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Surface modification of polyethersulfone membranes with goethite through self-assembly

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ABSTRACT

The use of ultrafiltration membranes for wastewater treatment is a technique that has gained importance in recent decades. Its success is based on the fact that low energy is required for separating species due to low-pressure operating conditions compared with the techniques of nanofiltration and reverse osmosis. The major disadvantages of processes using ultrafiltration membranes for separation are the large pore size and membrane fouling. To overcome these drawbacks, ultrafiltration membranes have been modified by physical and chemical treatment in an attempt to reduce the pore size and change the surface properties of the membrane for specific applications. In this work, the surface modification of polyethersulfone ultrafiltration membranes by sub-microparticles of goethite is presented. The surface modification is achieved through self-assembly by coating the polyethersulfone membranes with goethite sub-microparticles in suspension. The modified membranes were characterized by scanning electron microscopy (SEM), energy-dispersive X-ray spectroscopy (EDS) and fourier transform-infrared (FT-IR). The results obtained display the goethite's interaction with the membranes through hydrogen bonds between the hydroxyl groups of the goethite, and the $–SO_2$ and CO bonds present in polyethersulfone. The membranes obtained were evaluated for retention of chromate ions at pH values of 4 and 8. It was observed that membranes modified with 1 mg of goethite are capable of retaining almost 90% of the Cr(VI) at pH 8. The pH increase ionizes the hydroxyl groups of the goethite and creates a negative charge on the membrane that rejects chromate ions. The modification of the membrane can be achieved by a simple and efficient procedure that achieves the separation of charged species at low pressure (20 psig).

Keywords: Ultrafiltration; PES; Self-assembly; Goethite; Cr(VI)

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