

Supporting Information for “Ultra high adsorption capacity of fried egg
jellyfish-like γ -AlOOH(Boehmite)@SiO₂/Fe₃O₄ porous magnetic microspheres
for aqueous Pb(II) removal”

Table S1 physical properties of the different samples

Samples	BET (m ² g ⁻¹)	Average Pore Diameter (nm)	Pore Volume (cm ³ g ⁻¹)
Fe ₃ O ₄	6.9633	19.3082	0.0336
SiO ₂ /Fe ₃ O ₄	6.9380	2.9320	0.0051
γ -AlOOH(Boehmite)@SiO ₂ /Fe ₃ O ₄	28.5980	10.2883	0.0736

Table S2 Impact of the different concentrations of the reactants for the formation of fried egg jellyfish-like γ -AlOOH(Boehmite)@SiO₂/Fe₃O₄ microspheres.

Samples	1	2	3	4
SiO ₂ /Fe ₃ O ₄ concentration (g L ⁻¹)	2.8	2.8	2.8	2.8
NaAlO ₂ concentration (g L ⁻¹)	3.4	6.8	10.2	13.6
NH ₂ CONH ₂ concentration (g L ⁻¹)	9.6	19.2	28.8	38.4

Table S3 Langmuir isotherm parameters for aqueous Pb(II) adsorption by fried egg jellyfish-like γ -AlOOH(Boehmite)@SiO₂/Fe₃O₄ microspheres.

Samples	Pb(II)		
	q _m (mg g ⁻¹)	K _L (L mg ⁻¹)	r ²
Fe ₃ O ₄	6.21	0.188	0.9962
SiO ₂ /Fe ₃ O ₄	18.32	0.914	0.9985
γ -AlOOH(Boehmite)@SiO ₂ /Fe ₃ O ₄	214.59	0.525	0.9987

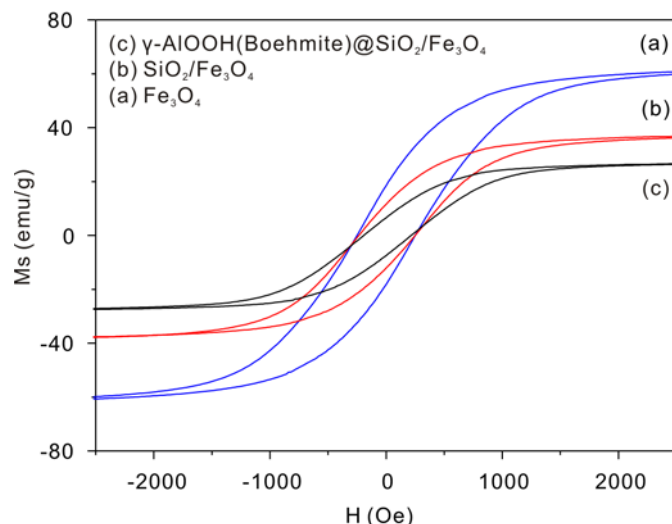


Fig. S1 The enlarged view of the central magnetic hysteresis loops of (a) Fe₃O₄ microspheres, (b) SiO₂/Fe₃O₄ microspheres, and (c) fried egg jellyfish-like γ -AlOOH(Boehmite)@SiO₂/Fe₃O₄ microspheres.

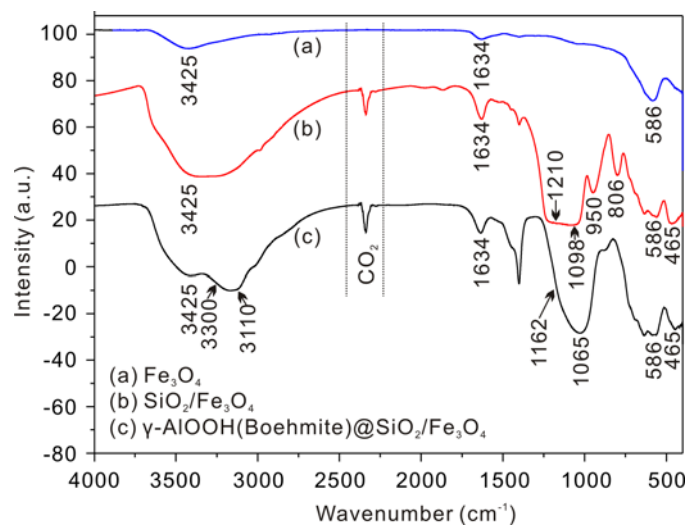


Fig. S2 FTIR spectra of (a) Fe₃O₄ microspheres (b) SiO₂/Fe₃O₄ microspheres, and (c) fried egg jellyfish-like γ -AlOOH(Boehmite)@SiO₂/Fe₃O₄ microspheres.

