

**Magnetic nanoparticles modified with DTPA-AMC-Rear Earth
for fluorescent and magnetic resonance's dual model imaging**

**Zengchen Liu,^a Bo Li,^b Baodui Wang,^a Zhengyin Yang,^{*a} Qin Wang,^b Tianrong
Li,^a Dongdong Qin,^a Yong Li,^a Mingfang Wang,^a Mihui Yan^a**

*^a State Key Laboratory of Applied Organic Chemistry and College of Chemistry and Chemical
Engineering, Lanzhou University, Lanzhou 730000, PR China*

^bSchool of life science, Lanzhou University, Lanzhou 730000, PR China.

Experimental Section

Cell lines and culture conditions. Uterine cervix carcinoma cell line (HeLa) were purchased from the Biology Preservation Center in Shanghai Institute of Materia Medica and cultured with DMEM medium (Gibco) supplemented with 10% fetal bovine serum (Gibco), 2 mM l-glutamine, 100 units/ml penicillin and 100 mg/ml streptomycin and incubated at 37 °C in a humidified atmosphere of 5% CO₂ and 95% air.

Preparation of DBI-PEG-NH-DTPA-AMC-Gd³⁺ (Eu³⁺)

10 mg DTPAA was dissolved in dry DMF, then the dry DMF solution containing 4.9 mg 4-amino-7-methyl coumarin (AMC) was added to the DTPAA solution, After reacting 6h with stirring at room temperature, DTPA-AMC (7-amino-4-methyl coumarin) monoanhydride was obtained, DBI-PEG-NH-DTPA-AMC was prepared by mixing the dry CHCl₃ solution containing DBI-PEG-NH₂ and DTPA-AMC (7-amino-4-methyl coumarin) monoanhydride DMF solution, the mixture reacted 24h with stirring at room temperature. The solution was concentrated to obtain DBI-PEG-NH-DTPA-AMC by reduced pressure distillation. The product was stored at -20 °C. The ¹H-NMR and ¹³C-NMR spectra of DBI-PEG-NH-DTPA-AMC were listed in Fig. S3 and Fig. S4. Some characteristic peak position from ¹H-NMR (400 MHz, *d*₆-DMSO, ppm): δ 3.01 (t, 2H, CH₂N_{DBI-PEG-NH}), 3.51 (bs, ~386H, PEG4000), 6.74 (d, 1H, Ph_{DBI-PEG-NH}), 6.60 (d, 1H, Ph_{DBI-PEG-NH}), 6.40 (s, 1H, Ph_{DBI-PEG-NH}), 7.40 (d, 1H, Ph_{DTPA-AMC}), 7.27 (d, 1H, Ph_{DTPA-AMC}), 6.98 (s, 1H, Ph_{DTPA-AMC}), 5.89 (s, 1H, Ph_{DTPA-AMC}), 2.89 (s, 3H, -CH₃_{DTPA-AMC}). ¹³C-NMR (400 MHz, *d*₆-DMSO, ppm): δ 191.22, 172.58, 160.72, 158.13, 155.47, 153.74, 153.10, 126.19, 111.17, 108.82, 107.45, 98.51, 88.19, 69.79, 55.24, 36.80, 18.00. DBI-PEG-NH-DTPA-AMC-Gd³⁺ (Eu³⁺) was prepared

by synthetic DBI-PEG-NH-DTPA-AMC reacting with isometric gadolinium nitrate (europium nitrate) in DI water. The accurate concentration of Gd^{3+} and Eu^{3+} were determined by ICP emission spectrometer (ICP-AES).

MR images evaluation of Fe_3O_4 NPs-DBI-PEG-NH-DTPA-AMC- Gd^{3+} samples

In MR Experiments, six-week male ICR mice with weights of 29-31g were used for the in vivo study. The mice (n =6) were anesthetized by 1.5% isoflurane in oxygen. Measurements were made before and after injection of 5c via tail vein. The amount of CA per each injection is as follows: 1 mmol of Gd^{3+} /kg for MR images. After each measurement the mouse was revived from anesthesia and placed in the cage with free access to food and water. During these measurements, the animals were maintained at approximately 37 °C using a warm water blanket.

MR images were taken with 0.55 T MR unit (Mini MR-60 MR image instrument, 23.309 MHz) equipped with a homemade small animal rf coil. The coil was of the receiver type with its inner diameter being 50 mm. The imaging parameters for 3D fast SPGR (spoiled GRASS images) are as follows: repetition time (TR) = 520 ms; echo time (TE) = 14 ms; 10 mm field of view (FOV); 128×256 matrix size; 1.0 mm slice thickness; number of acquisition (NEX) = 16. The imaging parameters for spin-echo are as follows: TR = 520 ms; TE = 14 ms; 6 mm FOV; 128×256 matrix size; 1.5 mm slice thickness; NEX = 16. Each image was taken at an interval of 3 min and 16 s. MR images were obtained for 24 h after injection. The MRI temperature was maintained at 37 °C.

