

Brief Description of Drawings

[0012] [FIG. 1] FIG. 1 is a schematic block diagram to be used for describing a method for treating ballast water in Embodiment 1.

[FIG. 2] FIG. 2 is a schematic block diagram to be used for describing a method for treating ballast water in Embodiment 2.

[FIG. 3] FIG. 3 is a schematic block diagram showing an example of the arrangement of a centrifugal separator and a neutralizer addition means.

[FIG. 4] FIG. 4 is a schematic block diagram to be used for describing a method for treating ballast water in Embodiment 3.

[FIG. 5] FIG. 5 is a schematic block diagram to be used for describing a method for treating ballast water in Embodiment 4.

[FIG. 6] FIG. 6 is a schematic block diagram showing an example of the arrangement of a centrifugal separator and an electrolysis unit 2.

[FIG. 7] FIG. 7 is a schematic block diagram to be used for describing a method for

CLAIMS

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

electrolyzing a supply liquid to be supplied to a ballast tank located inside a ship 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 ballast tank disposed in the ship, wherein the electrolysis and the physical treatment are carried out inside the ship, the electrolysis is carried out with respect to the whole amount of supply liquid and,

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 ship from the ballast tank.

[3] The method according to claim 1 or 2, wherein the concentrated liquid contains aquatic organisms with a shell whose height is at least 50 μm.

[4] The method according to any one of claims 1 to 3, comprising electrolyzing a discharge liquid to be discharged outside the ship from the ballast tank to produce the chlorine-containing substance.

[5] The method according to any one of claims 1 to 4, 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 ship from the ballast tank.

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

[7] The method according to any one of claims 1 to 6, wherein the ballast tank is a ballast tank.

[8] 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 ballast tank located inside a ship; 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 ballast tank located inside a ship

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,

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

the physical means and the inactivating means are located inside the ship, and

the inactivating means is arranged so as to carry out the electrolysis with respect to the whole amount of supply liquid.

[9] The device according to claim 8, further comprising a neutralizing means for adding, to a discharge liquid to be discharged outside the ship from the ballast tank, a neutralizer that neutralizes the chlorine-containing substance.

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

carrying out an aquatic organism-inactivating treatment by electrolyzing a liquid taken in from outside a ship 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 ballast tank located inside the ship

wherein the electrolysis and the physical treatment are carried out inside the ship, and

the electrolysis is carried out with respect to the whole amount of supply liquid.

[11] 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 B 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 B 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 D using a centrifugal force by a liquid cyclone with respect to the treated liquid that has been subjected to the inactivating treatment C 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 D to the outside of the housing, and

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

METHOD FOR TREATING BALLAST WATER AND DEVICE FOR TREATING BALLAST WATER USED THEREFOR

ABSTRACT

Provided are a novel method and device for treating a liquid that can be utilized for treating ballast water used in ships, etc. The method and device for treating a liquid provided herein allow aquatic organisms contained in a liquid to be sufficiently inactivated or separated by being configured in such a manner as to, in supplying the liquid containing aquatic organisms, carry out at least one of an aquatic organism-inactivating treatment and a physical treatment using a centrifugal force and then store the liquid in a storage means, and in discharging the liquid thus stored, determine whether or not the aquatic organism-inactivating treatment is required, carry out the treatment based on the determination, and carry out the physical treatment using a centrifugal force.

[Fig. 2]