Supplementary Information

A new adsorbent of Ce ion-implanted metal-organic frameworks with high efficiency of Ce utilization for removing fluoride from water

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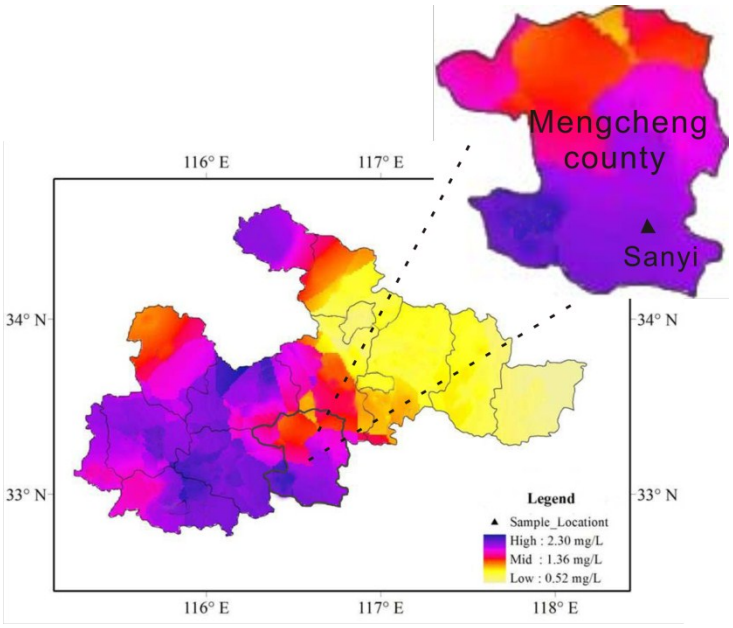

Fig. S1 The distribution of fluorine pollution in north of Anhui Province, China

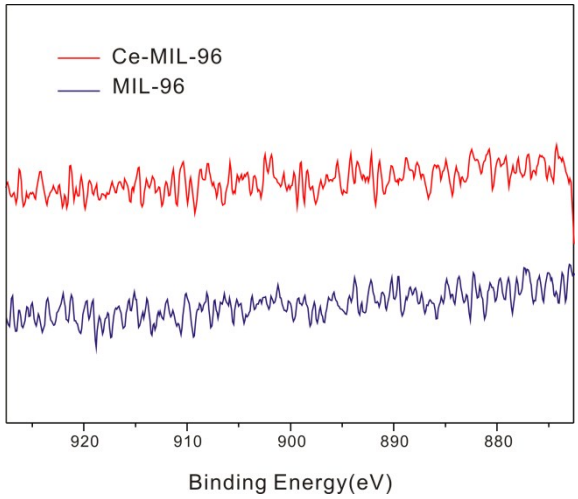

Fig. S2 XPS high resolution Ce3d spectra of MIL-96 and Ce-MIL-96.

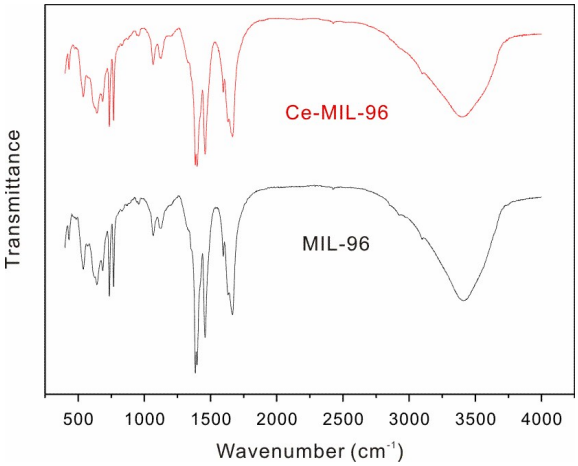

Fig. S3 FTIR spectra of the powdered MIL-96 and Ce-MIL-96.

