

Supporting Information

Ionic Liquid Modified Magnetic Microspheres for Isolation of Heme Protein with High Binding Capacity

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Supplementary Figures

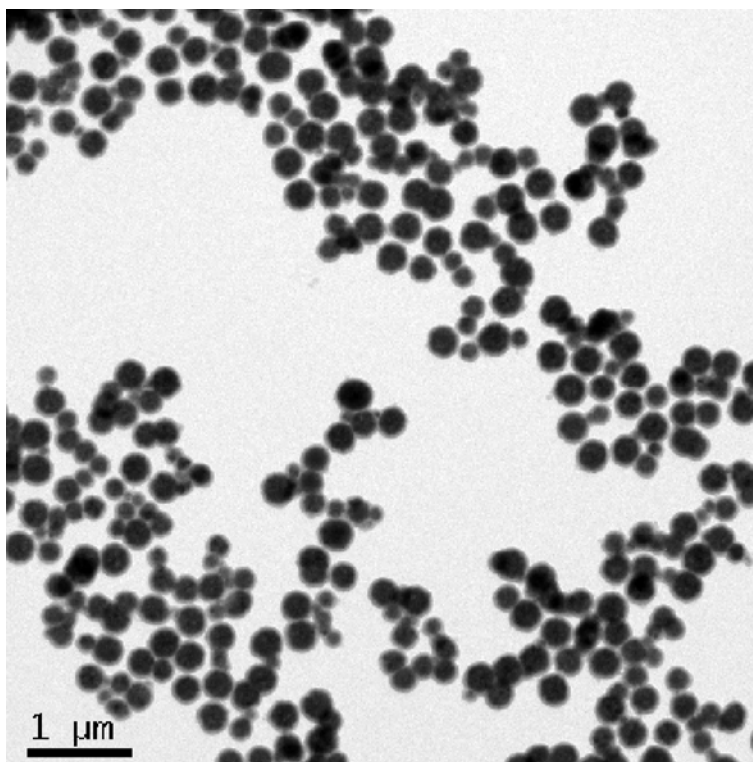


Figure S1. TEM images of Fe₃O₄@SiO₂ microspheres.

