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Application of resin in pulp technique for ion exchange separation of uranium from alkaline leachate

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The hydrometallurgical process for the recovery of uranium from different ores uses ion exchange (IX) technique for the separation of dissolved uranium values. Conventionally, the IX process is carried out on leach solution obtained after the filtration or counter-current decantation of the leach slurries. Amongst the two types of leach pulps generated in uranium ore processing, viz acidic and alkaline, the latter one consists of predominantly fine-size pulps of higher viscosity, thus making the solid-liquid separation an arduous task. Sustained research for improvising the efficiency of various unit operations in the uranium process flowsheet have resulted in advent of new generation resins which are mechanically re-silent, posses higher exchange capacity thereby enabling separation of dissolved uranium ions from the leach pulps directly.
Some of the prominent low-grade uranium ore deposits in India are hosted in acid consuming gangue matrix. These ore deposits necessitate fine grinding as well as application of alkaline leaching for the dissolution of uranium values. The leach pulps analyse 500 –600 mg/l of U3O8 and contain total dissolved solutes (TDS) to the extent of about 50 g/l. Analysis of the characteristics of the leach pulp indicated suitability of resin-in-pulp technique for the separation of uranyl carbonate anions from the leachate. This paper describes the results of the RIP test work on alkaline leach slurry using various commercially available strong base anionic exchange resins. Parametric variation studies were conducted to establish the adsorption isotherm and sorption kinetics followed by elution of loaded uranium. Based on these results semi-continuous experiments on "carousel"mode was carried out. The results indicate superiority of gel type polystyrene based resins grafted with quaternary ammonium ion in comparison to the macro-porous resins. Semi-continuous counter-current extraction and elution tests indicated that about 98% of the dissolved uranium values can be recovered during the loading process and practically the entire loaded uranium can be eluted using NaCl eluant. Integration of the RIP followed by precipitation of dissolved uranium as uranium peroxide helps in overcoming processing difficulties associated with slimy diuranate precipitates.

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