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TAILORED-DESIGN OF RADIATION MODIFIED IMPRINTED POLYMER ADSORBENT FOR SELECTIVE REMOVAL OF THORIUM AND URANIUM

Adsorption has been proven as an effective process for the separation of metal ions, especially at relatively low concentration. However, conventional chelating polymer adsorbents suffer limitation of selectivity. Ion-imprinted polymer has been receiving great attention due to its selective recognition of targeted ion in solution via cavity imparted into the polymers. This research aims to develop a grafted ion-imprinted polymer (IIP) adsorbent for the selective recognition of thorium, in the presence of uranium as interfering ion in acidic aqueous system. A new concept of surface imprinting in the synthesis of IIP is proposed by using radiation induced graft polymerization and crosslinking techniques. The concept is based on the usage of polyolefin non-woven fiber (PE/PP-NWF) that consists of polypropylene (PP) core and polyethylene (PE) sheath as the polymer substrate and the creation of an imprinted layer grafted onto the surface of the substrate. An amine-based monomer, 2-(Dimethylamino)ethyl methacrylate (DMAEMA) was covalently bonded onto the PE/PP-NWF through graft polymerization (denoted as P-DMAEMA) and followed by template, thorium complexation through adsorption. Afterwards, the P-DMAEMA was crosslinked with divinylbenzene (DVB) to form the cavity of IIP and finally the template was removed. The physicochemical properties of the synthesized polymer adsorbents were characterized. The effect of operational parameters was investigated in batch adsorption experiment. The experimental data were correlated with several isotherm and kinetic models for the determination of the adsorption potential. It was found that P-DMAEMA showed favourable adsorption towards uranium (U(VI)) compared to thorium (Th(IV)). After crosslinking process, the IIP showed a reverse selectivity pattern with the highest selectivity coefficient ratio of Th(IV) over U(VI) was 3.1. The findings of this study will help in designing adsorbents for future application in radioactive wastewater research.

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