Claims

1. A method for performing a purification treatment on a harmful substance-containing liquid, the method comprising: adding and mixing dissolved ozone with a harmful substance-containing liquid containing a harmful substance; thereafter flowing the resulting harmful substance-containing liquid comprising the ozone to contact a transition metal-containing oxide, so that oxidation of the harmful substance with the dissolved ozone is accelerated, thereby performing oxidative decomposition of the harmful substance in the harmful substance-containing liquid, wherein the transition metal-containing oxide is a complex oxide of Co, Mn, and Cu, or an oxide of Co, the transition metal-containing oxide is in a form of an ultrafine particle having an average particle diameter in a range of 0.1 μm or smaller and has a BET specific surface area in a range of 80 m^2/g or more, and the transition metal-containing oxide adsorbs ozone and the harmful substance.

2. The method for performing a purification treatment on a harmful substance-containing liquid according to claim 1, wherein the ultrafine particle of the transition metal-containing oxide is formed by using a precipitate, and the precipitate is produced by mixing (a) an aqueous solution comprising a metal salt of Co, or (b) a mixed aqueous solution comprising metal salts of Co, Mn, and Cu, with an alkaline solution.

3. The method for performing a purification treatment on a harmful substance-containing liquid according to claim 1, wherein the transition metal-containing oxide is carried on a high silica adsorbent in a honeycomb form.

4. The method for performing a purification treatment on a harmful substance-containing liquid according to claim 1, the method further comprising: disposing a high silica adsorbent, which adsorbs both the harmful substance and the dissolved ozone, at an upstream side or a downstream side relative to the transition metal-containing oxide, so that the harmful substance-containing liquid is brought into contact with the high silica adsorbent; and allowing the harmful substance-containing liquid to flow contacting the high silica adsorbent.

5. The method for performing a purification treatment on a harmful substance-containing liquid according to claim 3, wherein the high silica adsorbent comprises at least one material selected from the group consisting of a high silica pentasil zeolite, a dealuminized faujasite, and a mesoporous silicate.

6. A harmful substance-containing liquid purification treatment apparatus that carries out the method for performing a purification treatment on a harmful substance according to claim 1, the apparatus comprising: an adsorbent-packed bed comprising at least the transition metal-containing oxide in a form of a single substance or a mixture disposed therein; a supply piping that supplies the harmful substance-containing liquid into the adsorbent-packed bed; a dissolved ozone generator that adds the dissolved ozone into the harmful substance-containing liquid, wherein the dissolved ozone generator is connected to the supply piping; and a treated liquid discharge piping that discharges a treated liquid as a resulting liquid of the purification treatment, from the adsorbent-packed bed.

7. The harmful substance-containing liquid purification treatment apparatus according to claim 6, wherein the form of a single substance or a mixture of the transition metal-containing oxide disposed inside the adsorbent-packed bed is at least one form selected from the group consisting of the ultrafine particle form, a granular form, a pellet form, a Raschig ring form, and a honeycomb form.

8. The method for performing a purification treatment on a harmful substance-containing liquid according to claim 1, wherein the harmful substance-containing liquid is at least one liquid selected from the group consisting of wastewater having a value of a chemical oxygen demand specified by the Environmental Agency in the chemical oxygen demand regulation, and water containing one or more malodorous substances in a culture tank.

9. The method for performing a purification treatment on a harmful substance-containing liquid according to claim 8, wherein the malodorous substance in a culture tank is ammonia.