DESCRIPTION

OZONE WATER GENERATION DEVICE, WATER TREATMENT DEVICE, OZONE WATER GENERATION METHOD, AND CLEANING METHOD

TECHNICAL FIELD

[0001] The present disclosure relates to an oxidation device for performing treatment on oxidizable substances in treatment target water, a water treatment device including the oxidation device, a water treatment method using the oxidation device, an ozone water generation method for generating ozone water on the basis of treatment target water treated by the water treatment method, and a cleaning method using the ozone water.

BACKGROUND ART

[0002] In water cleaning treatment, waste water treatment, and the like, water treatment technology using ozone is widely applied. This water treatment technology is also used, for example, in the case of decomposing impurities such as organic substances contained in waste water by directly supplying ozone gas to waste water to be treated, or in the case of generating ozone water as a cleaning agent for a filtration membrane to which impurities are adhered in membrane separation technology for filtering impurities in waste water by the filtration membrane to obtain clean water

CLAIMS

[1] An ozone water generation device for generating ozone water using treatment target water, the ozone water generation device comprising:

an oxidation unit for supplying an oxidation material to the treatment target water so as to make contact therebetween, to generate contacted treatment target water;

a measurement unit for performing water quality measurement for the contacted treatment target water;

a control unit for performing control to continue or stop supply of the oxidation material to the generated contacted treatment target water on the basis of a first change amount obtained from change over time in a measurement value obtained through the water quality measurement by the measurement unit, to generate controlled treatment target water; and

an ozone water generation unit for supplying ozone to the controlled treatment target water, to generate the ozone water.

[2] The ozone water generation device according to claim 1, wherein the control unit determines whether oxidation of oxidizable substances in the contacted treatment target water is completed, on the basis of the first change amount, and performs control to continue or stop supply of

the oxidation material to the contacted treatment target water on the basis of a result of the determination, to generate the controlled treatment target water.

[3] A water treatment device comprising:

the ozone water generation device according to claim 1 or 2;

a filtration unit for filtering organic substances in raw water to generate filtered water;

a first transfer unit for transferring the filtered water as the treatment target water to the oxidation unit; and

a second transfer unit for transferring the ozone water to the filtration unit.

[4] The water treatment device according to claim 3, wherein

the first transfer unit includes a first outside air contact device for exposing the filtered water to outside air.

[5] An ozone water generation method for generating ozone water using treatment target water, the ozone water generation method comprising:

an oxidation step of supplying an oxidation

material to the treatment target water so as to make contact therebetween, to generate contacted treatment target water;

a water quality measurement step of performing water quality measurement for the contacted treatment target water;

a controlled treatment target water generation step of performing control to continue or stop supply of the oxidation material to the generated contacted treatment target water on the basis of a first change amount obtained from change over time in a measurement value obtained through the water quality measurement in the water quality measurement step, to generate controlled treatment target water; and

an ozone water generation step of supplying ozone to the controlled treatment target water, to generate the ozone water.

[6] The ozone water generation method according to claim 5, wherein in the controlled treatment target water generation step,

whether oxidation of oxidizable substances in the contacted treatment target water is completed is determined on the basis of the first change amount, and

control to continue or stop supply of the oxidation material to the contacted treatment target water is

performed on the basis of a result of the determination, to generate the controlled treatment target water.

[7] The ozone water generation method according to claim 5 or 6, wherein

a slope of the measurement value is used as the first change amount.

[8] The ozone water generation method according to claim 5 or 6, wherein

a ratio of the measurement value is used as the first change amount.

[9] The ozone water generation method according to claim 7, wherein

the measurement value measured at a first time point is defined as a first measurement value, and the measurement value measured at a second time point after the first time point is defined as a second measurement value,

the measurement value measured at a third time point after the second time point is defined as a third measurement value, and the measurement value measured at a fourth time point after the third time point is defined as a fourth measurement value, and

a relationship between a first slope of a line

connecting the first measurement value and the second measurement value, and a second slope of a line connecting the third measurement value and the fourth measurement value or a line connecting the second measurement value and the third measurement value, is used.

[10] The ozone water generation method according to claim 9, wherein

the measurement value is at least one of a dissolved oxygen concentration value or a standard oxidation reduction potential value of the contacted treatment target water, and the oxidation material is continuously supplied to the treatment target water, and

control to stop supply of the oxidation material to the contacted treatment target water is performed, when an absolute value of the second slope becomes greater than an absolute value of the first slope or a value obtained by dividing the absolute value of the second slope by the absolute value of the first slope becomes equal to or greater than a predetermined first value.

[11] The ozone water generation method according to claim 9, wherein

the measurement value is a pH value of the contacted treatment target water, and the oxidation material

is continuously supplied to the treatment target water, and

control to stop supply of the oxidation material to the contacted treatment target water is performed, when an absolute value of the second slope becomes smaller than an absolute value of the first slope or a value obtained by dividing the absolute value of the second slope by the absolute value of the first slope becomes equal to or smaller than a predetermined second value.

[12] The ozone water generation method according to claim 8, wherein

the oxidation material is intermittently supplied to the treatment target water with a predetermined interruption period provided,

the ratio of the measurement value in the interruption period is used as the first change amount,

the measurement value measured at a first time point is defined as a first measurement value, and the measurement value measured at a second time point after the first time point is defined as a second measurement value, and

control to stop supply of the oxidation material to the contacted treatment target water is performed, when the ratio of the measurement value obtained by dividing the second measurement value by the first measurement value

becomes equal to or greater than a predetermined third value.

[13] The ozone water generation method according to any one of claims 5 to 9 and 12, wherein

the measurement value is at least one of a dissolved oxygen concentration value, a standard oxidation reduction potential value, or a pH value of the contacted treatment target water.

[14] The ozone water generation method according to any one of claims 5 to 13, wherein

supply of the oxidation material to the treatment target water is performed by jetting gas as the oxidation material, into the treatment target water.

[15] The ozone water generation method according to any one of claims 5 to 13, wherein

supply of the oxidation material to the treatment target water is performed by transferring the treatment target water so that the treatment target water is exposed to outside air as the oxidation material.

[16] The ozone water generation method according to any one of claims 5 to 15, wherein

removal of carbonate ions in the controlled

treatment target water is performed.

[17] The ozone water generation method according to claim 16, wherein

removal progress of the carbonate ions in the controlled treatment target water is determined on the basis of a second change amount obtained from change over time in an intermediate treatment measurement value obtained through water quality measurement for the controlled treatment target water for which the removal of the carbonate ions has been performed, and thus control to continue or stop the removal of the carbonate ions in the controlled treatment target water is performed.

[18] The ozone water generation method according to claim 17, wherein

the intermediate treatment measurement value is a pH value of the treatment target water, and

a ratio of the intermediate treatment measurement value is used as the second change amount.

[19] The ozone water generation method according to any one of claims 16 to 18, wherein

the removal of the carbonate ions in the controlled treatment target water is performed using at least one of

jetting of decarbonation gas into the controlled treatment target water, heating of the controlled treatment target water, or application of ultrasonic vibration to the controlled treatment target water.

[20] The ozone water generation method according to claim 16, wherein

the removal of the carbonate ions in the controlled treatment target water is performed by adding a pH adjustment agent made of an acidic chemical to the controlled treatment target water so that the controlled treatment target water has a predetermined pH value.

[21] A cleaning method comprising cleaning a cleaning target part using the ozone water generated by the ozone water generation method according to any one of claims 5 to 20.