Electronic Supplementary Material (ESI) for RSC Advances.

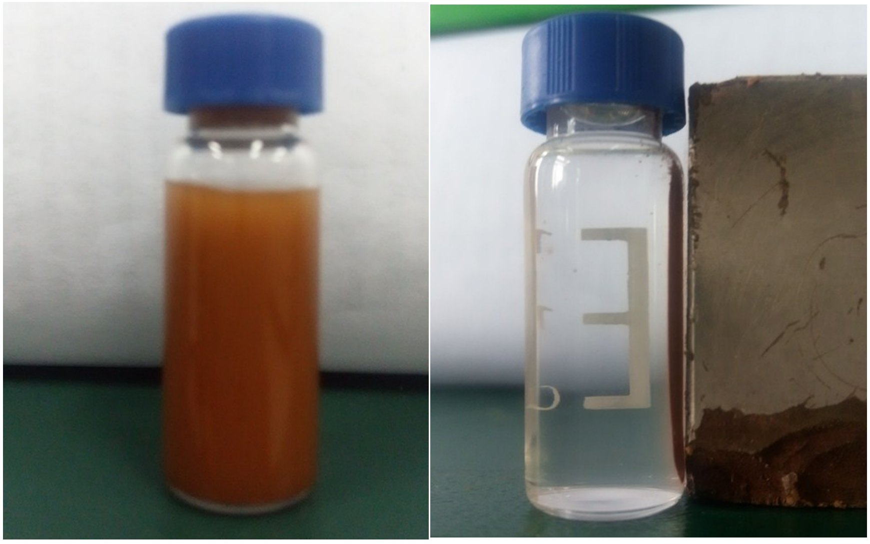


Fig. S1. The composite in the absence (left) and presence (right) of an external magnetic field

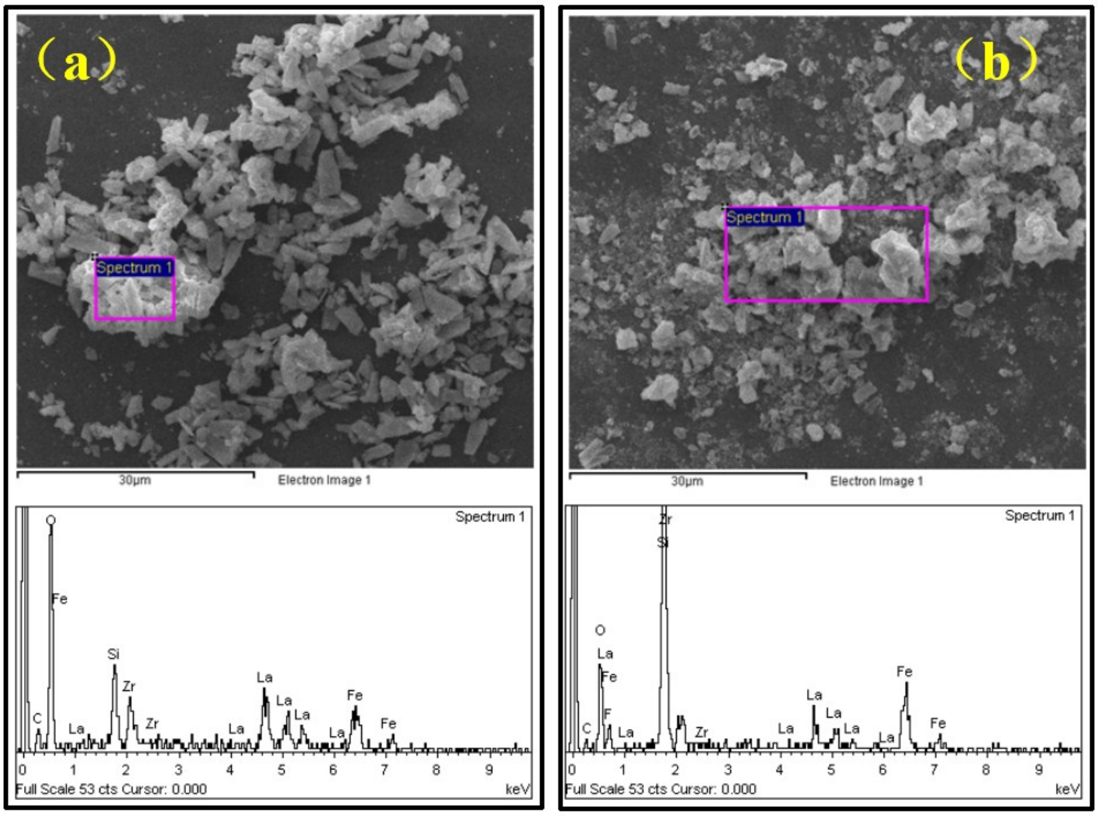


Fig. S2. (a) EDS of La-Zr magnetic composite; (b) EDS of La-Zr magnetic composite dried at 60℃ after adsorbed 300 mg/L F^-.

