Two Dimentional MXene / PVC Membrane for Removal of Lead and Bovine Serum Albumine

by

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Abstract

Since their inception in 2011, MXenes have attracted significant

attention from a range of industries due to their fascinating architectures

and alluring features. Given its two-dimensional multilayered structures,

high mechanical strength, outstanding electrical conductivity, and

customizable surface chemistry, MXene, a new family of two-dimensional

(2D) multifunctional nanomaterials, has demonstrated exceptional

performance in water treatment technologies. This study explores the

synthesis of MXenes from MAX phases and then the fabrication of

MXene-based membranes by incorporating them into the solution of

polyvinyl chloride (PVC) polymer and Dimethylacetamide (DMAc)

solvent for the first time to enhance ultrafiltration (UF) performance for

wastewater treatment. The loading of MXene in the PVC solution was

adjusted from 0 to 0.5g in order to create modified membranes. The

properties and performance of these membranes were thoroughly analyzed

using field emission scanning electron microscopy (FE-SEM), contact

angle (CA) measurements, Fourier transform infrared spectroscopy (FTIR),

Bovine serum albumin (BSA) rejection, pb metal ions rejection and water

permeation flux tests. Among the developed membranes, the N2-modified

PVC membrane, with 0.4g of MXene, exhibited the most favorable

characteristics, including a contact angle of 65.77° and a porosity of 84.8%.

This membrane achieved the highest clean water permeation flux of 201.3

LMH, along with a 99.9%, 91.03% BSA, pb rejection rate respectivly, and

a flux recovery ratio (FRR) of 90.2%. ANOVA was employed to assess the

significance of individual factors, while RSM was used to optimize

membrane performance by modeling and analyzing the interactions

between multiple variables. The incorporation of MXene nanosheets

significantly enhanced membrane efficiency compared to neat PVC

membranes, demonstrating the promising capabilities of MXene-