“Tailored CNTs Buckypaper Membranes for the Removal of Humic Acid and Separation of Oil-In-Water Emulsions”

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Carbon nanotubes (CNTs) are a robust material and proven as a promising candidate for a wide range of electronic, optoelectronic and environmental applications. In this work, two different methods were utilized for the preparation of CNTs exhibiting different aspect ratios via chemical vapor deposition (CVD). The as-prepared CNTs were analyzed using scanning electron microscopy (SEM), transmission electron microscopy (TEM), N_2adsorption isotherms, thermogravimetric analysis and Raman spectroscopy in order to investigate their morphological and structural properties. Free-standing CNTs “buckypaper” membranes were fabricated, characterized and tailored to meet the requirements of two applications, i.e., (1) the removal of humic acid (HA) from water and (2) separation of oil-in-water emulsions. It was revealed that the hydrophobic bucky papers showed high separation performance for Shell oil-in-water emulsions filtration, with up to 98% through the accumulation of oil droplets onto the membrane surface. The absorption capacity of buckypaper membranes for various organic liquids (oil, chloroform and toluene) was evaluated over 10 absorption cycles to investigate their recyclability and robustness. Moreover, surface modification was introduced to the pristine CNTs to increase their surface hydrophilicity and improve the pure water permeability of buckypapers. These modified buckypapers showed high flux for HA solutions and excellent HA rejection efficiency up to 95%via size exclusion and electrostatic repulsion mechanisms.

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