Three-dimensional MXene ($Ti_3C_2T_x$) Film for Radionuclide Removal From Aqueous Solution

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Abstract

MXenes are a new family of 2D transition metal carbide nanosheets analogous to graphene (Lv et al., 2017; Sun et al., 2018). Due to the easy availability, hydrophilic behavior, and tunable chemistry of MXenes, their use in applications for environmental pollution remediation such as heavy metal adsorption has recently been explored (Li et al., 2017). In this study, three-dimensional (3D) MXene ($Ti_3C_2T_x$) films with high adsorption capacity, good mechanical strength, and high selectivity for specific radionuclide from aquose solution were successfully fabricated by a polymeric precursor method using vacuum-assisted filtration. The highest removal efficiency on the films was 99.54%, 95.61%, and 82.79% for Sr^{2+}, Co^{2+}, and Cs^{+}, respectively, using a film dosage of 0.06 g/ L in the initial radionuclide solution (each radionuclide concentration = 1 mg/L and pH = 7.0). Especially, the adsorption process reached an equilibrium within 30 min. The expanded interlayer spacing of $Ti_3C_2T_x$ sheets in MXene films showed excellent radionuclide selectivity (Cs^{+} and/or Sr^{2+}/Co^{2+}) (Simon, 2017). Besides, the MXene films was not only able to be easily retrieved from an aqueous solution by filtration after decontamination processes, but also to selectively separate desired target radionuclides in the solutions. Therefore, the newly developed MXene ($Ti_3C_2T_x$) films has a great potential for radionuclide removal from aqueous solution.

Keywords: MXene; Radionuclides; Polymer films; Separation; Adsorption

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