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Simultaneous removal of mixed Pb(II) and tetracycline using magnetic strontium hexaferrite doped ZIF-8 nanocomposite

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Simultaneous removal of mixed Pb(II) and tetracycline using magnetic strontium hexaferrite doped ZIF-8 nanocomposite

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Tetracycline (TC) has been widely used as an antibiotic and as an additive to aquatic products and livestock feeds. TC is a non-biodegradable, and its long-term exposure can disturb an immune function of human and increase the risk for various diseases. Because surface waters and wastewater effluents commonly contain TC mixed with heavy metals, it is a still challenge to simultaneously sequestrate those mixed pollutants from the aqueous media. In recent years, several methods such as advanced oxidation, electrochemistry, biodegradation, and adsorption have been developed to remove TC and Pb(II). Among these techniques, adsorption is more preferable, but previously reported adsorbents for TC and Pb(II) adsorption are quite limited. In this study, zeolitic imidazole framework-8 (ZIF-8) was loaded onto the strontium hexaferrite ($SrFe_{12}O_{19}$) with the help of sodium lauryl sulfate via an in-situ self-assembly method. The morphological structures and surface properties of the obtained material (SFZIF-8) were confirmed by X-ray diffraction, Fourier transform-infrared spectroscopy, zeta potential, X-ray photoelectron spectroscopy, field emission-scanning electron microscopy, and high-resolution transmission electron microscopy. Batch experiments exhibited that SFZIF-8 could uptake higher amount of TC and Pb(II) compared to the pristine ZIF-8 and $SrFe_{12}O_{19}$ alone and commercial activated carbons. The effect of operating parameters such as solution pH, initial pollutant concentration, adsorbent dosage, and co-existing ions on the adsorption of TC and Pb(II) as well as adsorption kinetics and isotherms were also determined. The as-prepared SFZIF-8 can be easily recovered using an external magnets and recycled to remove TC and Pb(II) multiple times. Considering magnetic controllability and high adsorption capacity, SFZIF-8 is a promising and potent material for adsorption of TC and Pb(II) from water.

Keywords : $SrFe_{12}O_{19}$, ZIF-8, Pb(II), Tetracycline, Adsorption