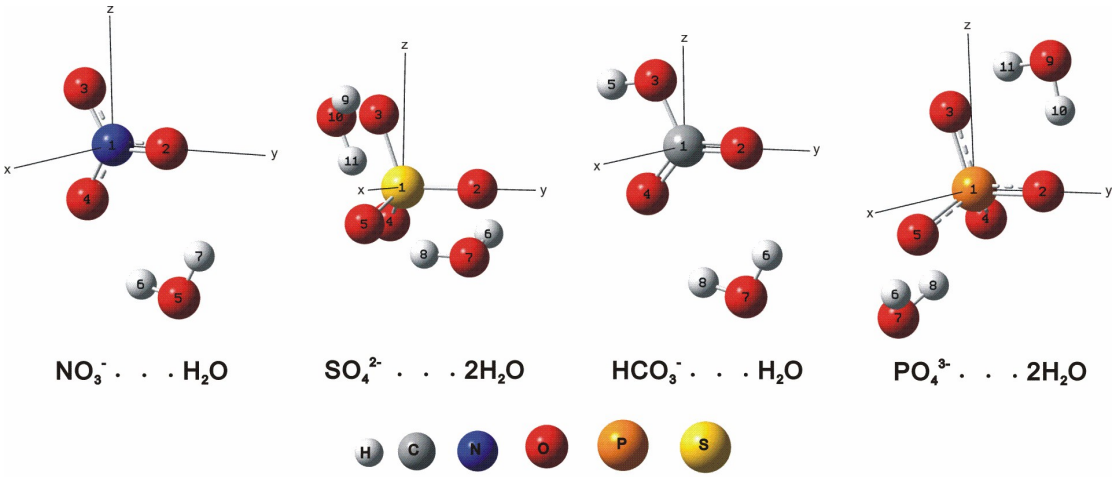

Fig. S4 Simulated structures of $NO_3^-(H_2O)$, $SO_4^{2-}(H_2O)_2$, $HCO_3^-(H_2O)$ and $PO_4^{3-}(H_2O)_3$.

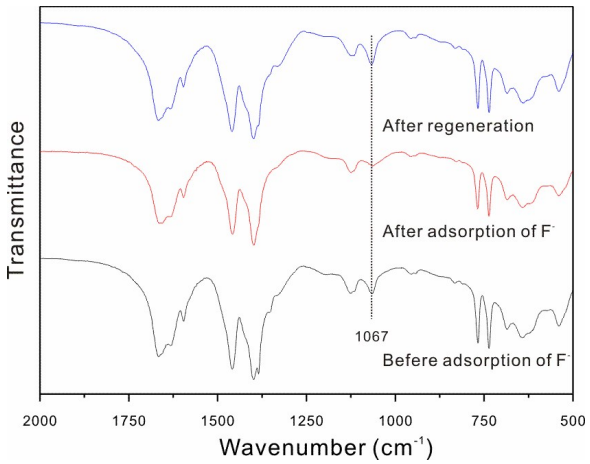

Fig. S5 FTIR spectra of Ce-MIL-96 at the three stages: before adsorption of fluoride, after adsorption of fluoride and after regeneration.

Table S1 Chemical parameters of groundwater before and after treatment with Ce-MIL-96.

Parameters	Before treatment	After treatment
F^- (ppm)	3.16	0.09
pH	7.9	8.3
Cl^- (ppm)	169	161
Mg^{2+} (ppm)	10.3	10.1
Ca^{2+} (ppm)	9.0	8.5
SO_4^{2-} (ppm)	110	108
HCO_3^- (ppm)	470	415

Table S2 The results of reverse ion implantation experiment.

	Al (mg L^{-1})	Ce (mg L^{-1})
MIL-96	0	-
Ce-MIL-96	0	16.73

[a] 0.20g sample were immersed in 4 mL pure alcohol for 4 hours at room temperature

[b] measured by ICP-AES

Table S3 Experimental q_e values for different Ce(Ⅲ) initial concentrations.

C_0 (mol L^{-1})	0	0.00	0.00	0.01	0.02	0.05	0.1	0.2	0.3	0.5
w (%)[a]	0	0.02	0.10	0.20	0.39	1.01	2.05	4.00	5.69	9.48
q_e (mg g^{-1})	29.1	30.3	32.4	34.9	35.2	37.5	39.7	39.9	39.7	36.3
$q_e - q_0/q_0$ (	-	3.94	11.2	19.7	20.8	28.8	36.1	36.9	36.1	24.7

[a] measured by ICP-AES

Table S4 Residual of aluminum and cerium in solutions treated by MIL-96 and Ce-MIL-96. (temperature = 298 K; contact time = 4 h; adsorbent dose = 0.5 g L^{-1}, initial fluoride concentration = 10 mg L^{-1})

	Al (mg L^{-1})	Ce (mg L^{-1})
MIL-96	0.162	-
Ce-MIL-96	0.142	0.218