

Supplementary Information

Fe₃O₄-SiO₂-Graphene Oxide-Amino Acid Ionic Liquid magnetic solid-phase extraction combined with ICP-OES for speciation of Cr(III) and Cr(VI) in environmental waters

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Fig. S1 SEM images of (a) $\text{Fe}_3\text{O}_4\text{-SiO}_2\text{-GO}$ and (b) $\text{Fe}_3\text{O}_4\text{-SiO}_2\text{-GO-AAIL}$.

Fig. S2 FT-IR spectra (a) IL, (b) GO, (c) Fe_3O_4 , (d) $\text{Fe}_3\text{O}_4\text{-SiO}_2$, (e) $\text{Fe}_3\text{O}_4\text{-SiO}_2\text{-GO}$, (f) $\text{Fe}_3\text{O}_4\text{-SiO}_2\text{-GO-AAIL}$.

Fig. S3 Magnetic hysteresis loops of Fe_3O_4 , $\text{Fe}_3\text{O}_4\text{-SiO}_2$, $\text{Fe}_3\text{O}_4\text{-SiO}_2\text{-GO}$ and $\text{Fe}_3\text{O}_4\text{-SiO}_2\text{-GO-AAIL}$.

Fig. S4 TGA spectra of $\text{Fe}_3\text{O}_4\text{-SiO}_2\text{-GO}$ and $\text{Fe}_3\text{O}_4\text{-SiO}_2\text{-GO -AAIL}$.

Fig. S5 Zeta potential plots of $\text{Fe}_3\text{O}_4\text{-SiO}_2\text{-GO-AAIL}$.

Table S1 Existent forms of Cr(III) and Cr(VI) under different pH.

Table S2 The determination results of Cr(III) and Cr(VI) in certified sample.

Table S3 The determination results of Cr(III) and Cr(VI) in certified sample and environmental samples by FAAS.

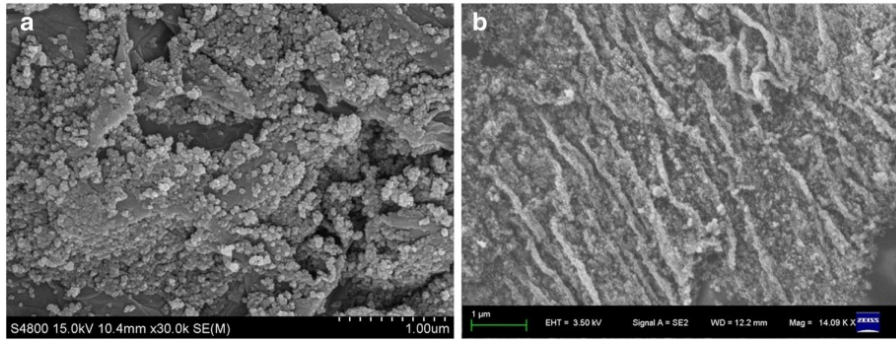


Fig. S1 SEM images of (a) $\text{Fe}_3\text{O}_4\text{-SiO}_2\text{-GO}$ and (b) $\text{Fe}_3\text{O}_4\text{-SiO}_2\text{-GO-AAIL}$.

