CLAIMS

1. A ballast water treatment system including a water treatment apparatus which removes a substance to be removed from ballast water, a ballast tank which stores the ballast water treated by the water treatment apparatus installed on a ship, and a circulation line for returning the ballast water in the ballast tank or the ballast water to be discharged out of the ballast tank to the water treatment apparatus, the ballast water treatment system comprising:

a monitoring apparatus which monitors water quality of the ballast water at an inlet part of the water treatment apparatus, water quality of the ballast water at an outlet part of the water treatment apparatus and water quality of the ballast water in the ballast tank;

a control apparatus which controls an operational condition of the water treatment apparatus based on a monitoring result of the monitoring apparatus, wherein the control apparatus:

compares the monitored water quality of the ballast water at the inlet part of the water treatment apparatus with the monitored water quality of the ballast water at the outlet part of the water treatment apparatus and controls the operational condition of the water treatment apparatus based on the comparison result,

compares the monitored water quality of the ballast water in the ballast tank with a permissible value, and as a result of the comparison, controls to discharge the ballast water in the ballast tank without the circulation and the retreatment when the monitored water quality of the ballast water in the ballast tank satisfies the permissible value, and controls to circulate the ballast water in the ballast tank to the water treatment apparatus through the circulation line so as to be retreated in the water treatment apparatus,

controls to stop circulation of the ballast water in the ballast tank to the water treatment apparatus and retreatment in the water treatment apparatus when the monitored water quality of the ballast water in the ballast tank becomes substantially equal to the monitored water quality of the ballast water at the outlet part of the water treatment apparatus.

2. The ballast water treatment system according to claim 1, wherein the monitoring apparatus automatically takes a sample of the ballast water through a sampling pipe to monitor the water quality.

3. The ballast water treatment system according to claims 1 or 2, wherein the water treatment apparatus comprises a physical removal apparatus which physically removes large aquatic organisms and suspended solids to prevent mud from accumulating in the ballast tank.

4. The ballast water treatment system according to claim 3, wherein the water treatment apparatus further comprises a sterilizing apparatus which kills small aquatic organisms using disinfectant.

5. The ballast water treatment system according to any one of claims 1 to 4, wherein

the water treatment apparatus comprises:

a coagulation apparatus which coagulates the substance to be removed by injecting a coagulant into and agitating the ballast water; and

a separation/removal apparatus which separates and removes aggregates which occurs in the coagulation apparatus.

6. The ballast water treatment system according to claim 5, wherein

the control apparatus controls the coagulation apparatus based on the monitoring result of the monitoring apparatus to adjust an injection amount of the coagulant.

7. The ballast water treatment system according to claims 5 or 6, wherein

the separation/removal apparatus is configured as a combination of a magnetic separation and a filter separation.

8. The ballast water treatment system according to any one of claims 1 to 7, wherein

the monitoring apparatus monitors the ballast water by measuring at least one of

a turbidity and a chromaticity of the ballast water.

9. The ballast water treatment system according to any one of claims 1 to 8, wherein

the monitoring apparatus monitors the ballast water by performing an image analysis of the ballast water.

10. The ballast water treatment system according to any one of claims 1 to 9, wherein

the control apparatus controls a treatment volume that is treated by the water treatment apparatus per unit time.

CLAIMS

1. A ballast water treatment system comprising:

a water treatment apparatus which is installed on a vessel including a ballast tank and a pump that withdraws and discharges a ballast water, the water treatment apparatus which treats the ballast water;

a valve which is disposed in a piping connecting the ballast tank and the pump;

a monitoring apparatus which monitors a concentration of aquatic organisms in the ballast water at an inlet part or outlet part of the water treatment apparatus; and

a control apparatus which monitors the concentration of aquatic organisms in the ballast water when the ballast water is withdrawn,

controls an opening degree of the valve based on a result of the monitoring to adjust a treatment flow rate per unit time of the water treatment apparatus,

monitors the concentration of aquatic organisms in the ballast water when the ballast water is discharged,

controls to discharge the ballast water when the monitored concentration of aquatic organisms satisfies a permissible value, and

controls to discharge the ballast water after retreating the ballast water in the water treatment apparatus when the monitored concentration of aquatic organisms does not satisfy the permissible value.

2. The ballast water treatment system according to claim 1, further comprising:

a circulation line which has one end connected to the ballast tank and another end connected to an upstream side of the pump, wherein

the ballast water is fed to the water treatment apparatus via the circulation line.

3. The ballast water treatment system according to claim 2, wherein

the monitoring apparatus monitors the concentration of aquatic organisms in the ballast water in the ballast tank,

the control apparatus monitors the concentration of aquatic organisms in the ballast water in the ballast tank, and

based on a result of the monitoring, the control apparatus controls to circulate the

ballast water in the ballast tank to the water treatment apparatus so as to make the ballast water retreated, or controls to feed the ballast water in the ballast tank to the water treatment apparatus so as to make the ballast water retreated, and then discharge the ballast water when the ballast water is discharged.

4. The ballast water treatment system according to any one of claims 1 to 3, wherein the water treatment apparatus comprises a physical removal apparatus or a sterilizing apparatus.

5. The ballast water treatment system according to claim 4, wherein

the sterilizing apparatus utilizes at least any one of sodium hypochlorite, ozone, chlorine dioxide, peracetic acid, hydrogen peroxide, ultra-violet light.

6. The ballast water treatment system according to any one of claims 1 to 5, wherein the water treatment apparatus comprises:

a coagulation apparatus which coagulates the substance to be removed by injecting a coagulant into and agitating the ballast water; and

a separation/removal apparatus which separates and removes aggregates which occurs in the coagulation apparatus.

7. The ballast water treatment system according to claim 6, wherein

the separation/removal apparatus is configured as a combination of a magnetic separation and a filter separation.

8. The ballast water treatment system according to any one of claims 1 to 7, wherein

the monitoring apparatus monitors the ballast water by measuring at least one of a turbidity and a chromaticity of the ballast water.

9. The ballast water treatment system according to any one of claims 1 to 7, wherein

the monitoring apparatus monitors the ballast water by performing an image analysis of the ballast water.

10. The ballast water treatment system according to claim 5, wherein

the control apparatus controls an injection amount of a disinfectant based on the result of the monitoring of the concentration of aquatic organisms in the ballast water at the inlet part of the water treatment apparatus, or the concentration of aquatic organisms in the ballast water at the outlet part of the water treatment apparatus.