CLAIMS

[Claim 1] A wastewater treatment device, comprising:

an ozone generator which supplies ozone;

a mixer which mixes ozone supplied from the ozone generator with wastewater and supplies ozone mixed wastewater;

an ozone oxidation unit which progresses ozone oxidation in the ozone mixed wastewater while passing the ozone mixed wastewater therethrough and discharges wastewater in which the ozone has been consumed;

a biological treatment unit which has microorganisms for biological treatment and performs the biological treatment on the wastewater discharged from the ozone oxidation unit using the microorganisms; and

an adjusting device which adjusts the amount of ozone to be mixed with the wastewater by the mixer so that ozone in an amount that inhibits the microorganisms of the biological treatment unit does not remain in the wastewater discharged from the ozone oxidation unit,

wherein the ozone oxidation unit has a catalyst that promotes an ozone oxidation reaction by contacting with the ozone mixed wastewater.

[Claim 2] The wastewater treatment device according to claim 1, wherein the adjusting device includes:

a measuring device which measures the amount of ozone in the wastewater discharged from the ozone oxidation unit; and

a regulating valve capable of regulating the amount of ozone to be mixed with the wastewater by the mixer,

and the regulating valve is adjusted based on measurement by the measuring device in such a manner that the amount of ozone in the wastewater is lower than a level at which the microorganisms are inhibited.

[Claim 3] The wastewater treatment device according to claim 2, further comprising:

a release passage for avoiding the supply of the wastewater to the biological treatment unit when the ozone remains in the wastewater discharged from the ozone oxidation unit; and

a control valve which stops the supply of the wastewater to the biological treatment unit when the amount of ozone in the wastewater is equal to or higher than the level at which the microorganisms are inhibited, based on the measurement by the measuring device.

[Claim 4] The wastewater treatment device according to claim 3, wherein the release passage is a return passage capable of supplying the wastewater discharged from the ozone oxidation unit to the mixer, and the wastewater flows through the return passage when the supply of the wastewater to the biological treatment unit is stopped by the control valve.

[Claim 5] The wastewater treatment device according to claim 1, wherein the mixer includes a bubble generator, and ozone is dispersed in the ozone mixed wastewater in a state of bubbles.

[Claim 6] The wastewater treatment device according to claim 5, wherein the bubble generator is a microbubble generator which generates fine bubbles having a bubble diameter of 10 to 50 μm.

[Claim 7] The wastewater treatment device according to claim 1, wherein the ozone oxidation unit is configured in a multistage structure in which a plurality of catalyst beds on which the catalyst is supported are stacked in a vertical direction, and is configured so that the ozone mixed wastewater sequentially passes through the plurality

of catalyst beds while being introduced from a bottom part of the ozone oxidation unit and rising toward a top part of the ozone oxidation unit.

[Claim 8] The wastewater treatment device according to claim 1, wherein a difference in height between the biological treatment unit and the ozone oxidation unit is provided so that a water level in the biological treatment unit is lower than that in the ozone oxidation unit, and the wastewater of the ozone oxidation unit is supplied to the biological treatment unit using a gravity action due to the difference in height.

[Claim 9] The wastewater treatment device according to claim 2, further comprising:

an ozone decomposing device which decomposes ozone remaining in the wastewater discharged from the ozone oxidation unit when ozone remains in the wastewater discharged from the ozone oxidation unit.

[Claim 10] A wastewater treatment method, comprising:

ozone generation that supplies ozone;

mixing preparation for mixing the ozone supplied by the ozone generation with wastewater to supply ozone mixed wastewater;

ozone oxidation treatment in which ozone oxidation is allowed to proceed in the ozone mixed wastewater, using a catalyst that promotes an ozone oxidation reaction by contacting with the ozone mixed wastewater, to discharge the wastewater in which the ozone has been consumed; and

biological treatment in which the wastewater after the ozone oxidation treatment is biologically treated with microorganisms,

wherein an amount of ozone mixed with the wastewater in the mixing preparation is adjusted so that ozone in an amount that inhibits the microorganisms of the biological

treatment does not remain in the wastewater discharged from the ozone oxidation treatment.

[Claim 11] The wastewater treatment method according to claim 10, wherein a ratio of ozone to be mixed with the wastewater is adjusted according to a flow rate of the wastewater supplied to the ozone oxidation treatment and water quality of the wastewater so that an appropriate amount of ozone is mixed with the wastewater in the mixing preparation.

[Claim 12] The wastewater treatment method according to claim 10, which is applied to an advanced treatment for treating industrial wastewater containing a persistent organic substance.

[Claim 13] The wastewater treatment device according to claim 1, wherein the catalyst comprises a heterogeneous catalyst selected from metal oxides, metal-supported oxides, platinum group metals, zeolites, and activated carbon.

[Claim 14] The wastewater treatment device according to claim 13, wherein the metal oxides include Fe_2O_3, CoO, MoO_3, MnO_2, SiO_2, Al_2O_3 and TiO_2, and the metal-supported oxides include silica gel and titania on each of which a metal selected from Co, Cu, Pb, Ru, Pt and Pd is supported.

[Claim 15] The wastewater treatment method according to claim 10, wherein the catalyst comprises a heterogeneous catalyst selected from metal oxides, metal-supported oxides, platinum group metals, zeolites, and activated carbon.

[Claim 16] The wastewater treatment method according to claim 15, wherein the metal oxides include Fe_2O_3, CoO, MoO_3, MnO_2, SiO_2, Al_2O_3 and TiO_2, and the metal-supported oxides include silica gel and titania on each of which a metal

selected from Co, Cu, Pb, Ru, Pt and Pd is supported.

[Claim 17] The wastewater treatment device according to claim 1, wherein the catalyst promotes the ozone oxidation reaction in which an organic substance contained in the ozone mixed wastewater decomposes.

[Claim 18] The wastewater treatment device according to claim 1, wherein the ozone oxidation reaction is promoted by a hydroxyl radical or an ozonide ion generated from the ozone.

[Claim 19] The wastewater treatment device according to claim 1, wherein the catalyst comprises a heterogeneous catalyst selected from a group consisting of metal oxides, metal-supported oxides, zeolites, and activated carbon,

wherein the metal oxides include at least one selected from a group consisting of CoO, MoO_3, and MnO_2,

wherein the metal-supported oxides include silica gel on which at least one metal selected from a group consisting of Co, Cu, Pb, Ru, Pt and Pd is supported.