

Synthesis of Modified Cellulose for the Capture of Uranyl Ions from Aqueous Solutions

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Abstract : The poly(amidoamine) dendrimers (PAMAM) are a class of material introduced by D. Tomalia. Modifications of the PAMAM dendrimer with several functional groups have attracted the attention for new interesting properties and new applications in many fields such as chemistry, physics, biology, and medicine. However, in the last few years, the use of dendrimers in environmental applications has increased due to pollution concerns. In this contribution, we report the synthesis of three new PAMAM derivatives modified with asparagine amino acid supported in cellulose: PG0-Asn (PAMAM-asparagine), PG0-Asn-Trt (with trityl group) and PG0-Asn-Boc-Trt (with tert-butyl oxycarbonyl group). The functionalization of generation 0 PAMAM dendrimer was carried out by amidation reaction by using an EDC/HOBt protocol. In a second step, functionalized dendrimer was covalently supported to the cellulose surface and used to study the capture of uranyl ions from aqueous solution by fluorescence spectroscopy. The structure and purity of the desired products were confirmed by conventional techniques such as FT-IR, MALDI, elemental analysis, and ESI-MS. Batch experiments were carried out to determine the affinity of uranyl ions with the dendrimer in aqueous solution. Firstly, the optimal conditions for uranyl capture were obtained, where the optimum pH for the removal was 6, the contact time was 4 hours, the initial concentration of uranyl was 100 ppm, and the amount of the adsorbent to be used was 2.5 mg. PAMAM significantly increased the capture of uranyl ions with respect to cellulose as the starting substrate, reaching 94.8% of capture (PG0), followed by 91.2% corresponding to PG0-Asn-Trt, then 70.3% PG0-Asn and 24.2% PG0-Asn-Boc-Trt. These results show that the PAMAM dendrimer is a good option to remove uranyl ions from aqueous solutions.

Keywords : asparagine, cellulose, PAMAM dendrimer, uranyl ions

Conference Title : ICEC 2020 : International Conference on Environmental Chemistry

Conference Location : London, United Kingdom

Conference Dates : March 12-13, 2020