Communications

Radiochemical Separations by Isotopic Exchange: a Rapid, High-Decontamination Method for Silver

It has been reported by Langer (*1*) that the exchange of silver ion between a precipitate of silver chloride and a solution of silver nitrate reaches isotopic equilibrium very rapidly. Because of the low solubility of silver chloride, a very favorable ratio exists at equilibrium between the silver atoms in the precipitate and the silver atoms in the solution. For this reason, if silver chloride is added to a solution containing only trace amounts of radioactive silver, a high percentage of this silver will have exchanged with the silver in the precipitate by the time equilibrium is attained. Use has been made of this fact to develop a rapid, high-decontamination, single-step method for the separation of traces of radioactive silver from a solution containing other radioactive species (*2*).

Platinum gauze is coated with metallic silver by plating (*3*) from an alkaline cyanide bath. The silver is then changed to silver chloride by reversing the current and electrolyzing the silver in an HCl solution.

To separate radioactive silver from other activities (except halides), the "silver chloride electrode" is immersed for 5 min at room temperature in about 10 ml of an acid solution containing the active material. The solution may be stirred magnetically. The electrode is removed and washed with a stream of 1:1 HNO_3 for 1 min.

Yields of radioactive silver from this procedure are given in Table 1 for varying temperatures, amounts of silver chloride, and times of immersion. The exchange rate appears to be independent of the nitric acid concentration in the range of 0.1 to 4*M*, whereas at 8*M* HNO_3 only 92 percent and at 16*M* HNO_3 only 50 percent is exchanged in 5 min at 25°C. The exchange is also independent of hydrochloric acid concentration in the range 0 to 0.6*M*, whereas in 1.2*M* HCl only 77 percent and in 6.0*M* HCl only 30 percent of the silver is exchanged in 5 min at 25°C. This effect of HCl is noted only as long as the silver concentration is so low that the solubility product of silver chloride is not exceeded in the tracer solution before immersion of the electrode. Higher concentrations of silver in hydrochloric acid were not investigated.

Table 1. Yields of radioactive silver from 1*M* HNO_3 by exchange procedure.

AgCl (mg)	Immersion time	Temp. (°C)	Recovery (%)
2	5 min	25	> 97
2	2 min	95	> 98
2	20 sec	95	50
0.3	5 min	25	85–90

A study of the decontamination afforded by this procedure showed a decontamination factor of 2×10^4 with 4-yr-old fission products and a factor of at least 10^4 with cadmium freshly bombarded with 7.8-Mev deuterons in the University of Michigan cyclotron. In addition, when carrier-free iodine was oxidized with permanganate and nitric acid, a decontamination of 10^4 was obtained. The advantages of this exchange method include its rapidity, its high decontamination in a single step, and simplicity of manipulation. Greater than 98-percent recovery is possible as long as the weight of solid inactive silver chloride is at least 50 times the weight of tracer silver in the solution.

This method should find use in radiochemical assay work when simplicity and speed are essential. It should be useful in characterization studies of short-lived silver activities in bombardment work and in the rapid determination of silver in fission products. It should also prove useful in the rapid preparation of high specific activity silver from irradiated materials such as palladium. It is readily adaptable to work with high levels of radiation when handling by remote control is required.

Experiments with this method of separation are continuing, and its applicability in other cases such as the exchange of iodide with silver iodide is being studied.

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References and Notes

1. A. Langer, *J. Chem. Phys.* **10**, 321 (1942).
2. This work was supported in part by the U.S. Atomic Energy Commission.
3. An inexpensive battery eliminator (Model BE-4), available from Heath Co., Benton Harbor, Mich., was used as a source of direct current.

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Prepottery, Lithic Complex from Sonora, Mexico

In the vicinity of Hermosillo, the capital of Sonora, Mexico, during the summer of 1953, I examined a group of seven campsites that represent a prepottery, lithic complex, very similar in type to the Cochise culture of southeastern Arizona. If, after more thorough study, a relationship is actually established between this complex and the prepottery cultures of the Southwest, then the southern range of Cochise influence will be greatly increased.

Topographically, the locale of these sites is predominantly a stretch of flat desert with little vegetation and no immediate evidence of a natural water supply. However, the Rio de Sonora flows approximately 1 to 2 mi to the south of the site area.