Electronic Supplementary Material (ESI) for Environmental Science: Nano.

Supplementary information

Highly radiation-resistant Al-MOF selected based on the radiation stability rules of metal-organic frameworks with ultra-high thorium ion adsorption capacity

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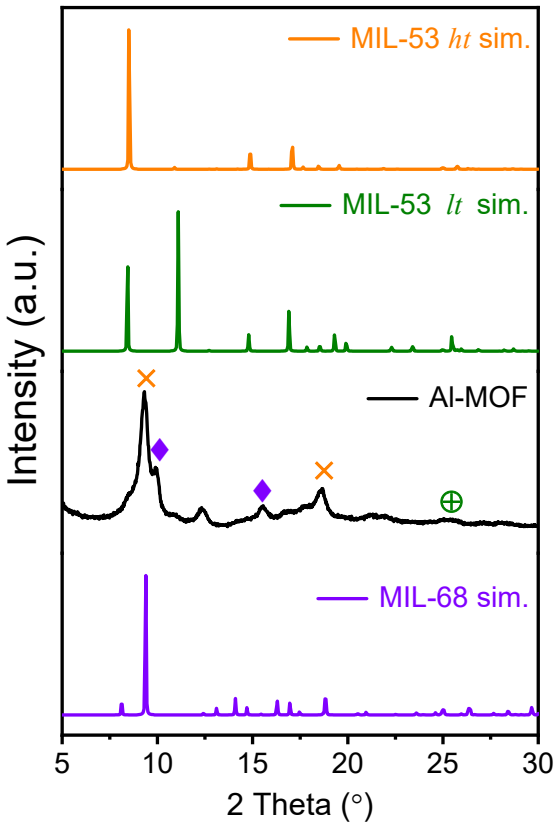

Fig. S1 PXRD pattern of the Al-MOF. Peak labeled with ◆, x, ⊕ represent MIL-68, MIL-53 *lt* sim., MIL-53 *ht* sim., respectively.

