DECONTAMINATION OF SPENT DIAMEX SOLVENTS CONTAINING CONTAMINANTS DIFFICULT TO STRIP

Kamil Vavřinec Mareš, Jan John, Martin Vlk, Ferdinand Šebesta, Tereza Svobodová
Czech Technical University in Prague, Czech Republic

Abstract

A serious obstacle in industrialization of the DIAMEX process is accumulation of "difficult-to-strip" elements (e.g. Ru, Y, Mo, Pd, Zr, Sr etc.) in the spent solvents. The aim of this study was to verify the possibility to decontaminate such spent solvents by solid sorbents.

A thorough literature review revealed that activities in the field of separation of metals from non-aqueous media are rare. Materials, which can be used for efficient separation of metals from non-aqueous liquids, include micro- and macroporous ion exchange resins, papers impregnated with resins, and (modified) cellulose. A general observation has been that the effect of small amounts of water on the distribution equilibria can be remarkable, especially in low-polar solvents. A problem in the pre-selection of potentially suitable sorbents is the fact that for the case of spent solvents and the metals like Ru or Pd, their speciation in organic phase is hardly predictable and may well be of non-ionic nature (colloids or pseudo-colloids containing reduced species etc.).

For the experimental part of this work, the DIAMEX solvent based on TODGA in kerosene /octan-1-ol (5 vol.%) mixture was used as a reference system. An attempt to characterize speciation of the elements of interest in the simulant of the spent solvent was done by FTIR, ESI-MS, APCI-MS, and thin-layer chromatography.

More than 50 solid sorbents of various nature, identified as potentially prospective, were obtained and their efficiency for the removal of Ru and Y from the simulated spent solvent was screened in batch contact experiments. The results obtained revealed that relatively high weight distribution ratios D_g, sufficient for the design of a process for quantitative separation of the contaminants from the solvent, can be achieved for some of the solid sorbents, e.g. Amberlyst A26 or Fe-EDA-SAMMS. For the prospective materials, sorption kinetics and sorption isotherms were determined. The materials with the highest sorption capacity were tested in dynamic column experiments. The results obtained in these tests will be presented in detail.