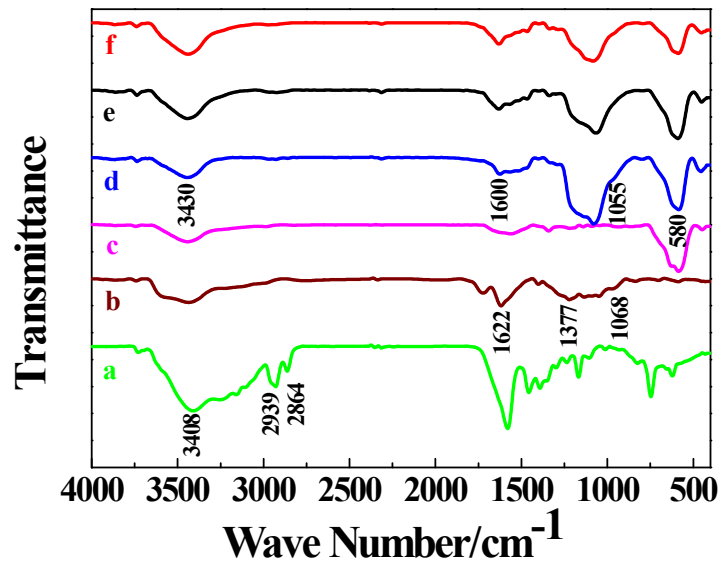


Fig. S2 FT-IR spectra (a) IL, (b) GO, (c) Fe_3O_4 , (d) $\text{Fe}_3\text{O}_4\text{-SiO}_2$, (e) $\text{Fe}_3\text{O}_4\text{-SiO}_2\text{-GO}$, (f) $\text{Fe}_3\text{O}_4\text{-SiO}_2\text{-GO-AAIL}$.

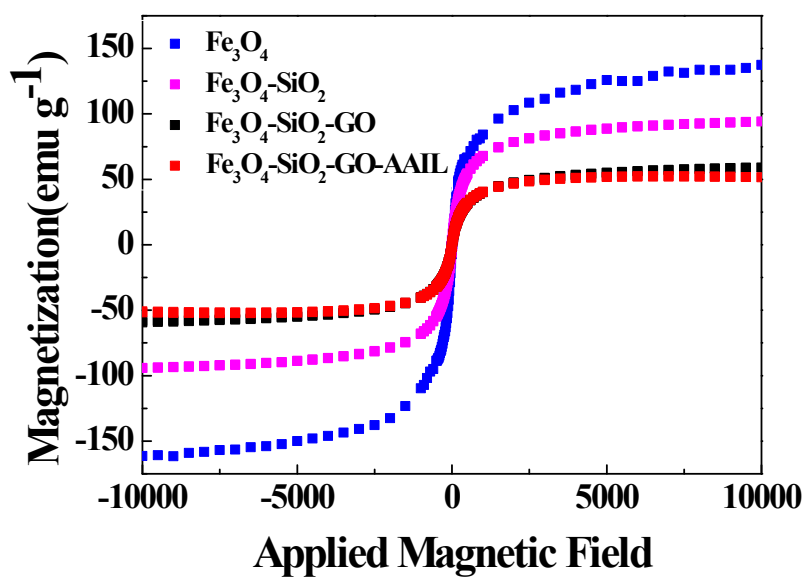


Fig. S3 Magnetic hysteresis loops of Fe_3O_4 , $\text{Fe}_3\text{O}_4\text{-SiO}_2$, $\text{Fe}_3\text{O}_4\text{-SiO}_2\text{-GO}$ and $\text{Fe}_3\text{O}_4\text{-SiO}_2\text{-GO-AAIL}$.

