Supporting Information

Lanthanide-doped mesoporous MCM-41 nanoparticles as a novel optical-magnetic multifunctional nanobioprobes

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1. Synthesis of the nanoparticles.

0.2 g of cetyltrimethylammonium bromide (C_{16}TAB) and 0.505g polyethylene glycol (PEG) was dissolved in 100 ml of distilled water. 2 ml of 25% $NH_3 \cdot H_2O$ was then added to the vigorously stirred solution at room temperature, followed by the addition of 1 ml tetraethoxysilane (TEOS), and 0, 2, and 4 ml of $Ln(NO_3)_3$ solution (2.4 mM, contains 95% mol $Gd(NO_3)_3$ and 5% mol $Eu(NO_3)_3$). After one hour of stirring, the fine particle precipitate was centrifuged and dried in a freezer dryer. Then, the samples were calcined at 500 ◦C for 5 h to remove the templates.

Table S1 Synthesis parameters for MCM-41, LLn-MCM-41, and HLn-MCM-41 nanoparticles.

Samples	$Ln(NO_3)_3$ (2.4 mM)	C_{16}TAB	PEG	$NH_3 \cdot H_2O$	TEOS	Time
MCM-41	0 ml	0.2 g	0.505g	2 ml	1 ml	1 h
LLn-MCM-41	2 ml	0.2 g	0.505g	2 ml	1 ml	1 h
HLn-MCM-41	4 ml	0.2 g	0.505g	2 ml	1 ml	1 h

2. Multicolored Ln-MCM-41 fluorescence nanoparticles.

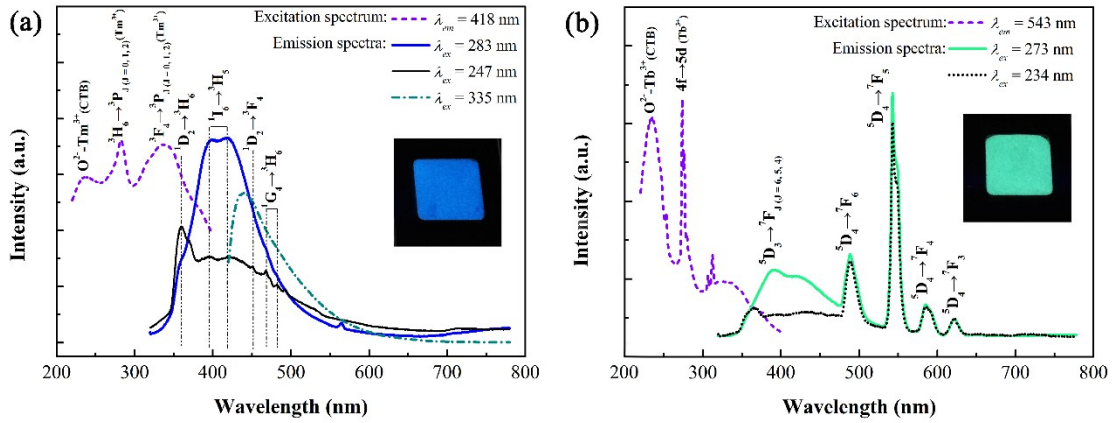

Figure S1 Room temperature photoluminescence excitation (PLE) and photoluminescence emission (PL) properties of the Ln-MCM-41 nanoparticles: (a) Ln = Gd/Tm and (b) Ln = Gd/Tb.

3. RT magnetization of the Ln-MCM-41 nanoparticles.

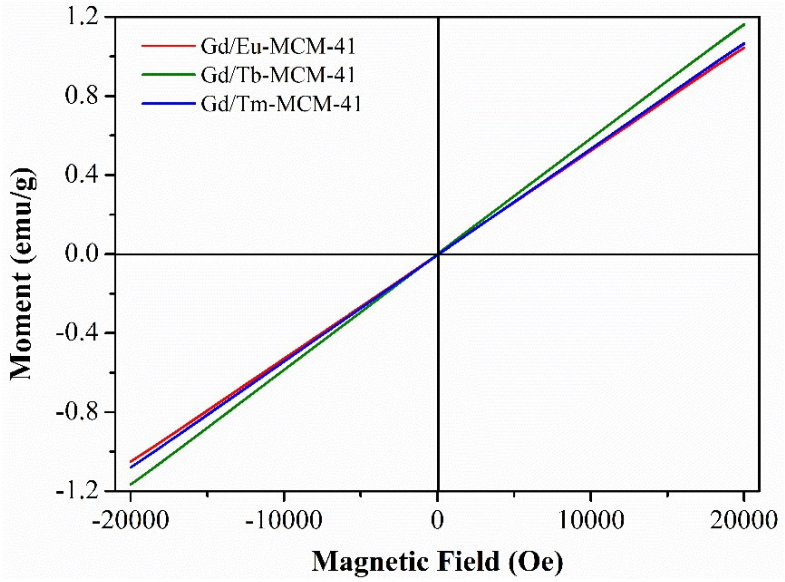

Figure S2 RT magnetization as a linear function of magnetic field for the Gd/Eu-MCM-41, Gd/Tb-MCM-41, and Gd/Tm-MCM-41 nanoparticles.

Table S2 Magnetization and applications of the reported Gd-based materials.