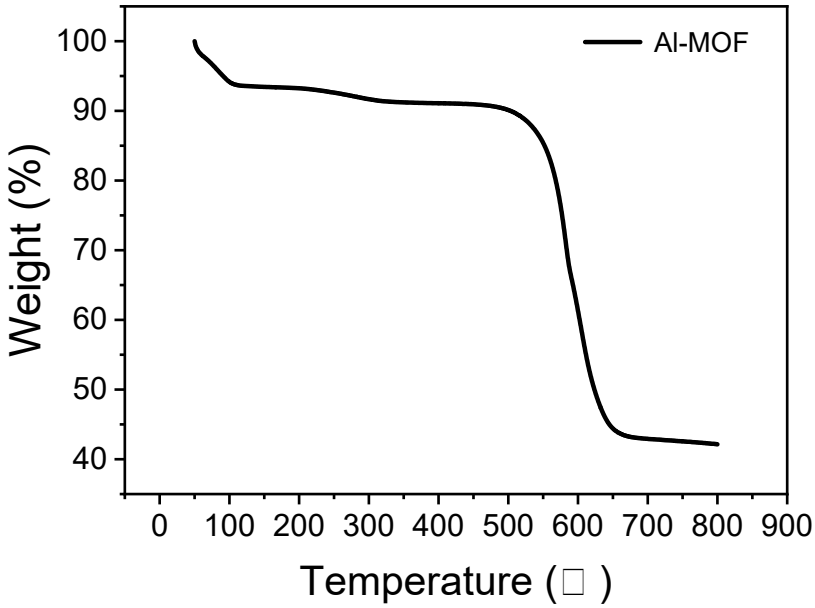

Fig. S2 TGA curve of Al-MOF

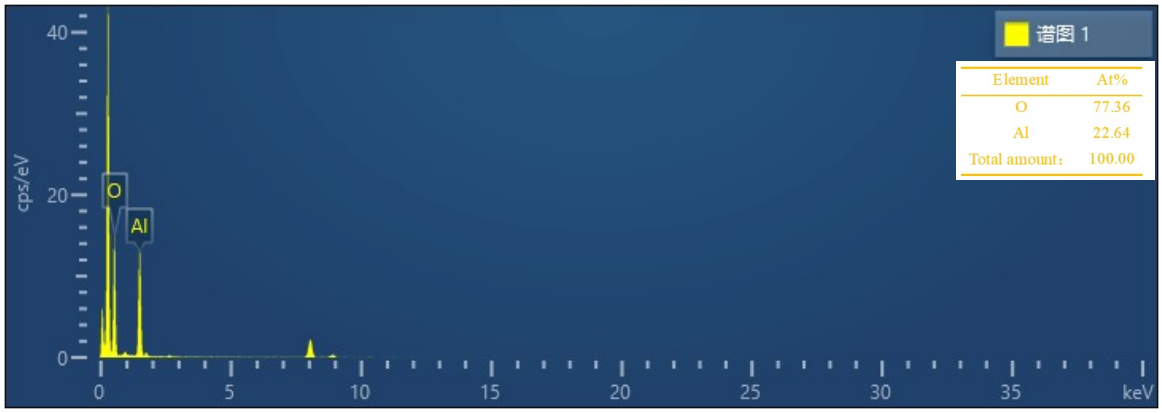

Fig. S3 EDS spectrum of Al-MOF

Table S1 Kinetic fitting parameters of Th (IV) adsorption in Al-MOF

Kinetic model	T	C_0	k_1/k_2	R^2
	℃	(mg/L)	$(min^{-1})/(g/mg \cdot min)$	
Pseudo-first order	25	400	0.035771	0.973
Pseudo-second order	25	400	0.000067	0.982

Table S2 Langmuir and Freundlich model fitting parameters for Th (IV) adsorption

Model	Parameters	T(K)		
		298K	308K	318K
Langmuir	Q_{max} (mg/g)	1324.64	16703.31	1844.98
	K_L (L/mg)	0.1668	0.1547	0.2664
	R^2	0.901	0.899	0.971
Freundlich	$K_F(mg^{1-n} \cdot L^n/g)$	200.53	251.14	410.35
	n	0.7651	0.7252	0.7979
	R^2	0.888	0.874	0.967

Table S3 Thermodynamic parameters of Th (IV) adsorption in Al-MOF

T (K)	ΔG^0 (kJ•mol^{-1})	ΔH^0 (kJ•mol^{-1})	ΔS^0 (J•mol^{-1})
298	-2.905		
308	-4.305	31.686	116.313
318	-5.222		

