Electronic Supplementary Information

Multifunctional Mesoporous Nanocontainer with Iron Oxide Core and Cyclodextrin Gatekeeper for Efficient Theranostic Platform

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1. Materials

NCO-PEG (Mw = 5,000) from Nanocs, mono-6-azido-6-deoxy-β-CD from Cyclolab, and all the rest chemicals from Aldrich were used as received. All the solvents were purified by a literature procedure.[1]

2. Synthesis of CTAB-stabilized iron oxide nanocrystals

Cetyl trimethylammonium bromide (CTAB)-stabilized iron oxide nanocrystals were synthesized following the reference procedure.[2]

3. Synthesis of Fe@Si-MP

An aqueous solution of CTAB-stabilized nanocrystals (10 mL) was added into distilled water (86 mL) and the NaOH solution (2 M, 0.7 mL). After tetraethyl orthosilicate (TEOS, 1 mL) was added to the solution, the reaction mixture was vigorously stirred at 70°C for 2 hrs. The resulting solid was washed thoroughly with methanol by centrifugation (9000 rpm, 20 min) and dried under vacuum oven.

4. Synthesis of Fe@Si-SH

Fe@Si-MP (100 mg) was stirred with 3-mercaptopropyltrimethoxysilane (3 mL) in methanol (20 mL) at 40°C for 12 hrs. The resulting particles were separated by centrifugation (9000 rpm, 20 min) and washed three times with methanol.

5. Synthesis of S-(2-aminoethylthio)-2-thiopyridine hydrochloride

S-(2-Aminoethylthio)-2-thiopyridine hydrochloride was synthesized following the reported procedure.[3]

6. Synthesis of Fe@Si-NH_2

A DMF solution (4 mL) of Fe@Si-SH (100 mg), S-(2-aminoethylthio)-2-thiopyridine hydrochloride (100 mg), and acetic acid (40 μL) was stirred at room temperature for 5 hrs. The resulting particles (Fe@Si-NH_2) were separated by centrifugation (9000 rpm, 20 min) and washed three times with DMF and dried under vacuum oven.

7. Synthesis of Fe@Si-alkyne

A methanol (15 mL) with Fe@Si-NH_2 (100 mg) was stirred with 2 mL of propargyl bromide at 60℃ overnight. The particles were separated by centrifugation (9000 rpm, 20 min) and washed three times with methanol. CTAB was removed by stirring in 15 mL of methanol with 120 mg of ammonium nitrate for 20 min at 60℃. The surfactant removed Fe@Si-alkyne was separated by centrifugation and washed several times with ethanol.

8. Synthesis of Fe@Si-DOX-CD

Surfactant removed Fe@Si-alkyne (50 mg) and DOX (10 mg) were suspended in DMF (1.2 mL). After stirring for 24 hrs at room temperature, mono-6-azido-6-deoxy-β-CD (50 mg), copper(II) sulfate pentahydrate (50 mg) and sodium ascorbate (70 mg) were then added sequentially. The mixture was stirred at room temperature for 3 days. The resulting Fe@Si-DOX-CD was separated by centrifugation (9000 rpm, 20 min) and washed several times with DMF and distilled water.

9. Synthesis of Fe@Si-CD

A synthesis of Fe@Si-CD was carried out with aforementioned way to prepare Fe@Si-DOX-CD without DOX loading.

10. Synthesis of Fe@Si-DOX-CD-PEG

A DMF (5 mL) with Fe@Si-DOX-CD (50 mg) was stirred with 600 mg of NCO-PEG (Mw = 5,000) and dibutyltin dilaurate (60 μL) for 5 days at room temperature. The resulting particles were separated by centrifugation (9000 rpm, 20 min) and washed several times with distilled water.

11. Synthesis of Fe@Si-CD-PEG

A synthesis of Fe@Si-CD-PEG was carried out with aforementioned way to prepare Fe@Si-DOX-CD-PEG with Fe@Si-CD instead of Fe@Si-DOX-CD.

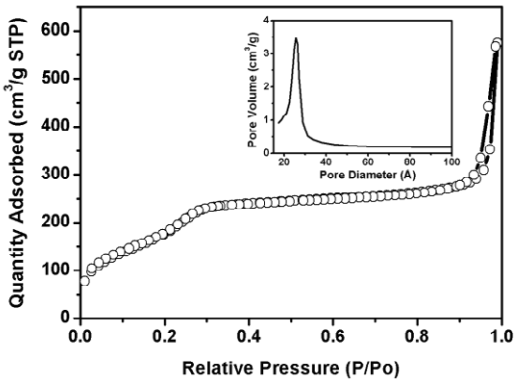

Fig. S1 BET nitrogen adsorption-desorption isotherms and BJH pore size distribution plots (inset) of Fe@Si-MP.

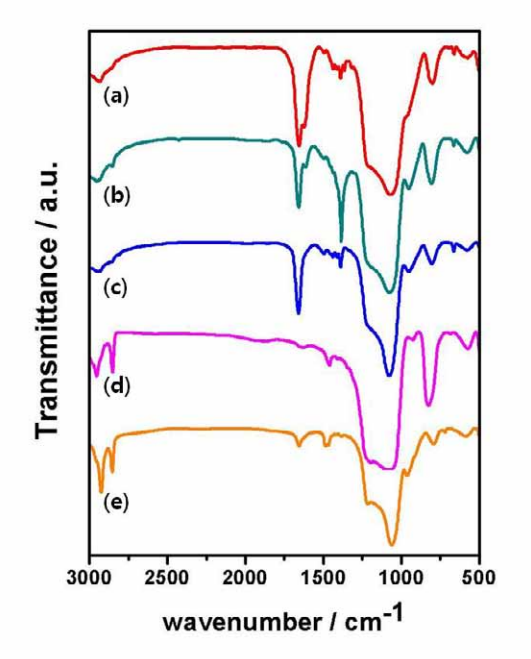

Fig. S2 FT-IR spectra of (a) Fe@Si-MP, (b) Fe@Si-SH, (c) Fe@Si-NH_2, (d) Fe@Si-alkyne, and (e) Fe@Si-CD.

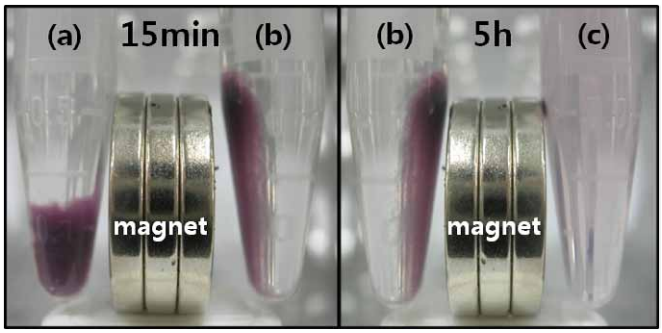

Fig. S3 Photographs of (a) Si-DOX-CD, (b) Fe@Si-DOX-CD and (c) Fe@Si-DOX-CD-PEG dispersed in PBS with exposure to a magnet.

References

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2. M. Liong, J. Lu, M. Kovochich, T. Xia, S. G. Ruehm, A. E. Nel, F. Tamanoi and J. I. Zink, *ACS Nano*, 2008, **2**, 889.
3. A. J. van der Vlies, C. P. O'Neil, U. Hasegawa, N. Hammond and J. A. Hubbell, *Bioconj. Chem.*, 2010, **21**, 653.