Supporting Information

1. Characterization

All $^1$H NMR spectra and $^{13}$C NMR spectra were recorded on a Bruker AVANCEIII™ 500 spectrometer (500 MHz) by using CDCl$_3$ as a solvent. GPC data was obtained from Waters GPC system equipped with a 2414 refractive index (RI) detector, a Waters 1515 isocratic HPLC pump, and two Waters’ HPLC columns. THF (HPLC grade) was used as the solvent for polymers and eluent for gel permeation chromatography (GPC) with a flow rate of 1 mL/min at room temperature. The GPC instrument was calibrated with narrowly dispersed linear polystyrene standards. Transmission electron microscopy (TEM) images were obtained using a JEM-2100F TEM instrument. Samples were prepared by dip-coating a 400 mesh carbon-coated copper grid from the dilute sample solution allowing the solvent to evaporate. A Quantachrome Autosorb IQ surface area and porosity analyzer was utilized to study the pore structure of the samples. Before measurements, the polymer samples were degassed for more than 10 h at 120°C. The Brunauer-Emmett-Teller (BET) surface area and the micropore surface area were determined by the BET equation and the t-plot equation, respectively. The pore size distribution was analyzed by original density functional theory (DFT). FT-IR spectra were recorded on a Thermo NICOLET is50 spectrometer using pressed KBr pellets to measure the chemical bonding of the products from 400 to 4000
Thermogravimetric analyses (TGA) were carried out with a NETZSCH STA449F3 simultaneous thermal analyzer at a heating rate of 10 K/min from 30 to 800 °C in a nitrogen atmosphere. UV-Vis tests were performed by using an UV-Vis spectrophotometer (UV-2400). The absorbance spectra were collected within the range of 200-800 nm wavelengths. Magnetic properties were collected using a vibrating sample magnetometer (VSM) at room temperature by cycling the field from -15000 to 15000 Oe. The powder X-ray diffraction (XRD) analyses of all samples were recorded on an X-ray diffractometer; a continuous scan mode was used to collect 2θ data from 20 to 70° at a constant rate of 4°/min.
Fig S1. Synthetic route of polymer ligands (Dopa-PS).

Fig S2. $^1$H NMR spectrum of NHS-TC (500 MHz, CDCl$_3$).
Fig S3. $^1$H NMR spectrum of the Dopa-TC (500 MHz, CDCl$_3$).

Fig S4. $^{13}$C NMR spectrum of the Dopa-TC (125 MHz, CDCl$_3$).
ESI-MS (m/z): C_{25}H_{41}NO_{3}S_{3}Na for +, calculated 522.2141, found 522.2149.

Fig S5. Mass spectrogram of Dopa-TC.

Fig S6. $^1$H NMR spectrum of the Dopa-PS (500 MHz, CDCl$_3$).

Fig S7. GPC curve of Dopa-PS.
Fig S8. FTIR spectra of (a) Fe$_3$O$_4$-Cit, (b) Fe$_3$O$_4$@Dopa-PS, (c) Fe$_3$O$_4$-MONNs and (d) PGM-g-(PLA-b-PS).

Fig S9. TEM image of Fe$_3$O$_4$@Dopa-PS nanoparticles.
Fig S10. $^1$H NMR spectra of PGM-g-(PLA-b-PS) bottlebrush.

Fig S11. GPC curves of PGM, PGM-g-PLA, PGM-g-PLA-TC and PGM-g-(PLA-b-PS).
Fig S12. TGA curves of (a) Fe$_3$O$_4$-Cit, (b) Fe$_3$O$_4$@Dopa-PS and (c) Fe$_3$O$_4$-MONNs.

Fig S13. The photographs of adsorption behaviors and magnetic separation of the six dyes. (A) dye solutions after adsorption by the Fe$_3$O$_4$-MONNs for 3 min and then left under the magnet for 10 s and (B) initial dye solutions. Between two bottles is the magnet. All the initial dye concentration of the six dyes is 0.01 mg/mL and the volume of the dye solutions is 3 mL.
Fig S14. Nitrogen adsorption-desorption isotherms and pore size distribution of Fe$_3$O$_4$-MONNs after adsorption of ST (A) and desorption of ST (B).

Fig S15. FTIR spectra of Fe$_3$O$_4$-MONNs after adsorption of ST (a) and desorption of ST (b).
Fig S16. TGA curves of Fe₃O₄-MONNs after adsorption of ST (a) and desorption of ST (b).

Table S1. Textural parameters of as-synthesized Fe₃O₄-MONNs, Fe₃O₄-MONNs after adsorption of ST (2) and Fe₃O₄-MONNs after desorption of ST (3).

<table>
<thead>
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<th>Samples</th>
<th>$S_{\text{BET}}^a$(m$^2$g$^{-1}$)</th>
<th>$S_{\text{micro}}^b$(m$^2$g$^{-1}$)</th>
<th>$S_{\text{meso}}^c$(m$^2$g$^{-1}$)</th>
<th>$V_{\text{total}}^d$(cm$^3$g$^{-1}$)</th>
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<tr>
<td>1</td>
<td>648</td>
<td>68</td>
<td>580</td>
<td>0.64</td>
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<tr>
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<td>0</td>
<td>208</td>
<td>0.39</td>
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<tr>
<td>3</td>
<td>687</td>
<td>102</td>
<td>585</td>
<td>0.68</td>
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[a] BET specific surface area calculated from N$_2$ adsorption isotherm at 77.4 K; [b] Microporous surface area calculated from t-plots; [c]Mesoporous surface area; [d] Total pore volume at P/P$_0$ = 0.998.