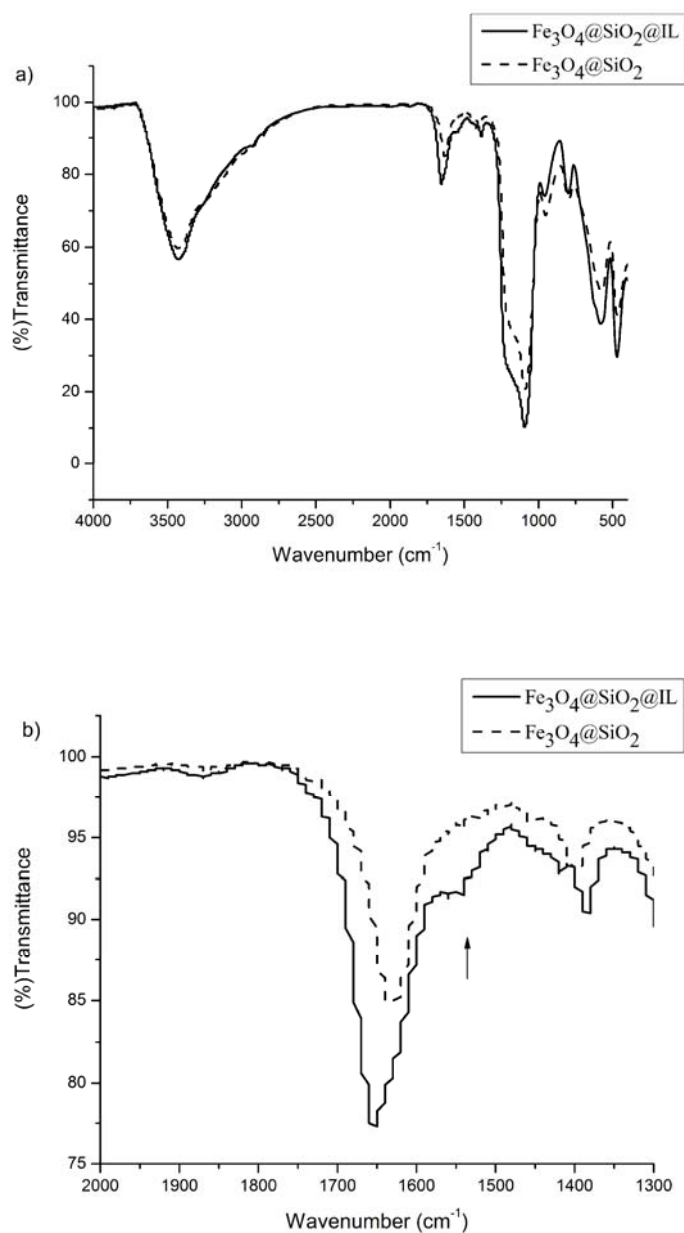


Figure S2. a) The FT-IR spectra of Fe₃O₄@SiO₂ and Fe₃O₄@SiO₂@IL. b) The FT-IR spectra of Fe₃O₄@SiO₂ and Fe₃O₄@SiO₂@IL from 1300 cm⁻¹ to 2000 cm⁻¹. Small differences in spectra were observed in relation to the wavenumbers and intensities of the absorption bands for Fe₃O₄@SiO₂ and Fe₃O₄@SiO₂@IL. In spectrum of Fe₃O₄@SiO₂@IL functionalized silica, one important band at 1540 cm⁻¹ is attributed to the characteristic frequencies of cationic imidazole group.

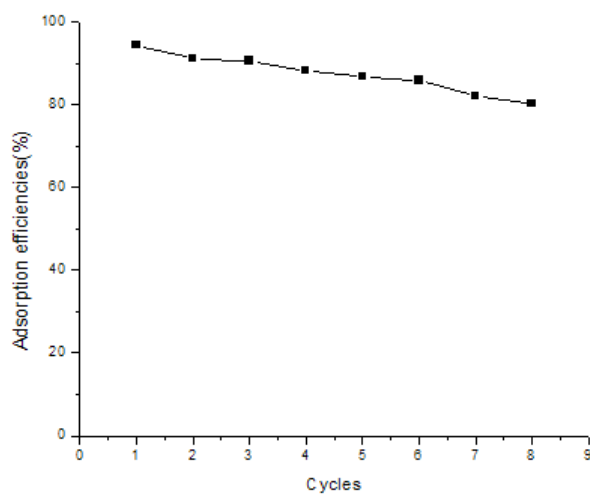


Figure S3. Recycled use of the IL resin for Hb adsorption.

The result of recycle experiment was shown in Fig.S3. The experiment condition is same as experiment 3.3.1 in this paper, pH 6.8. Compared to the actual bioseparations, sample concentration is very high. But the adsorption efficiencies maintained at more than 80% after 8 recycled use. So our resin would have a relatively long lifetime in the practical application.

Table S1. The separation efficiency of the IL resin compare to some commercial resins.

resin	Separation time	capacity	size	company
HIS-Select nickel magnetic beads ¹	30 min	>10 mg/g	20-75µm	Sigma
Glutathione High Capacity Magnetic Agarose Beads ²	30min	≥12 mg/g	50µm	Sigma
MagPrep [®] P-25 Protein A Particles ³		> 220 µg human IgG/mg	25nm	Novagen
Ni-NTA magnetic agarose beads ⁴	30min	0.25-1 mg/g	20-70µm	QIAGEN
IL resin (This work)	15min	2.15 g Hb per g resin	~270nm	

Table S2. The comparison of size, molecular weight and maximum adsorption number between Hb and Lys.

protein	Size (dimensions)	molecular weight	maximum adsorption number
Hb	5.3×5.4×6.5 nm ⁵	64500	3.33×10 ⁻⁵ mol/g
Lys	3.0×3.0×4.5 nm ⁶	14388	1.39×10 ⁻⁶ mol/g

Seen from the table 1 below, the gap of size is not conspicuous relative to molecular weight. But the magnitude of adsorption number is different, which proved the selective affinities for hemoglobin.

References

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- 2 <http://www.sigmaaldrich.com/catalog/product/sigma/g0924?lang=en®ion=CA>.
- 3 http://www.merckmillipore.com/china/life-science-research/magprep-p-25-protein-a-p/articles/EMD_BIO-72189/english/p_uDGb.s1O2tQAAAEjYRp9.zLX?WFSimpleSearch_NameOrID=+beads&BackButtonText=search+results
- 4 <http://www.qiagen.com/Products/Protein/Purification/QIAexpressProteinPurificationSystem/Ni-NTAMagneticAgaroseBeads.aspx?r=609>
- 5 (a) H. H. Weetall, *Appl. Biochem. Biotechnol*, 1993, **41**, 157;
(b) I. Gill, *Chem. Mater*, 2001, **13**, 3404.
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