Nanocomposite devices for water treatment and land remediation

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Nanotechnology offers huge potential in water treatment, given the extremely high reactivity and capacity of nanoparticles, and the novel reactions that can be generated at the nano-scale. This presentation outlines recent research carried out at the University of Brighton and with European academic and industrial partners aimed at developing flexible, low-cost and non-toxic nanocomposite devices for water treatment and land remediation applications. Prototype devices based on carbon, silver, gold and iron nanoparticles / nanoporous materials incorporated into stable polymer, silica and carbon-based "scaffolds" have been generated in a variety of larger-scale geometries, and show considerable utility in rapidly removing a range of problem contaminants from water and effluent streams. Fe nanoparticle : macroporous polymer composites show high adsorptive capacities for As(III) at significantly higher flow rates than conventional bead-type devices, while recent work using Ag nanoparticles on silica substrates indicates rapid and very high removal capacities (at hyperstoichiometric ratios) for Hg. The use of a flexible (and low-cost) "scaffold" as a host for the nanoparticles allows the devices to be produced in a range of geometries, which permits their use in a variety of configurations at point of treatment or as decentralised solutions, e.g. as a high-through flow filter for liquids with various viscosities (e.g. water through to blood and oils), or as a bed reactor or pipe liner device. Current work is examining the application of these nanocomposite devices in land remediation applications, as soil stabilizers/amendments or as permeable reactive barrier materials.

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