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Synthesis of Carbonaceous Nanowire Membrane for Removing Heavy Metal Ions and High Water Flux

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Abstract

This study investigated the hydrothermal synthesis of carbonaceous nanowire membrane (CNM) and its separation performances in terms of adsorbing heavy metals and transmembrane water permeation in water treatment. The hydrothermal dehydration and carbonization of mono-saccharide (glucose; 180 °C, 48 h) can yield one-dimensional (1D) carbonaceous nanowires in the presence of tellurium nanowire template. The subsequent solution-evaporation-self-assembly process results in the formation of macro-scale two-dimensional (2D) hydrophilic CNM sheet with large specific surface area, developed nano porosity, and abundant superficial oxygen-containing functional groups. Owing to these unique properties, the CNM is shown to be capable of efficiently adsorbing a variety of heavy metals, and highly permeable to water molecules. The CNM synthesized gives precedence over conventional membrane and adsorbents, and demonstrates promise as sustainable nanomaterial for separation of heavy metals from water via membrane adsorption process.

Keywords: Hydrothermal carbonization; carbonaceous nanowire membrane; removal of heavy metals

1. Introduction

Heavy metals, which are known as natural components existing in the crust of the Earth, are