The FTIR spectra of Fe₃O₄, SiO₂/Fe₃O₄, and fried egg jellyfish-like γ -AlOOH(Boehmite)@SiO₂/Fe₃O₄ magnetic microspheres are compared in Figure S3, which are performed for a better comprehension of the structure and composition of these materials. The analysis indicated the shoulder at 3425 cm⁻¹ and the weak band at 1634 cm⁻¹ can be assigned to the stretching and bending modes of the adsorbed water, respectively.^[1] The absorption centered at 586 cm⁻¹ corresponding to the Fe-O vibration related to the magnetite phase.^[2-3] For SiO₂/Fe₃O₄ magnetic microspheres, the absorption bands at 1210, 1098, 950, 806, and 465 cm⁻¹ observed can be ascribed

to the stretching and deformation vibrations of SiO_2 , reflecting the coating of silica on the surface of Fe_3O_4 microspheres. For fried egg jellyfish-like $\gamma\text{-AlOOH(Boehmite)}@\text{SiO}_2/\text{Fe}_3\text{O}_4$ microspheres, the bands at 3300 and 3110 cm^{-1} belong to the $\nu_{\text{as}}(\text{Al})\text{O-H}$ and $\nu_{\text{s}}(\text{Al})\text{-H}$ stretching vibrations, respectively^[4]. However, the two peaks of the as-prepared sample which were concealed by the peak of adsorbed water were not easily discerned. The bands at 1065 and 1162 cm^{-1} are, respectively, attributed to the $\nu_{\text{sym}}\text{ Al-O-H}$ and $\nu_{\text{asym}}\text{ Al-O-H}$ modes of $\gamma\text{-AlOOH}$ (Boehmite)^[5]. These results suggest that the surface of $\text{SiO}_2/\text{Fe}_3\text{O}_4$ microsphere has been covered by $\gamma\text{-AlOOH}$ (Boehmite).

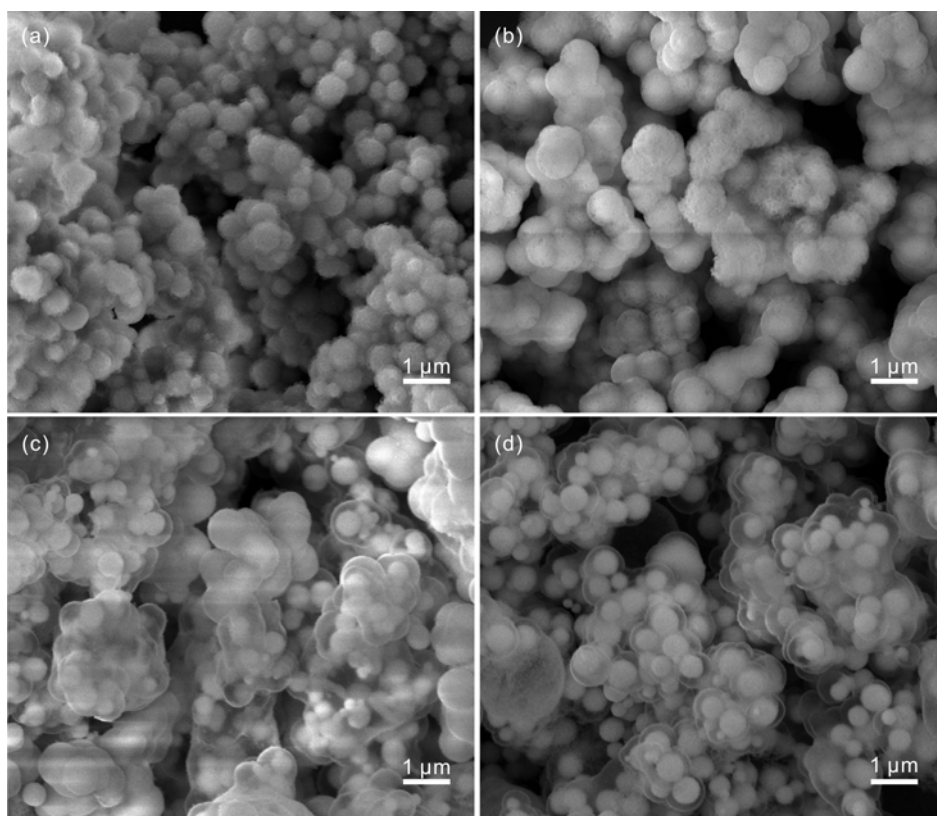


Fig. S3 SEM images of products obtained from the difference of the reactant concentrations at 160 °C for 12 h. (a) Sample 1. (b) Sample 2. (c) Sample 3. (d) Sample 4. The values of the reactant concentrations corresponding to these samples were shown in Table 1.

