Supporting Information

Hydroxyapatite nanoparticles on dendritic α-Fe_2O_3 hierarchical architectures for heterogeneous photocatalyst and adsorption of Pb(II) ions from industrial wastewater

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Table.S1 Magnetic parameters extracted from the hysteresis loop for the as-prepared α-Fe_2O_3 and HAp/α-Fe_2O_3 nanocomposites at room temperature

S. No	Samples	Magnetization (emu/g)	Coercivity (Oe)	Remanent Magnetization (emu/g)
1	α-Fe_2O_3	3.83	90	0.10
2	HAp/α-Fe_2O_3	2.80	110	0.24

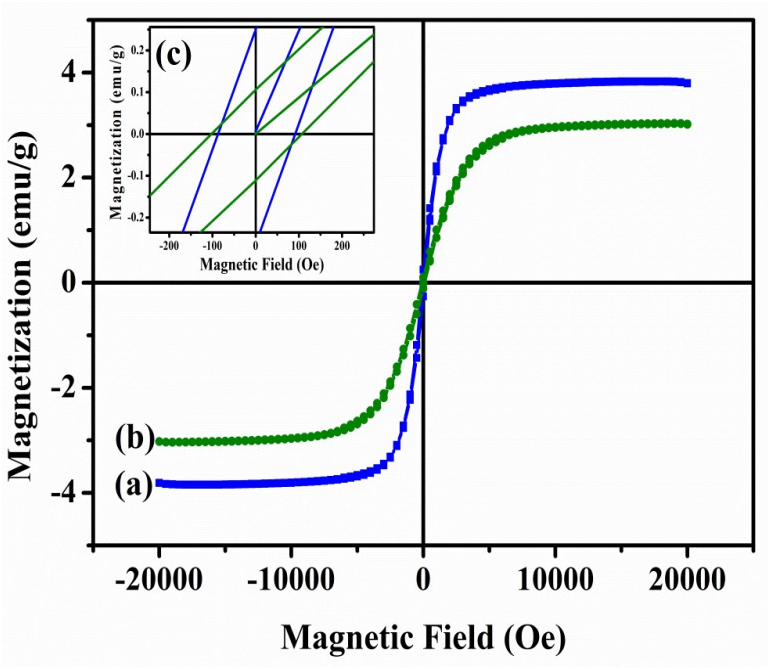

Fig.S1 Magnetic hysteresis (*M-H* curves) of (a) α-Fe_2O_3, (b) HAp/α-Fe_2O_3 and (c) partially enlarged *M-H* curves.