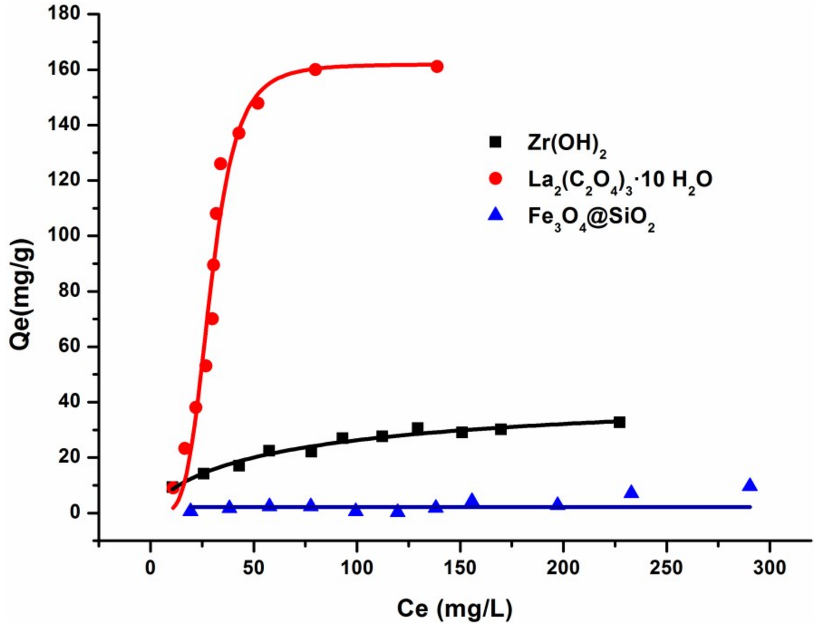


Fig. S3. Comparison between the measured and Lan-Fre isotherm modeled profiles of $ZrO(OH)_2$, $La_2(C_2O_4)_3$ • 10 H_2O and $Fe_3O_4@SiO_2$.

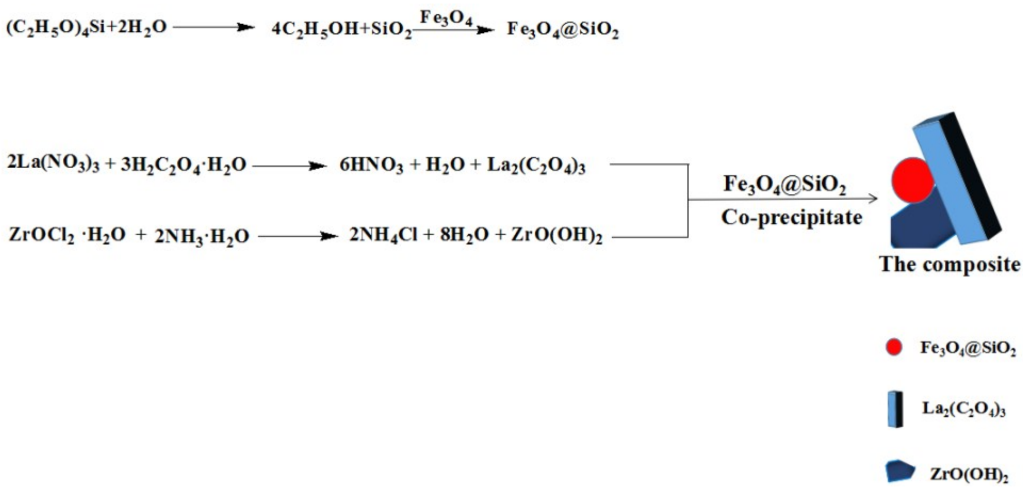
$ZrO(OH)_2$ was prepared with the same preparation method of La-Zr composite without adding $Fe_3O_4@SiO_2$ and $La(NO_3)_3$; $La_2(C_2O_4)_3$ • 10 H_2O was prepared with the same preparation method of La-Zr composite without adding $Fe_3O_4@SiO_2$, $ZrOCl_2$ •$8H_2O$ and NH_3• H_2O.

Adsorption isotherms were studied in the same conditions as La-Zr composite. The data fitting to Lan-Fra isotherm model are shown in Fig. S3. Regression coefficient (R^2) of $ZrO(OH)_2$ is 0.9655, and the maximum calculated sorption capacity is 46.50 g/mg; Regression coefficient (R^2) of $La_2(C_2O_4)_3$ • 10 H_2O is 0.9604, and the maximum calculated sorption capacity is 161.95 g/mg; The data of $Fe_3O_4@SiO_2$ can not be fitted to Lan-Fre model, and can not be fitted to Langmuir or Fredunlich models as well. The adsorption capacity of the composite is considered mainly comes from $La_2(C_2O_4)_3$ • 10 H_2O due to its high adsorption capacity toward F^-. But it is too expensive to use bare La compound as adsorbent since La is a rare earth element. $ZrO(OH)_2$ is a chemically inert and highly biocompatible material with low cost [1-4]. Furthermore, one can see from Fig. S3 it has medium adsorption capacity toward F^-. Consequently, it is an ideal component used to compose with La compound to cheapen the adsorbent while retain high adsorption ability. In addition, biocompatibility of $ZrO(OH)_2$ will significantly decrease the second contamination to environment, even if the composite were ineffectively recovered after used as adsorbent [1-2]. Adsorption ability of $Fe_3O_4@SiO_2$ is too low to make any sense for adsorbing F^- in the composite. Its function is to endow magnetism to the composite facilitating operation.

Table S2 Comparison the La-Zr composite with two other reported adsorbents with better adsorption records

Adsorbent	Preparation method	The maximum adsorption ability (mg/g)	Best fitted isotherm model	Best fitted kinetic model	Reference
La-Zr composite	Co-precipitated $La_2(C_2O_4)_3$ and $ZrO(OH)_2$ at the presence of nano $Fe_3O_4@SiO_2$	88.5	Lan-Fre isotherm model	Pseudo-second-order kinetic model	This study
Nano zirconium chitosan composite	synthesized Zr nanoparticles using aqueous extract of Aloevera, and then omposed it with chitosan by embedding.	96.58	Langmuir isotherm model	Pseudo-second order model	J. Hazard. Mater., 276 (2014) 232-240
Calcined MgAl-CO3 LDHs	Calcined MgAl-CO3 layered double hydroxides at 500 ℃ for 2 h.	141.64	No study	pseudo-second-order kinetic model	Ind. Eng. Chem. Res. 2006, 45, 8623-8628

The preparation scheme of the composite adsorbent



Reference

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