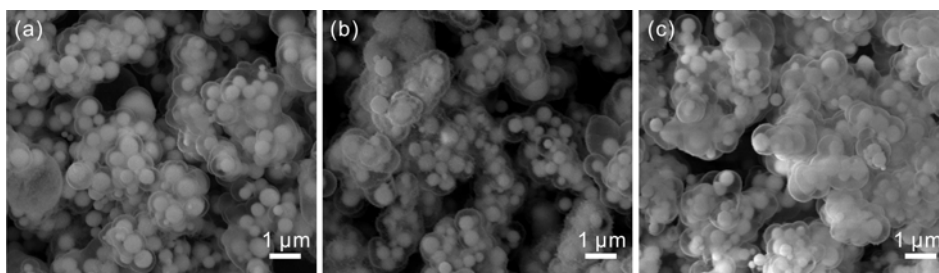


Fig. S4 SEM images of products obtained from the different reaction temperature for 12 h. (a) 160 °C. (b) 180 °C. (c) 200 °C.

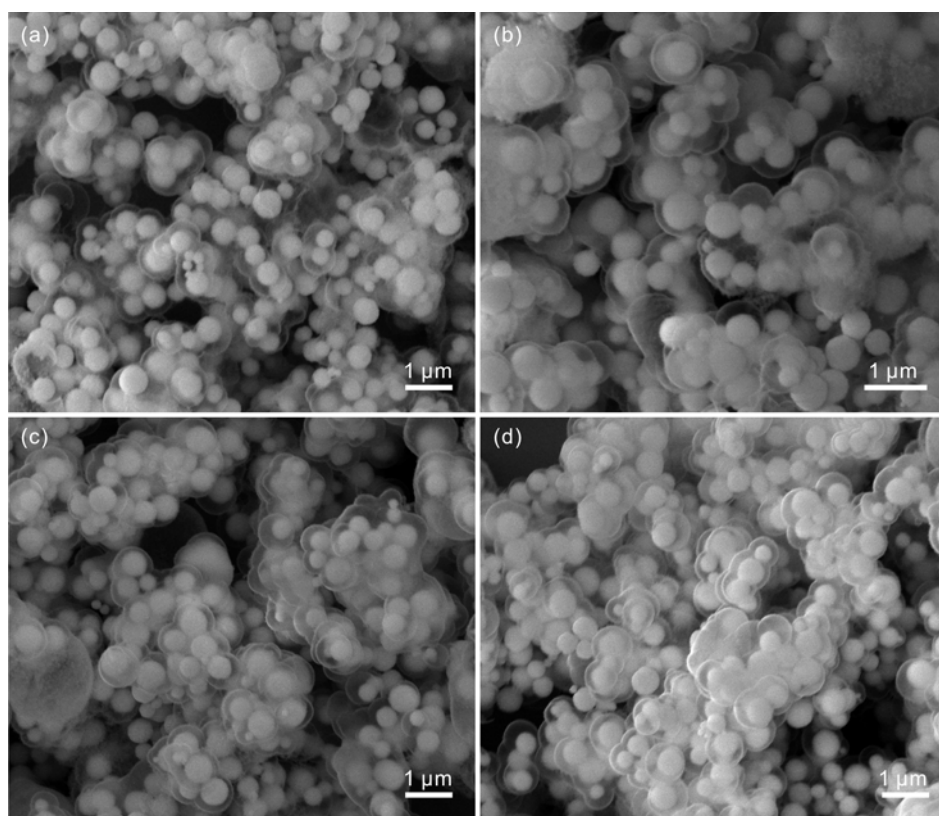


Fig. S5 SEM images of products obtained from the different reaction times at 160 °C. (a) 1 h. (b) 6 h. (c) 12 h. (d) 18 h.

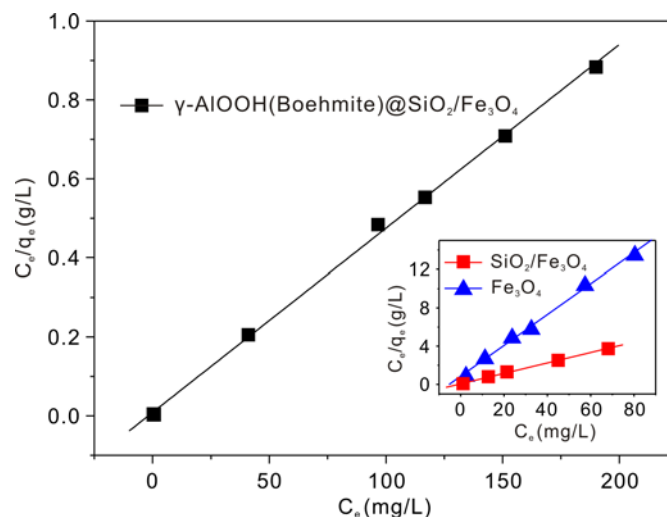


Fig. S6 Langmuir isotherms of Pb(II) onto fried egg jellyfish-like $\gamma\text{-AlOOH(Boehmite)}@\text{SiO}_2/\text{Fe}_3\text{O}_4$ microspheres. Inset: Langmuir isotherms of Pb(II) onto Fe_3O_4 microspheres and $\text{SiO}_2/\text{Fe}_3\text{O}_4$ microspheres. Adsorbent dose = 1 g L^{-1} , shaking rate = 100 rpm, contact time = 24 h, $T = 298 \text{ K}$, $\text{pH} = 5$.

