Adsorption Property of Nitrosylruthenium Complex on Activated Carbon

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Decontamination of radioactive ruthenium is one of the most difficult problems involved in the treatment of radioactive waste water, since the behavior of ruthenium solutions towards chemical treatment is extremely complicated. In the present article, the possibility of utilization of the activated carbon has been investigated.

The stock solution and the test liquids were prepared as follows. Ruthenium trichloride containing ^{106}Ru - ^{106}Rh was dissolved in 0.1 N HNO_3 solution. After filtering off silver chloride formed by adding silver nitrate to this solution, sulfuric acid was added to attain 6 N in concentration and then sodium bismuthate was added. Ruthenium tetroxide was prepared by distilling the solution at 100°C and was collected entirely in cooled HCl -ethanol mixed solution. After this solution was evaporated to dryness the residue was dissolved in 0.1 N HCl solution and dry nitro-

gen oxide was bubbled. Thus nitrosylruthenium chloride solution was prepared. Nitratonitrosyl or nitronitrosylruthenium was synthesized by the addition of fuming nitric acid or sodium nitrite solution to nitrosylruthenium chloride solution, respectively. The radioactive concentration of each stock solution was about $10^{-2}\mu\text{Ci/ml}$ and the concentration of each

Fig. 1 Effect of the activated carbon concentration on the decontamination.

Fig. 2 Effect of competing ion concentration (activated carbon, 1000 ppm).

complex was about $10^{-2}N$. The test liquids were prepared by diluting one part of stock solution with 100 parts of distilled water and adjusting pH at about 7.0.

Adsorption properties were investigated through batch equilibrium method at the room temperature. Commercially available activated carbon which was produced from coconut shell was ground to the standard mesh size lower than 60. The powdered activated carbon was added to 10 ml of the test liquid and after being shaken for about 60 min, the suspension was filtered through Toyo Roshi No. 4. Two ml of filtrate was dried, counted and the removal was calculated. The removals of these complexes increased with the increase of stirring time and reached the steady values after the stirring for about 30 min. Nitro-nitrosyl or nitratonitrosyl ruthenium complex was entirely removed by the addition of 500 or 700 ppm of the activated carbon, respec-

tively, as shown in Fig. 1. However, these complexes were removed neither by ferric hydroxide, phosphate, clay-polyelectrolyte flocculation, nor by the natural ion exchangers. The removals in the case of the test solutions containing foreign matters were measured in the following way. Solution containing NaCl, KCl, $NaNO_2$ or $NaNO_3$ was used as the test solution. To this solution, 1000 ppm of the activated carbon was added and the removal was measured in the same way described above. The removals were not influenced by the presence of competing Na^+ or K^+ ion, however, decreased slightly by the presence of NO_2^- or NO_3^- ion, as shown in Fig. 2.

From the experimental results obtained, it is noticed that the activated carbon is an excellent adsorber for the removal of nitrosylruthenium complexes from the radioactive waste water.