Application of novel surface-modified PES membranes for removal of heavy metals from aqueous solutions

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ABSTRACT

Plasma-treated poly(ether sulfone) (PES) membranes were functionalized with gamma-mercaptopropyltriemethoxysilane (MPTMS) in order to increase their affinity for heavy metals during filtration of aqueous solutions. The influence of effective parameters concerning the modification process such as concentration and pH of the silane solution on both surface properties and performance of the membranes were investigated. ATR-FTIR, contact angle, SEM, and EDS measurements were carried out to characterize the membranes. After plasma treatment, the hydrophilicity of the membranes increased which resulted in an increase in the adsorption of silanol groups on the membranes surfaces. By decreasing the pH level of the silane solutions to 3.5, the adsorption of silanol groups on the surface of plasma-treated PES membranes increased. The MPTMS-modified membranes showed a significant increase in heavy metal adsorption and a decrease in flux. Moreover, MPTMS-modified membranes showed a high selectivity for Hg^{2+} ions as well as good stability and recovery during filtration process.

Keywords: Polyethersulfone membrane; Surface functionalization; Heavy metal; Separation; Adsorption; Mercapto silane