Facile synthesis of aluminum-based bimetallic (hydr)oxides for enhanced fluoride removal from water

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A B S T R A C T

Various aluminum-based bimetallic (hydr)oxides including Mn, Zn, Cu, Bi, Zr and La have been synthesized in single-step coprecipitation without high energy consumption. The characterization of Ce–Al (hydr)oxides and La–Al (hydr)oxides was undertaken by scanning electron microscopy with an energy dispersive X-ray spectroscopy, zeta potential measurement, X-ray powder diffractometer and N2 adsorption/desorption analysis. The tendency of fluoride affinity to these aluminum-based bimetallic (hydr)oxides confirmed that the fluoride removal of the various composites decreased with the augment of the electronegativity of the anchored metals. Ce–Al (hydr)oxides and La–Al (hydr)oxides have better potential of fluoride removal from aqueous solution with adsorption capacity of 105.05 and 86.48 mg g⁻¹ calculated from Langmuir model. The high fluoride removal performance was attributed to the fact that both Ce and La atoms can act as a bridge between adsorbed fluoride and adsorbents surface while the main role for Al atoms was to form an amorphous structure. The regeneration confirmed that Ce–Al (hydr)oxides have good reusability in fluoride removal after the five recycle. The results indicate that the Ce–Al (hydr)oxides composites could be preferably used as an effective adsorbent for fluoride removal from aqueous solution.

Keywords: Aluminum-based bimetallic (hydr)oxides; Ce–Al (hydr)oxides; La–Al (hydr)oxides; Fluoride removal

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