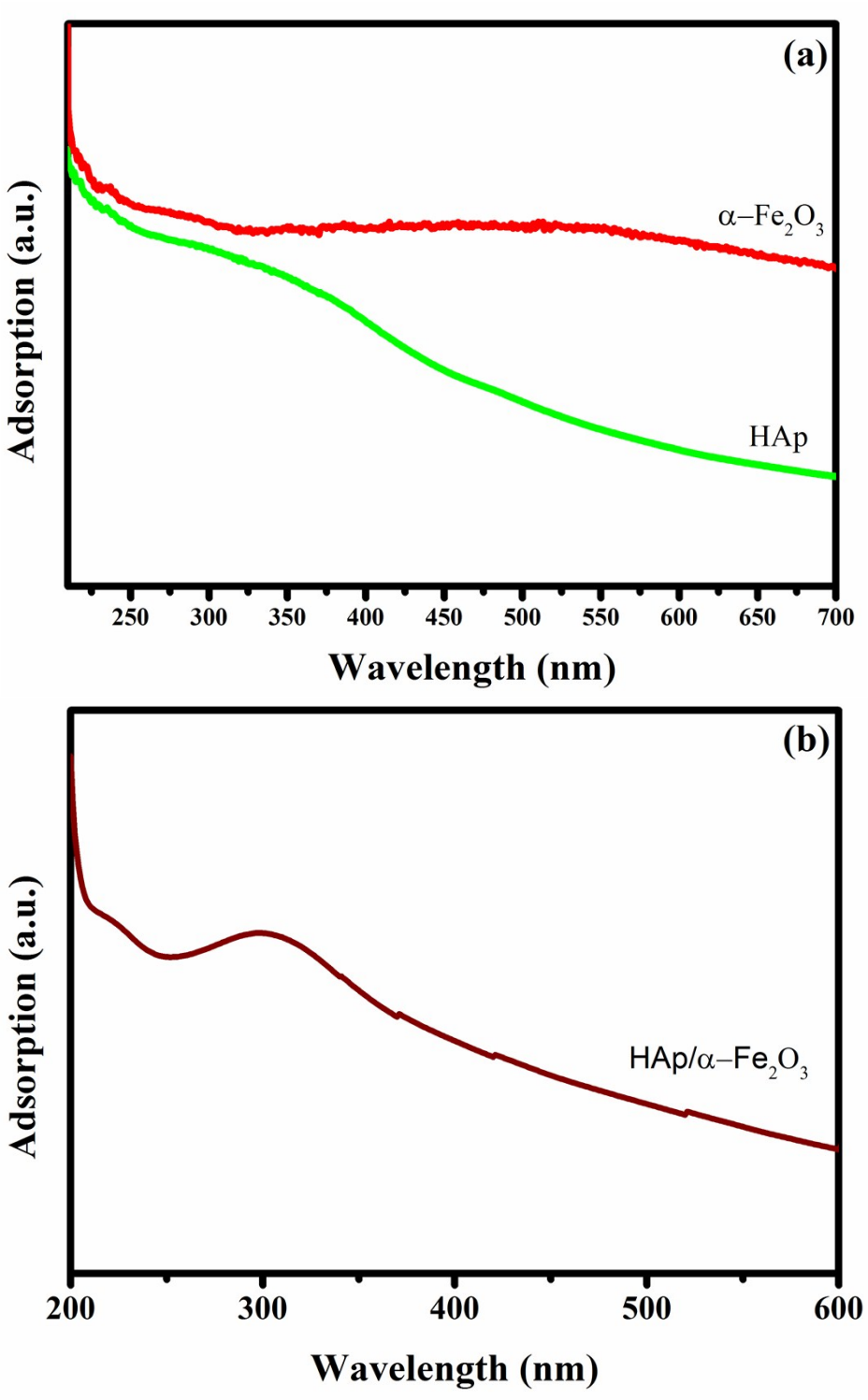

Fig.S2 UV-visible absorption spectra of (a)as-synthesized HAp and dendritic α-$Fe_2O_3$and (b) HAp/α-Fe_2O_3 nanocomposites

3.2.1 Adsorption Kinetics Study

The experimental data were fitted using the Lagergren's first order rate equation to determine the adsorption rates of Pb(II) ions on HAp/α-Fe_2O_3.

$$\log\left(q_e - q_t\right) = \log q_e - \frac{K_1}{2.303}t \quad (6)$$

Where $q_e$and q_t are the amounts of metal ions adsorbed (mg/g) at equilibrium and at any given time t (min) respectively. K_1 is the pseudo-first order reaction rate constant for adsorption (min^{-1}). The values of q_e and K_1, were calculated from the slope and intercept of the plots of $log(q_e - q_t)$ versus time (t) as shown in Fig. 12(a). The correlation coefficient of 0.9676, 0.9694 and 0.9665 were obtained for 20, 40 and 60 mg/L respectively.

The pseudo second order kinetic model can be represented as equation (7)

$$\frac{t}{q_t} = \frac{t}{q_e} + \frac{1}{K_2 q_e^2} \quad (7)$$

Where t is the contact time (min), K_2 is the equilibrium rate constant of pseudo second order adsorption (g mg^{-1} min^{-1}). The values of K_2 and $q_e$were calculated from the plots of t/q versus t as shown in Fig. 12(b). The $q_{e,cal}$and $q_{e,exp}$ values are very close to each other and the correlation coefficient of 0.9997, 0.9985 and 0.9986 are corresponds to 20, 40 and 60 mg/L.

The pseudo-first order kinetics, the experimental data significantly deviates from linear fit and this was evident by the low correlation values. On the basis of the above results indicates that the adsorption follows the pseudo-second order kinetic model.

