# Optimizing Radiochemical Methods at the Savannah River Site

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There have been significant advances in last five to ten years in radiochemical separations, with broad application in a wide range of labs. These improvements in column extraction chromatography have advanced analytical technology in process labs, bioassay labs, and environmental labs. Despite their differences, sample preparation is essential in all these labs to preconcentrate analytes and remove matrix interferences prior to assay.

Column extraction chromatography has become very popular over the last decade for analytical separations. It offers several advantages over large column ion exchange and liquid –liquid solvent extraction. Because extractant-coated resins are often more selective than ion exchange, these new methods are usually simpler than older ion exchange techniques. In addition, column extraction methods typically generate less liquid waste, can be employed using lower acid strengths and do not create hazardous organic solvent waste. Many of the new extraction chromatography resins available were developed at Argonne National Laboratory and are now marketed by Eichrom Technologies, Inc. (Darien, IL, USA).

Recently, the use of vacuum boxes and smaller particle size resin cartridges has become increasingly popular to reduce separation times and reduce labor costs. These boxes provide flow rates five times faster than gravity flow methods. This approach also allows the operator to apply increased vacuum to any "stubborn" columns that do not flow as fast as others in the batch. With gravity flow, one or more slow columns can significantly increase the time it takes to process the entire batch. The smaller particle size resin used with vacuum is 50 to 100 micron size. A typical particle size used with gravity-flow column methods is 100-150 microns. The smaller particle resin typically provides better resolution of elution bands than larger particle resin. The Westinghouse Savannah River Site Process Laboratory began using vacuum boxes in the 1980's to speed up ion exchange separations and later began applying this approach to extraction chromatography resins from Eichrom Technologies. The advent of prepacked resin cartridges *(1)* produced by Eichrom Technologies has made vacuum box separations even more popular.

In the 1990's, there was a need to upgrade radiochemistry methods at the Savannah River Site. The Savannah River Site Central Analytical Laboratory (CLAB) replaced a wide range of solvent extraction methods in CLAB used for the previous twenty to thirty years for actinide separation techniques. This eliminated mixed waste problems caused by the use of solvents such as hexane and thenolytrifluoroacetone (TTA)-xylene. New tandem methods *(2,3,4)* for process and waste analyses were developed at the Savannah River Site and implemented using rapid column extraction chromatography for a wide

range of process analyses. In 1998, an increase in requests at SRS to measure more than one actinide in urine samples prompted the need to consolidate actinide analysis into a single sequential method. A new method was successfully implemented for urine samples to take advantage of new resin cartridge technology that separates plutonium, neptunium, americium and uranium using a single column (*5).*

The SRS Environmental Laboratory analyzes a wide range of matrices, including water, air filters, soil, sediments, sanitary sludge, milk, and animal tissue. New radiochemical methods have been developed and implemented over the last two years in this lab to improve productivity, reduce labor costs and add both capability and capacity to this laboratory (*6,7).* This presentation will focus on recent improvements to optimize radiochemical methods in this laboratory.


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