Announcing the Final Examination of Amirsalar Rabbani Esfahani for the degree of Doctor of Philosophy

Time & Location: March 12, 2020 at 2:30 PM in Engineering II 211
Title: Removal of Heavy Metals From Landfill Leachate Using Electrospun Polyelectrolyte Complex Fiber-Laminated Ultrafiltration Membrane

Ultrafiltration (UF) is a low-pressure membrane process that yields higher permeate flux and saves significant operating costs compared to NF/RO. However, UF has not been applied as a primary method for landfill leachate treatment due to its large pore size. This research investigated the removal of heavy metals from landfill leachate using an UF membrane laminated with fiber mats produced from electrospinning of a polyelectrolyte complex. In this research, we modified the surface of the UF membrane with two polyelectrolytes including Polyacrylic Acid (PAA) and Polyallylamine Hydrochloride (PAH). The removal of heavy metals including Pb, Cd, and Cu from water using electrospun (ES) polyelectrolyte (PE) complex fibers of polyacrylic acid (PAA) and polyallylamine hydrochloride (PAH) was investigated.

PAA/PAH fiber mats were fabricated under various electrospinning operating conditions to optimize fiber size and stability. The fiber mats exhibited approximately 63%, 42%, and 21% removals of Pb, Cd, and Cu, respectively in synthetic metal solutions at pH 3.4. Furthermore, approximately 70%, 98%, and 92% removals of Pb, Cd, and Cu, respectively were observed at a higher pH (7.4). Moreover, the removal of heavy metals from various synthetic feed solutions and landfill leachate by the PAA/PAH-laminated UF membranes (PAA/PAH-UF) was studied. The PAA/PAH-UF membrane exhibited approximately 38%, 49%, and 85% higher removal of Pb, Cu, and Cd, respectively from laboratory-prepared metal ion solution (DI water) when compared to the unmodified UF membrane (UF). The PAA/PAH-UF membrane exhibited approximately 18% and 15% higher removal of Pb and Cu, respectively in the leachate when compared to DI water. The PAA/PAH-UF membrane showed around 16% and 72% higher removal of Pb and Cd at the presence of NOM. Moreover, the UF membrane showed approximately 18%, 25%, and 30% more removal of Pb, Cd, and Cu at the presence of NOM, respectively.

Major: Environmental Engineering

Educational Career:
Bachelor's of Civil Engineering, BS, 2012, IAUKHSH University
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Committee in Charge:
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Approved for distribution by Anwar, Sadmani, Committee Chair, on February 25, 2020.

The public is welcome to attend.