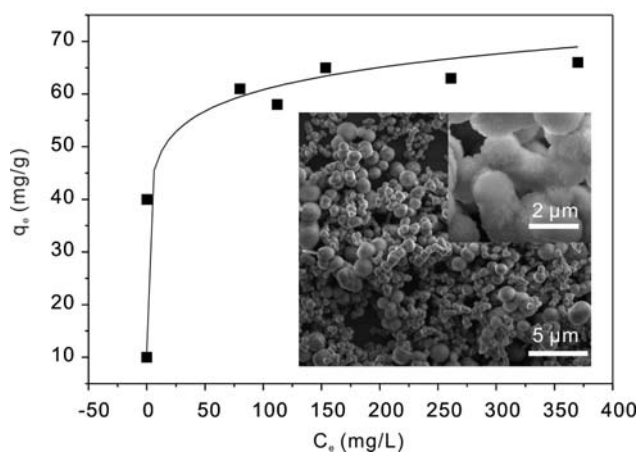


Fig.S7 Adsorption isotherm of boehmite particles (without $\text{SiO}_2/\text{Fe}_3\text{O}_4$ microspheres) for aqueous Pb(II). The inset is SEM of boehmite particles. Adsorbent dose = 1 g L^{-1} , shaking rate = 100 rpm, contact time = 24 h, $T = 298 \text{ K}$, and $\text{pH} = 5$.

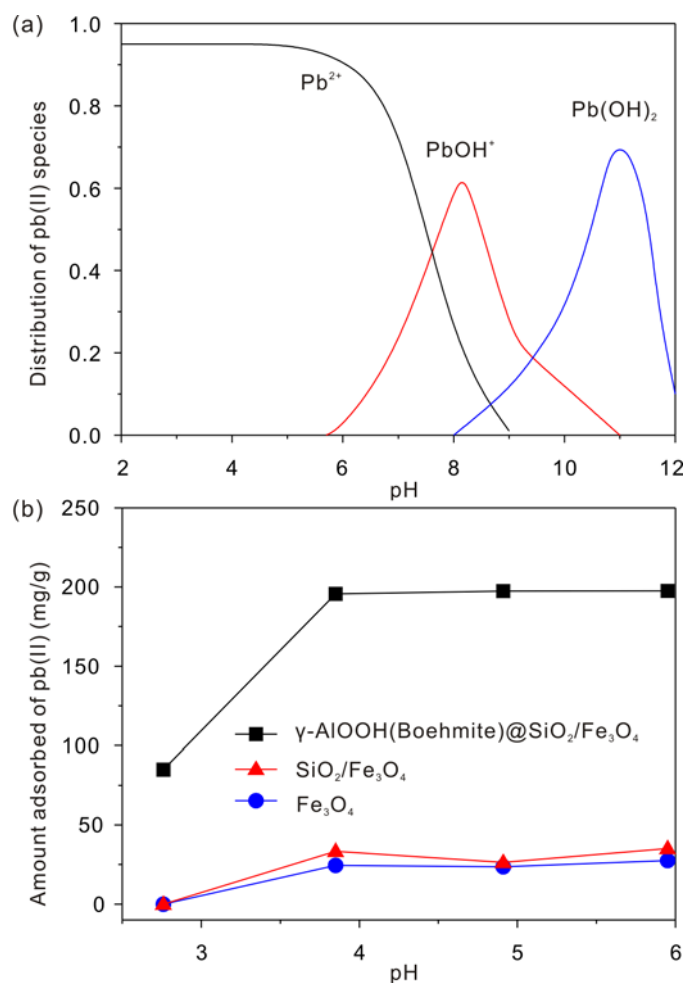


Fig. S8 (a) Speciation diagram of lead as a function of pH. (b) Effect of pH on Pb(II) adsorption onto Fe₃O₄ microspheres, SiO₂/Fe₃O₄ microspheres, and fried egg jellyfish-like γ -AlOOH(Boehmite)@SiO₂/Fe₃O₄ microspheres. Initial Pb(II) concentration: 240 mg L⁻¹, adsorbent dose: 1 g L⁻¹, shaking rate: 100 rpm, contact time: 24 h, and T = 298 K.

References

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