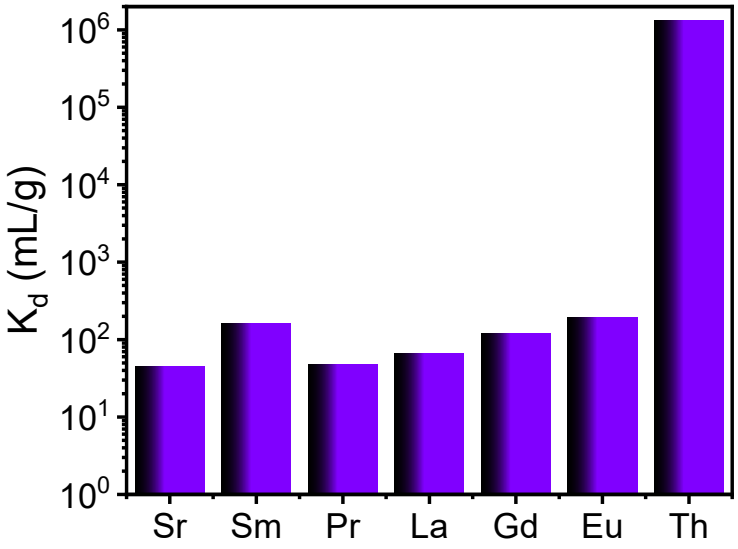

Fig. S4 The distribution coefficients for various metal ions

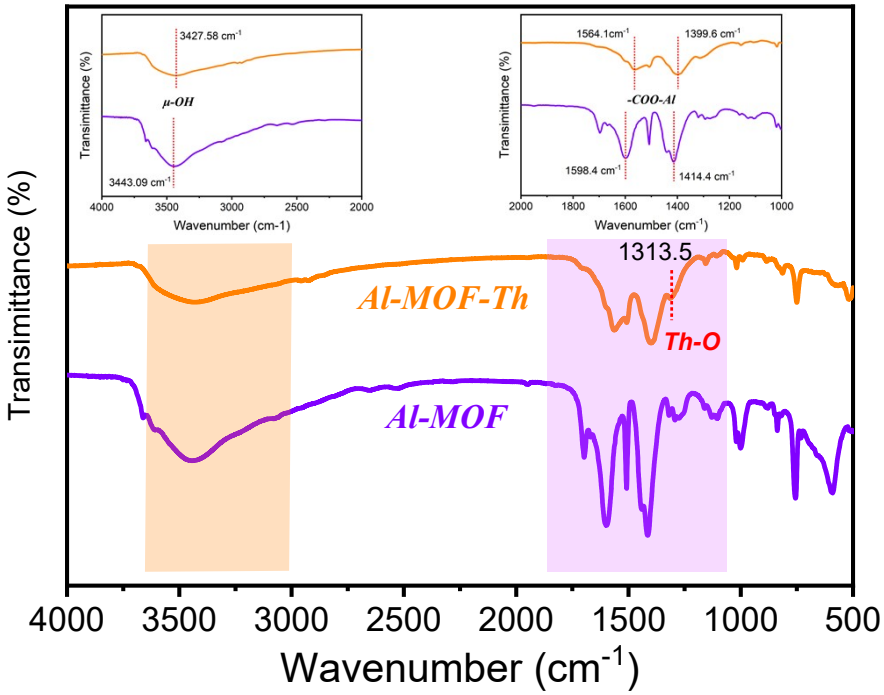

Fig. S5 FT-IR spectra of Al-MOF and Th (IV)-loaded sample

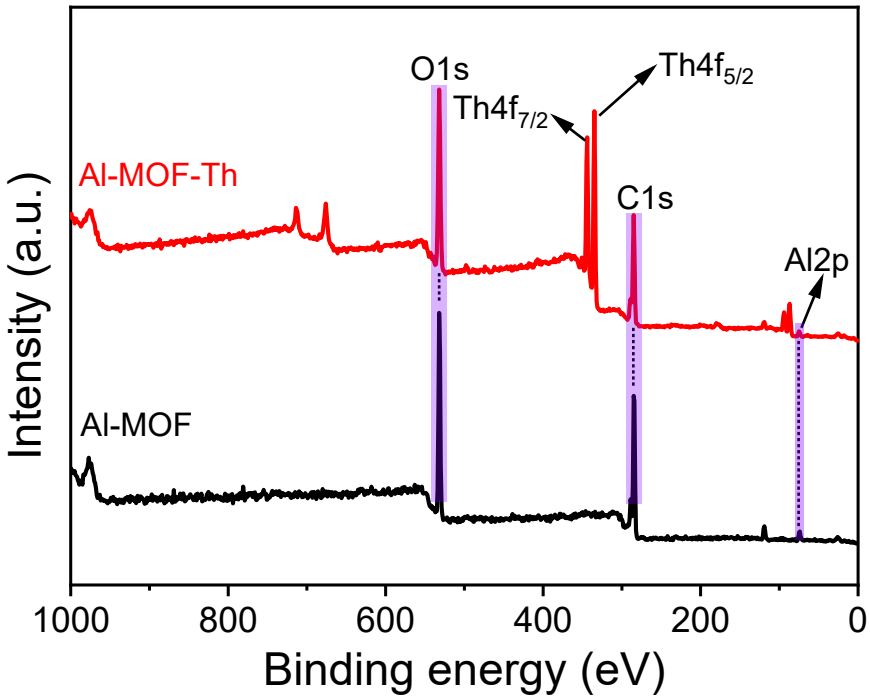

Fig. S6 XPS spectra of Al-MOF and Th (IV)-loaded sample

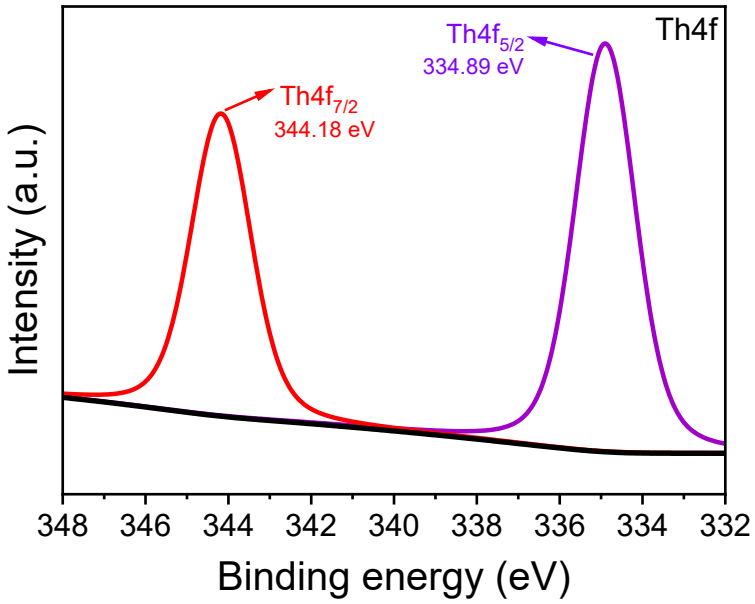

Fig. S7 Th4f XPS spectra of Th (IV)-loaded Al-MOF

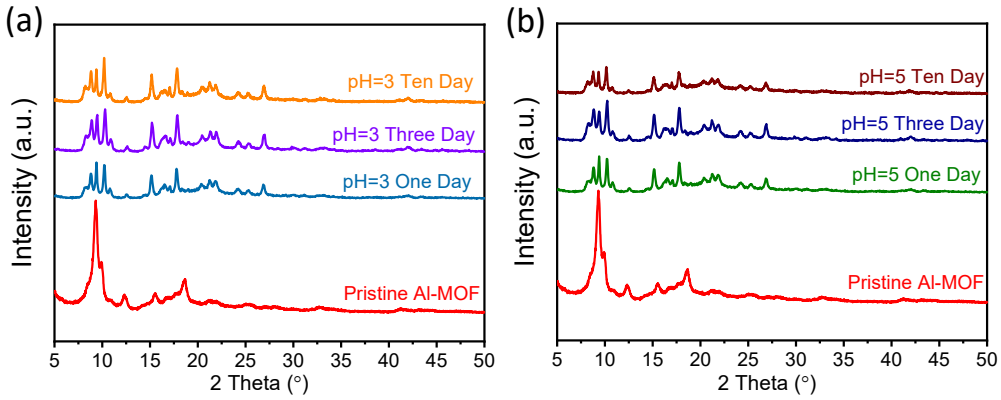

Fig. S8 Stability of Al-MOF in aqueous solutions with different pH ((a) pH=3, (b) pH=5).

Table S4 The adsorption capacity of the MOFs adsorbents for Th (IV) and the corresponding adsorption conditions

MOFs adsorbents	Adsorption capacity (mg/g)	Conditions	Ref.
MOF-LIC-SA	18.68	T=298 K, pH=5	1
MIL-100(Al)	167	T=293–295 K, pH=3-3.5	2
Fe_3O_4@AMCA-MIL-53(Al)	285.7	T=298 K, pH=4.7	3
UiO-66-$(COOH)_2$	350	T=298 K, pH=3	4
Ho-MOF	350	T=303 K, pH=5	5
MOF-303	461.7	T=298 K, pH=3	6
IEF-11	305.9	T=298 K, pH=3	7
CAU-1-NH_2	404	T=298 K, pH=5	8
Al-MOF	1324.64	T=298 K, pH=5	This work

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