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An Acid-Resistant Magnetic Nb-Substituted Crystalline Silicotitanate for Selective Separation of Strontium and/or Cesium Ions from Aqueous Solution

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Abstract: In this work, magnetic Nb-substituted crystalline silicotitanate (mag-Nb-CST), which can be used for separation of Sr^{2+} and Cs^{+} from aqueous solution, is successfully synthesized by embedding amine-functionalized Fe_3O_4 into the Nb-substituted crystalline silicotitanate (Nb-CST), being characterized by various techniques such as XRD, SEM, EDS, XPS, and VSM. The studies on the adsorption behaviors show that the adsorption process reaches equilibrium within about 8 hours, and the maximum adsorption capacity on mag-Nb-CST is 14.38 mg g^{-1} at pH 11.00 for Sr^{2+}, and 11.18 mg g^{-1} at pH 4.00 for Cs^{+}, respectively. Besides the excellent selectivity towards Sr^{2+} and Cs^{+} over various lanthanides and actinides, the pH dependence on the adsorption capacity suggests a possibility to separate Sr^{2+} and Cs^{+} from each other by simply adjusting pH. Mag-Nb-CST is able to remove most of the Sr^{2+} and Cs^{+} at ppb level. Even in real seawater, it is able to remove 94.19% of Cs^{+}. Moreover, mag-Nb-CST shows good acid-resistance and radiation stability. The crystal structure and morphology remained almost