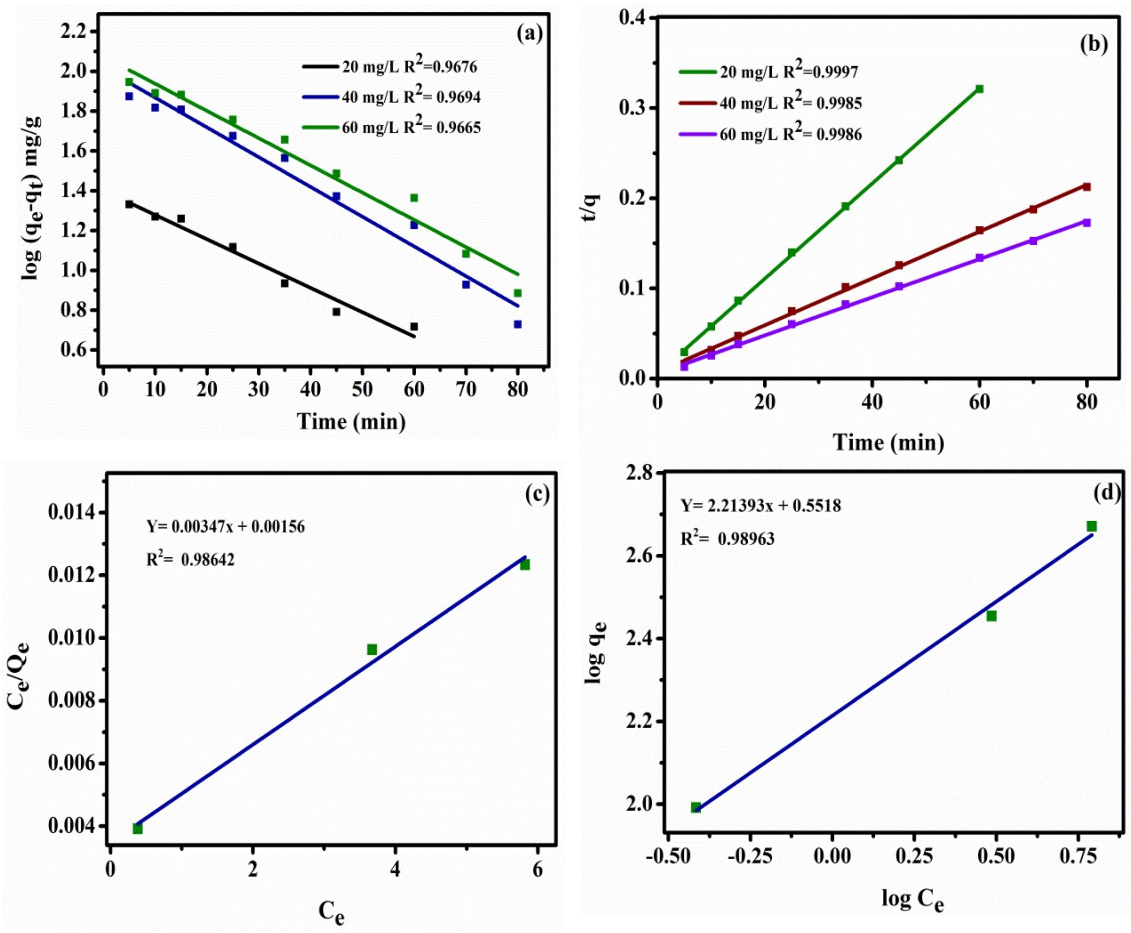

Fig.S3(a), (b) Linear fit of experimental data obtained using pseudo first and second order model and (c), (d) adsorption isotherms of Langmuir and Freundlich isotherm for the adsorption of Pb (II) ions on HAp/dendriticα-Fe_2O_3 nanocomposites.

3.2.2 Adsorption isotherms

The adsorption isotherms were mathematical analysis which was used to designate the diffusion of the adsorbate species between solid and liquid phases.The adsorption capacity (Q_o) of Pb(II) on the HAp/α-Fe_2O_3 was used to determine the characteristic adsorption constants by using Langmuir and Freundlich models. The observed experimental data were fitted with these models to describe the adsorption performances of heavy weight metal ions on the adsorbents.

The appearance for the Langmuir and Freundlich isotherm are by the following equations

$$\frac{C_e}{q_e} = \frac{1}{Q_0 b} + \frac{C_e}{Q_0} \qquad (8)$$

$$\log q_e = \log K_f + \frac{\log C_e}{n} \quad (9)$$

Where *Ce*is the equilibrium concentration of adsorbate (mg mL^{-1}) on adsorbent and q_e is the adsorbate adsorbed per unit mass of adsorbent (mg/g). Q_o and b are Langmuir constants related to the theoretical monolayer adsorption efficiency (mg g^{-1}) and energy of adsorption (L mg^{-1}) respectively. The Freundlich isotherm model undertakes heterogeneous surface energies in which the energy term in Langmuir equation varies as a function of surface coverage and K_f and $1/n$ are Freundlich constants associated to adsorption capacity (L/mg) and intensity of the adsorption respectively.

Table.S2 Langmuir and Freundlich constants and correlation coefficients for adsorption of Pb (II) on HAp/dendritic α-Fe_2O_3

Metal Ions	Langmuir			Freundlich		
	Q_0 (mg g^{-1})	b	R^2	k_f(mg $^{1-1/n}L^{1/n}$ g^{-1})	$1/n$	R^2
Pb (II) on HAp/leaf like α-Fe_2O_3	754.14	0.2551	0.8316	161.96	0.5737	0.9841