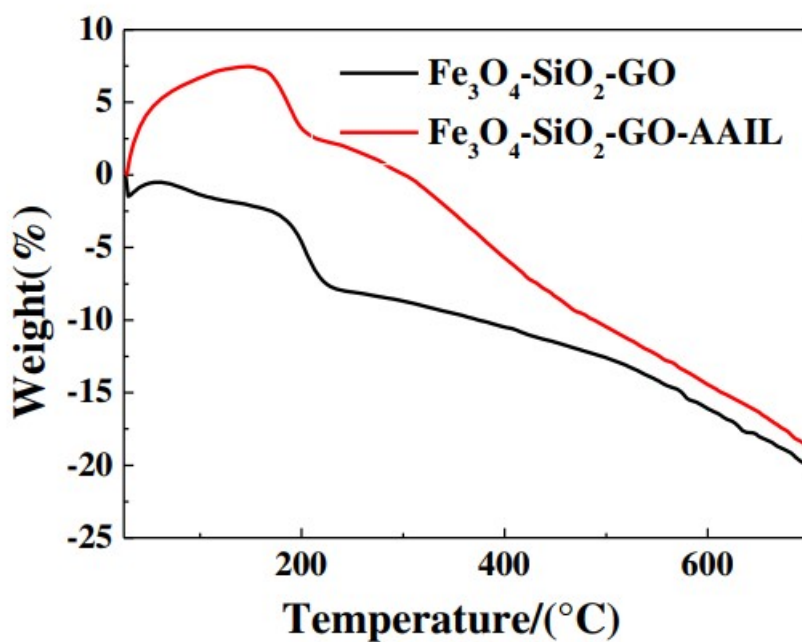


Fig. S4 TGA spectra of $\text{Fe}_3\text{O}_4\text{-SiO}_2\text{-GO}$ and $\text{Fe}_3\text{O}_4\text{-SiO}_2\text{-GO -AAIL}$.

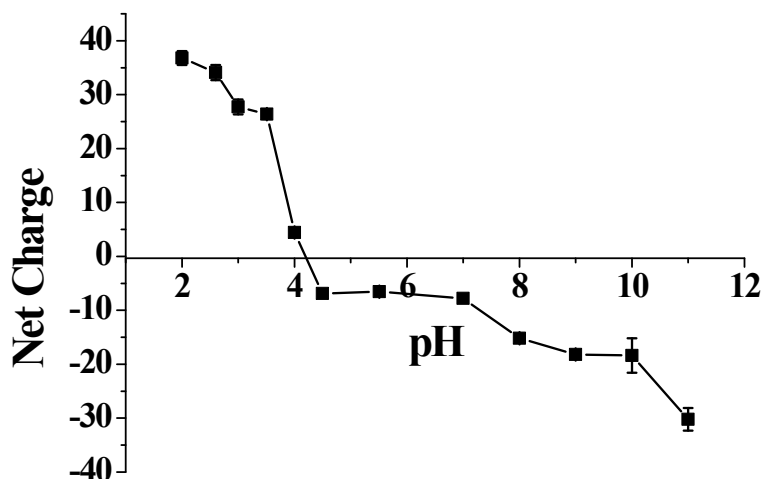


Fig. S5 Zeta potential plots of Fe₃O₄-SiO₂-GO-AAIL.

Table S1 Existent forms of Cr(III) and Cr(VI) under different pH

pH	3.0	4.0	6.0	6.5	7.0	9.0	>9.0
Cr(III)	Cr(H ₂ O) ₆ ³⁺	Cr(OH) ²⁺	Cr(OH) ₂ ⁺	Cr(OH) ₃	Cr(OH) ₃	Cr(OH) ₄ ⁻	
Cr(VI)	HCrO ₄ ⁻					CrO ₄ ²⁻	

Table S2 The determination results of Cr(III) and Cr(VI) in certified sample.

Samples	Certified value (μg·L ⁻¹)	Added (μg·L ⁻¹)		Found (μg·L ⁻¹)		Recovery (%)	
		Cr(III)	Cr(VI)	Cr(III)	Cr(VI)	Cr(III)	Cr(VI)
GSB 07-1187-2000	60.30	0.00	0.00	52.64 ± 2.59	7.36 ± 2.93	-	-
		50.00	50.00	103.93 ± 3.33	59.46 ± 2.46	102.6	104.2
		100.00	100.00	150.55 ± 3.98	119.17 ± 4.50	97.9	111.8
		150.00	150.00	201.63 ± 1.85	166.68 ± 2.59	99.3	106.2

Table S3 The determination results of Cr(III) and Cr(VI) in certified sample and environmental samples by FAAS.

Samples	Total Cr ($\mu\text{g} \cdot \text{L}^{-1}$)
GSB 07-1187-2000	60.34
Lake water	14.63
Water Sample Near Pesticide Chemical Plant	34.80
Water Sample Near Chemical Plant	29.66