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SURFACE-COATED SAND FOR CONCURRENT REMOVAL OF FLUORIDE AND TURBIDITY IN DRINKING WATER

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Drinking water treatment using sand filters has a long history in water purification plants, and it is one of the most energy-intensive components. Sand filters have many variants, such as rapid sand filters, etc., to enhance their efficiency. The majority of sand filters are used to trap suspended solids and colloid particles in the water. In the present study, the sand granules are modified to improve their efficiency by simultaneously removing fluoride and turbidity. The sand particles were chemically modified using iron oxide in the presence or absence of graphene oxide (labeled as Fe_2O_3-S for Fe_2O_3 coated sand, or Fe_2O_3-GOS for Fe_2O_3 and graphene oxide coated sand) mimicking the natural sand coating processes that occur in the environment. The graphene oxide (GO) was synthesized using Sri Lankan vein graphite as a starting material. The surface properties of sand composites were characterized by IR spectroscopy, X-ray diffraction, and surface titration methods conducted to probe their sites' reactivity. According to the surface titration data, the pH_{zpc} was at 6.30 for GOS, Fe_2O_3-S, and Fe_2O_3-GOS surface titration are in progress. Compared to Fe_2O_3-S, GOS and Fe_2O_3-GOS showed enhanced stability in water. The fluoride removal efficiency of sand, Fe_2O_3-S, GOS, and Fe_2O_3-GOS were 4.3, 17.0, 69.0, and 73.0%, respectively, at 2 mg l^{-1} initial fluoride loading. In the presence of bare sand, the water turbidity values increased from 0.85 to 1.04 NTU due to the presence of negatively charged colloids. However, when sand was chemically modified, the turbidity was decreased by 60% in Fe_2O_3-S, 90% in GOS, and 96% in Fe_2O_3-GOS (from 0.85 NTU to 0.34 NTU, 0.08 NTU, and 0.03 NTU). Our data suggested that the Fe_2O_3-GOS is the most stable for excess fluoride and turbidity removal in water. All these experiments were conducted in batch mode, and column mode experiments are in progress for reactor designs.

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Keywords: Coated sand, Fluoride, Graphene oxide, Sand filters, Turbidity