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Solid phase extractive preconcentration of Uranium from Jordanian phosphoric acid using 2-hydroxy-4-aminotriazine-anchored activated carbon

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Abstract: Jordanian phosphate ore contains 70?150 parts per million (ppm) uranium. The uranium in the ore tends to dissolve during the leaching of phosphate ore with sulfuric acid to produce phosphoric acid (PA). Solvent extraction (SX) using various extracting agents is widely used to extract uranium from PA . Meanwhile, much research work has been carried out to develop suitable solid phase extractants in order to reduce cost and enhance efficiency. In this study, a new solid phase extractant has been synthesized by anchoring 2-hydroxy-4-aminotriazine onto activated carbon (ACH). The extraction of uranium from Jordanian PA using ACH and the synergistic mixture of di-ethylhexyl phosphoric acid and trioctyl phosphine oxide (DEPA?TOPO) diluted in kerosene were investigated and the performance of each extractant was evaluated and compared. The results showed that 91% extraction and 559.9 ppm loading capacity were achieved after 2 to 3 min mixing time using 0.5MDEPA?0.125MTOPO at 20 ?C, 410mV and 1/1 phase ratio. The activation energy (Ea) of the solvent extraction (?26.03 kJ mol?1), calculated from Arrhenius plot, indicates that the reaction is barrier-less and exothermic in nature. On the other hand, uranium sorption onto ACH reaches equilibrium after 10 min and about 92% extraction can be achieved at 20 ?C, Co = 70 mg/l, V = 200 ml, W = 100 mg and 410 mV; the rate constant for the uranium sorption onto ACH (16.54 ? 10?3 g mg?1 min?1) was calculated from the pseudo-second order equation. The countercurrent extraction results showed that ACH has high physical , chemical stability and loading capacity about 618 mg g?1. Thermodynamic parameters (?Hads ? = 20.61 kJ mol?1, ?Sads ? = 160.47 J mol?1 K?1, ?Gads ? (333.3 K) = ?32.87 kJ mol?1) suggest that the adsorption is endothermic and spontaneous in nature, which confirm the feasibility of the process.