



## Removal of $^{99}\text{Tc}$ from low level radioactive liquid waste using commercial anion exchanger resin

Vaishali De<sup>a</sup>, N.L. Sonar<sup>a,\*</sup>, Y. Raghavendra<sup>a</sup>, T.P. Valsala<sup>a</sup>, M.S. Sonavane<sup>a</sup>,  
Savita Jain<sup>b</sup>, Y. Kulkarni<sup>a</sup>, R.D. Changrani<sup>a</sup>

<sup>a</sup>Nuclear Recycle Board, Bhabha Atomic Research Centre, Tarapur 401 504, India

Tel. +91 2525 286320, 286276; Fax: +91 2525 282158; email: aakash3010@rediffmail.com

<sup>b</sup>Waste Management Division, Bhabha Atomic Research Centre, Trombay 400 085, India

Received 9 December 2010; Accepted 3 May 2011

### ABSTRACT

Technetium exists as pertechnetate ( $\text{TcO}_4^-$ ) ion under oxidizing condition. It is found in almost all streams originating from reprocessing plant. The presence of  $^{99}\text{Tc}$  results substantial operating problems in waste management practices due to the long half life ( $2.1 \times 10^5$  year with beta energy 0.297 MeV). Intermediate level radioactive liquid waste (ILW) generated at different steps of PUREX process is made alkaline using carbonates in order to facilitate its storage in carbon steel tank and to avoid precipitation in tank. Major radionuclides present in the waste are  $^{137}\text{Cs}$ ,  $^{90}\text{Sr}$ ,  $^{106}\text{Ru}$  and  $^{99}\text{Tc}$ . The waste also contains  $^{125}\text{Sb}$  and alpha emitting radionuclides in trace concentration. The waste is being treated by ion exchange process using resorcinol formaldehyde (RF) resin for removal of  $^{137}\text{Cs}$  and  $^{90}\text{Sr}$ . During pH adjustment of the waste stream, alpha radionuclides as well as  $^{90}\text{Sr}$  gets precipitated as corresponding hydroxide along with uranium and iron present in the waste. The conditioned waste was treated using RF resin. The effluent of the IX process is low active in nature. The activity of the IX column effluent is mainly due to  $^{106}\text{Ru}$  and  $^{99}\text{Tc}$ . Commercially available anion exchange resin Indion -GS300 was used for removal of  $^{99}\text{Tc}$  in the present study. The performance of this anion exchanger resin material was evaluated for removal of  $^{99}\text{Tc}$  from the radioactive liquid waste. Various parameters like effect of pH, effect of total dissolved salt content, column performance etc. were studied. The sorption behaviour was examined using various isotherms like Langmuir, Dubinin – Radushkevich and Freundlich. Thermodynamic parameters such as  $\Delta G$ ,  $\Delta H$  and  $\Delta S$  were also evaluated. Elution of 90% of loaded  $^{99}\text{Tc}$  from the loaded anion exchanger column was possible using concentrated nitric acid.

**Keywords:** Technetium-99; Anion exchange resin; Tetra phenyl arsonium chloride; Langmuir; Dubinin radushkevitch; Free energy

\*Corresponding author.