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ABSTRACT

2D Nanomaterials Applications for Emerging Contaminant Removal from Water Streams

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Characteristic properties of two-dimensional (2D) transition metal carbides and nitrides (MXenes), such as high conductivity, hydrophilicity, and catalytic activity have led to a growing research interest in their use in environmental remediation and water treatment applications. The ability to process MXenes into flexible films with negative surface charge and hydrophilicity adds a possibility to control ion flux and biofouling by applying a small potential to the membrane. MXene shows a much higher antibacterial efficiency toward both Gram-negative and Gram-positive bacteria as compared with other 2D nanomaterials. Consequently, MXene membranes demonstrated outstanding water flux, and selective rejection of salts and organic molecules, which makes them ideal UF/NF membrane materials. Moreover, MXene has been successfully used for the efficient adsorption and removal of heavy metals such as Hg, and Cu. This talk summarizes the recent advances in the applications of MXenes as adsorbents, desalination membranes, electrodes for electrochemical deionization, and catalytic or antibacterial agents for water purification and other environmental remediation processes. The overview also features discussions on the computational attempts, biocompatibility, and environmental impact in the exploration of MXenes for water applications, highlighting the challenges and opportunities of these advanced 2D materials. The biocompatibility and cytotoxicity assessment of MXene and its impact on the environment will be highlighted.