Bacterial nanocellulose/MoS_2 hybrid aerogels as bifunctional adsorbent/photocatalyst membranes for *in-flow* water decontamination

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To address the limitations associated with the use powder nanophotocatalysts in water purification, in this study, we report the preparation of self-standing, porous hybrid aerogel membranes, (BC/MoS_2, with excellent adsorption-cum-photocatalytic properties. A molecular precision in the coating of quantum-confined MoS_2 nanostructures on bacterial cellulose (BC) nanofibrils was achieved through precursors' pre-adsorption on BC, followed by controlled hydrothermal growth, thus yielding hybrid BC/MoS_2 aerogels, characterized by high surface area and pore volume and controlled interlayer distance in the MoS_2 nanostructures. The resulting porous membranes, particularly those with inter-layer expanded MoS_2, when used inside a specifically design photoreactor, allow efficient *in-flow* removal of both organic molecule (MB) and heavy metal (Cr(VI)) ions, separately and/or simultaneously, under UV-vis light illumination and exhibit excellent recyclability and photostability. This highly efficient hybrid aerogel/photoreactor assembly represents a significant advancement in the use of self-standing monolithic aerogel materials for photocatalytic applications in liquid media.

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