CLAIMS

1. A pretreatment device of seawater to be supplied to a device for removing salt from the seawater or concentrating the seawater by membrane filtration, the pretreatment device comprising:

a supply duct through which the seawater is to be supplied;

a plurality of filters including a particulate filtering material which separates particles from the seawater supplied through the supply duct, and a biofilm formed on a surface of the particulate filtering material;

a plurality of connecting tubes which connect the plurality of filters in series from an upstream side in this order;

a plurality of bypass tubes each of which connects corresponding one of the plurality of filters to the supply duct;

a plurality of regulating valves each of which is disposed in corresponding one of the plurality of bypass tubes to regulate a flow rate

a water-quality detecting part disposed on an outlet section of at least one of the plurality of filters; and

a valve control part configured to control opening degrees,

wherein the valve control part controls the opening degrees of the regulating valves on the basis of a detection value obtained by the water-quality detecting part after the valve control part controls the plurality of regulating valves to be open.

2. The pretreatment device of seawater according to claim 1,

wherein the water-quality detecting part is disposed on the outlet section of the filter disposed most downstream among the plurality of filters, and

wherein the valve control part is configured to control the plurality of regulating valves to be closed in order from a downstream side, if the detection value obtained by the water-quality detecting part is greater than a first standard value set in advance after the valve

control part controls the plurality of regulating valves to be open.

3. The pretreatment device of seawater according to claim 2,

wherein the valve control part is configured to control the plurality of regulating valves to be open, if the detection value obtained by the water-quality detecting part is not greater than a second standard value set in advance, the second standard value being smaller than the first standard value, after the valve control part controls the plurality of regulating valves to be closed.

4. A pretreatment device of seawater to be supplied to a device for removing salt from the seawater or concentrating the seawater by membrane filtration, the pretreatment device comprising:

a supply duct through which the seawater is to be supplied;

a plurality of filters including a particulate filtering material which separates particles from the seawater supplied through the supply duct, and a biofilm formed on a surface of the particulate filtering material;

a plurality of connecting tubes which connect the plurality of filters in series from the upstream side;

a plurality of bypass tubes which respectively connect the plurality of filters to the supply duct;

a plurality of regulating valves which are respectively disposed in the plurality of bypass tubes to regulate a flow rate;

a nutrient detecting part configured to detect nutrients contained in supply water to be supplied to at least one of the plurality of filters; and

a valve control part configured to control opening degrees of the regulating valves;

wherein the valve control part controls the opening degrees of the regulating valves on the basis of a detection value obtained by the nutrient detecting part after the valve control part controls the plurality of regulating valves to be open.

5. The pretreatment device of seawater according to claim 4,

wherein the nutrient detecting part is disposed on an inlet section of the plurality of filters, and

wherein the valve control part is configured to control the opening degrees of the regulating valves so that a detection value of each nutrient detecting part is at least a predetermined standard value.

6. A pretreatment device of seawater to be supplied to a device for removing salt from the seawater or concentrating the seawater by membrane filtration, the pretreatment device comprising:

a supply duct through which the seawater is to be supplied;

a plurality of filters including a particulate filtering material which separates particles from the seawater supplied through the supply duct, and a biofilm formed on a surface of the particulate filtering material;

a plurality of connecting tubes which connect the plurality of filters in series from the upstream side;

a plurality of bypass tubes which respectively connect the plurality of filters to the supply duct;

a plurality of regulating valves which are respectively disposed in the plurality of bypass tubes to regulate a flow rate;

an activity-level detecting part disposed on at least one of the plurality of filters, and configured to detect an activity level of the biofilm of the at least one filter, and

a valve control part configured to control opening degrees of the regulating valves on the basis of a detection value obtained by the activity-level detecting part,

wherein the valve control part is configured to control the opening degrees of the regulating valves so that the detection value obtained by the activity-level detecting part is at least a predetermined standard value after the valve control part controls the plurality of regulating valves to be open.

7. The pretreatment device of seawater according to claim 6,

wherein the activity-level detecting part is configured to detect the activity level on the basis of a difference in oxygen concentration between an inlet section and an outlet section of the at least one filter.

8. A method of pretreating seawater to be supplied to a device for removing salt from the seawater or concentrating the seawater by membrane filtration by using a pretreatment device, the pretreatment device comprising:

a supply duct through which the seawater is to be supplied;

a plurality of filters including a particulate filtering material which separates particles from the seawater supplied through the supply duct, and a biofilm formed on a surface of the particulate filtering material;

a plurality of connecting tubes which connect the plurality of filters in series from the upstream side in this order;

a plurality of bypass tubes which respectively connect the plurality of filters to the supply duct; and

a plurality of regulating valves which are respectively disposed in the plurality of bypass tubes to regulate a flow rate,the method comprising:

setting the plurality of regulating valves to be open;

detecting water quality at an outlet section of at least one of the plurality of filters; and

controlling the opening degrees of the regulating valves on the basis of the detected water quality.