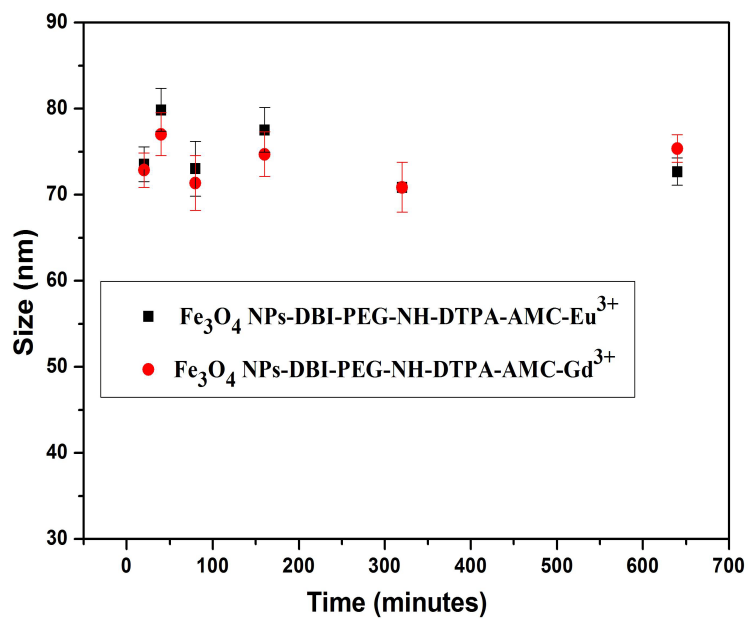


Fig. S1. Average hydrodynamic sizes of Fe_3O_4 NPs-DBI-PEG-NH-DTPA-AMC- Gd^{3+} and Fe_3O_4 NPs-DBI-PEG-NH-DTPA-AMC- Eu^{3+} in DI water.

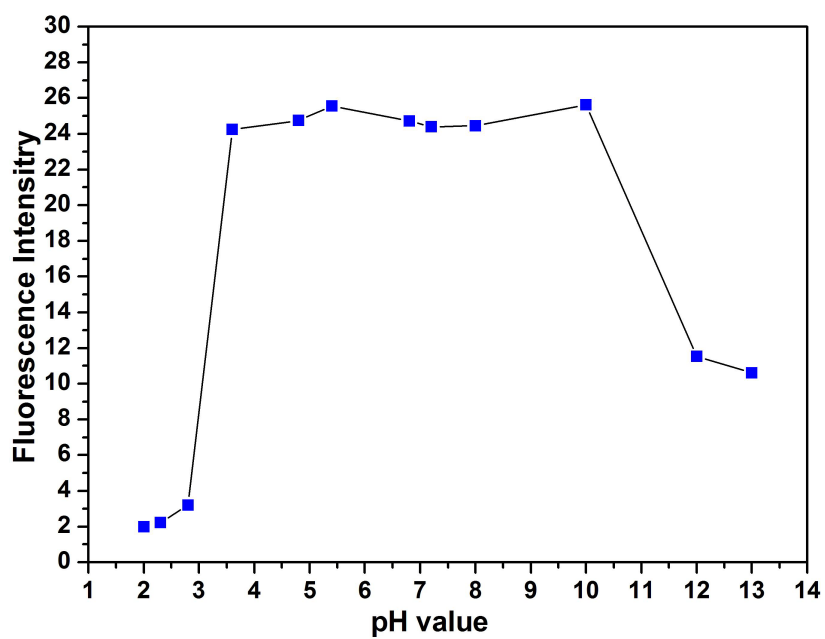


Fig. S2. The fluorescence intensity changes at 615 nm of Fe_3O_4 NPs-DBI-PEG-NH-DTPA-AMC- Eu^{3+} at different pH conditions.