Samples	Magnetization at 300 K	Application	Reference
Gd-doped nanorods	~0.3 $emug^{-1}$ at 10 kOe	MRI	Ref. 1
PEG-Gd_2O_3 nanoparticles	0.75 $emug^{-1}$ at 15 kOe	MRI	Ref. 2
Porous Gd_2O_3 nanoparticles	< 4 $emug^{-1}$ at 20 kOe	MRI	Ref. 3
Silica-coated magnetite	3.2 $emug^{-1}$ at 6 kOe	Bioseparation	Ref. 4
$BaGdF_5$:Yb/Er nanoparticles	1.05 $emug^{-1}$ at 20 kOe	MRI	Ref. 5
Ln-MCM-41 nanoparticles	1.04 $emug^{-1}$ at 20 kOe	/	This work

Ref.

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4. Drug storage and release behaviors.

The UV-vis absorbance spectra of the PBS medium were measured after loading at different time. As shown in Fig. S3, the absorbance at 480 nm of PBS medium was closed to zero after loading at 2 h. This result indicted that the DOX were completely loaded in to the Ln-MCM-41 nanoparticles. Thus, it can be calculated that the loading mount of DOX-Ln-MCM-41 nanoparticles were about 0.06 mg of the DOX per mg of nanoparticles.

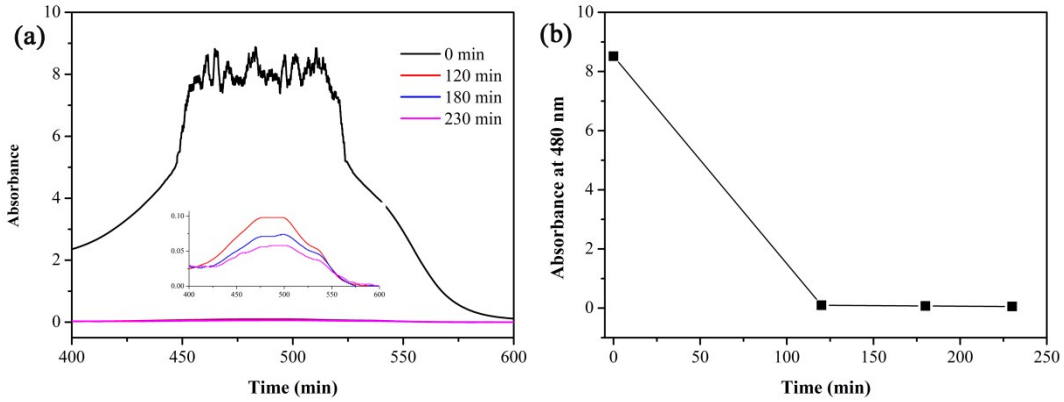

Fig. S3 UV-vis absorbance of the PBS medium after loading at different time

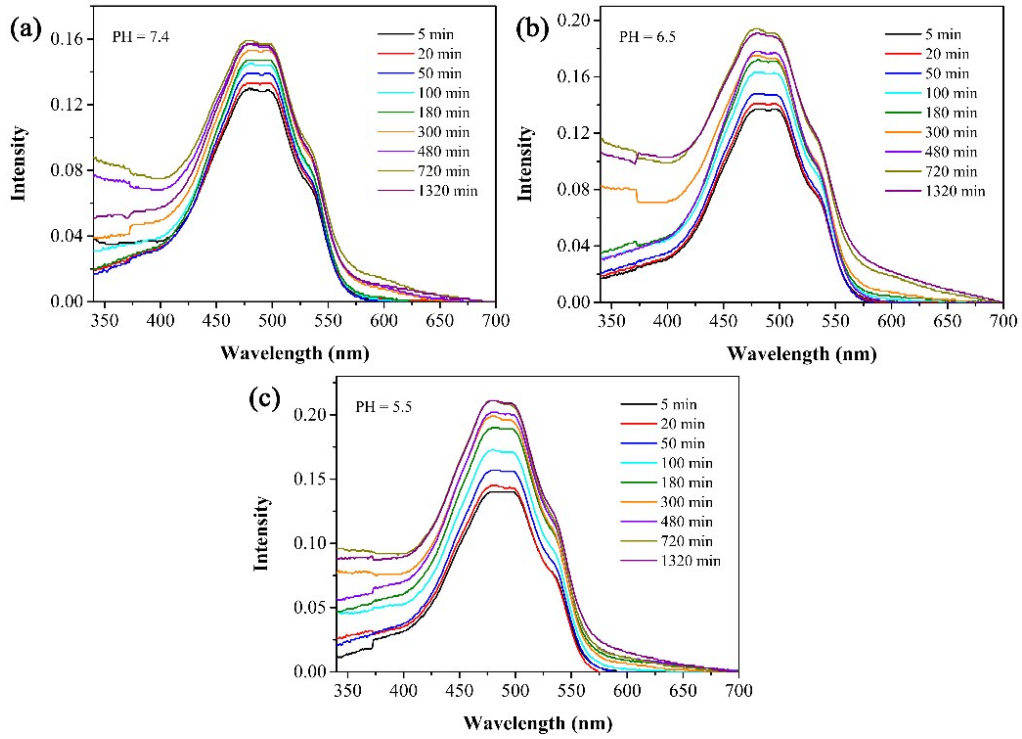

Figure S4 UV-vis absorbance spectra of the released PBS medium at predetermined time intervals: (a) pH =7.4; (b) pH =6.5; (c) pH =5.5.