



Contribution ID: 81

Type: Poster

Application of a mixed bed column for the removal of iodine from radioactive process effluents

Wednesday 19 September 2012 18:00 (1h 50m)

Safety and appropriate management of nuclear waste are of major importance in radioisotope production. Radioiodine has been identified as one of the most dangerous radioelements in terms of radiological effects on the population in case of accidental release; accordingly substantial efforts have been made to optimize the iodine capture in liquid effluents during the production process to avoid any possible iodine gas release from liquid waste during storage. The IRE production process results in highly acidic and oxidizing effluents, iodine might thus be present in various oxidation states and species. This needs to be taken into account for the decontamination of these effluents; accordingly a mixed bed column approach was chosen.

Literature reports the use of anion exchange resins and more recently of silver-coated sorbents such as zeolites, alumina or activated carbon for iodine removal, the latter being very attractive as silver is known to interact very strongly with iodine. However, these sorbents show significant leaching of silver when used in acidic media and can thus not be used in the present case.

CL Resin (TrisKem International) is an extraction chromatographic resin that retains silver over a wide pH range including high acid concentrations. It was further shown, after being loaded with silver, to strongly retain iodine species forming insoluble complexes with silver making it well suited for use in the given context; XAD-4 Resin (Sigma) on the other hand is known to retain elemental iodine.

A mixed bed column based on silver loaded CL Resin and XAD-4 resin was developed and optimized for iodine removal from IRE's process effluents by varying column size and resin ratios. Prepared mixed bed columns were evaluated by treating multi-curies production process solutions at the IRE. The mixed bed columns showed high iodine removal from elevated effluent volumes (> 10 L) even at flow-rates up to 150 mL/min.

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Session Classification: Poster Session

Track Classification: Nuclear Chemistry, Radionuclide Production, High-Power Targetry