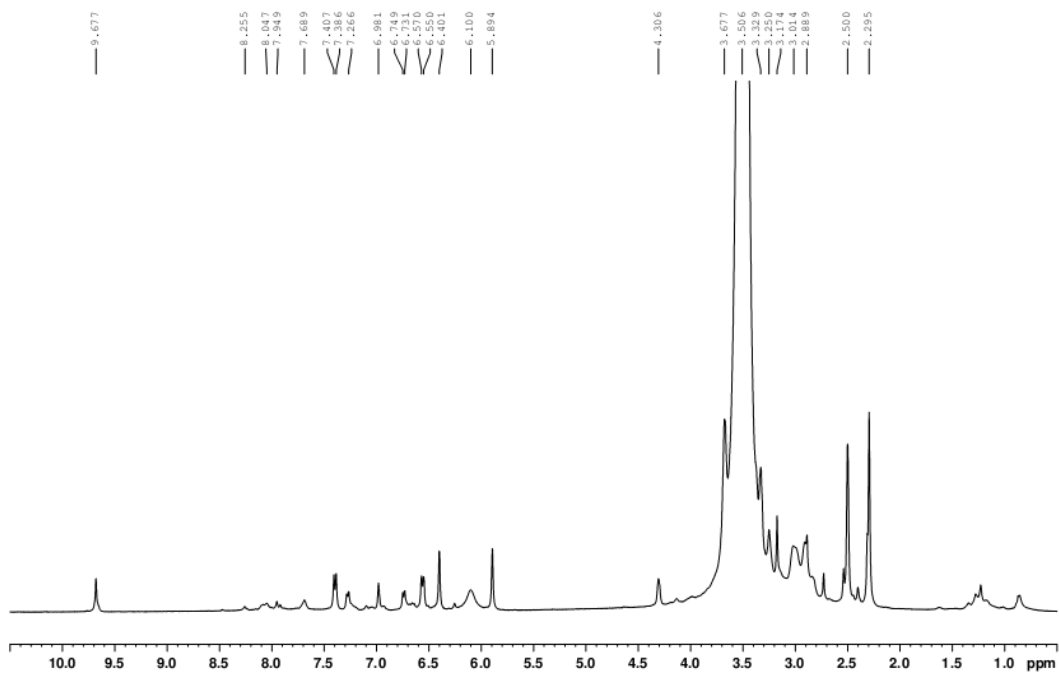


Fig. S3. The ¹H-NMR spectrum of DBI-PEG-NH-DTPA-AMC

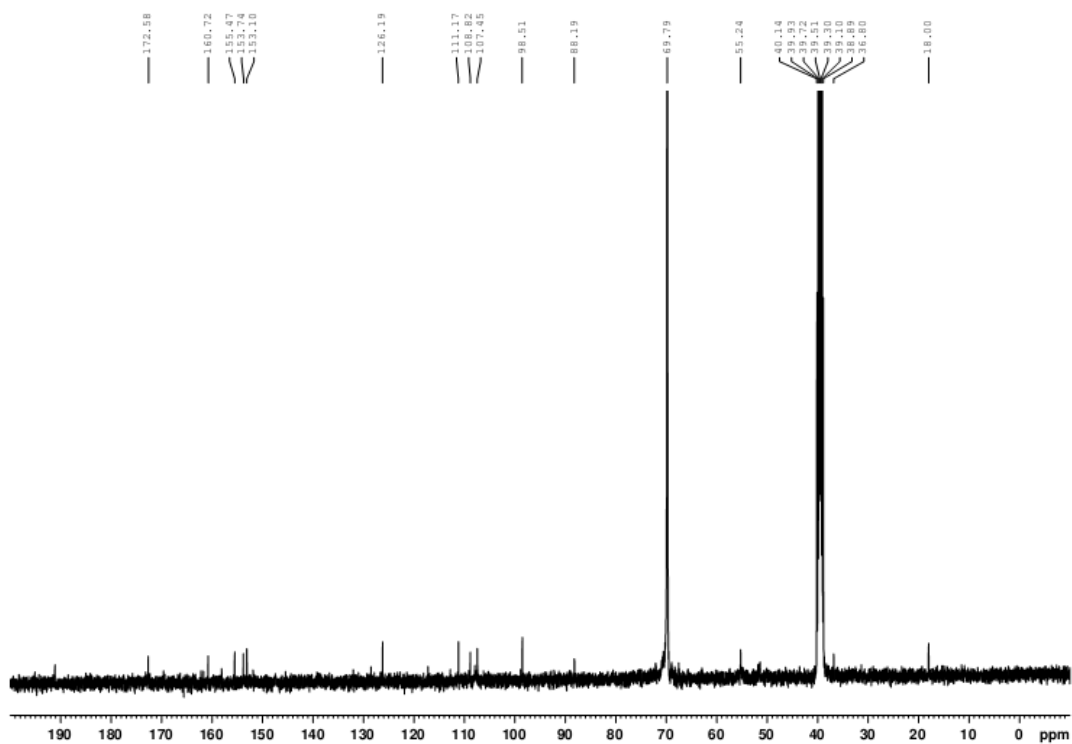


Fig. S4. The ¹³C-NMR spectrum of DBI-PEG-NH-DTPA-AMC