Supporting Information

Title: A matrix metalloproteinase-activated magnetic resonance imaging and Photoacoustic imaging contrast agent with improved turn-on relaxivity response and anion compatibility

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Fig. S1 Zeta potential of PEG-PepMMP2-MNP-Gd.

Fig. S2 Stability study of PEG-PepMMP2-MNP-Gd (A) and PEG-MNP-Gd (B) in PBS and FBS over 24 hours.

Fig. S3 Stability of PEG-PepMMP2-MNP-Gd (A) and PEG-MNP-Gd (B) with Gd$^{3+}$ ions in PBS (pH = 7.4).
**Fig. S4** UV-vis-NIR spectrum of PEG-PepMMP2-MNP-Gd. The nanoprobe exhibited a broad absorbance ranging from UV to NIR wavelengths for its potential application of PAI.

**Fig. S5** The PA spectra of PEG-PepMMP2-MNP-Gd (800 µg/mL) and the mouse blood.
Fig.S6 (A) PA images and the quantitative data of 4T1 cells incubation with PEG-PepMMP2-MNP-Gd at various concentrations (0, 50, 100, 200, 400, and 800 μg/mL).

(B) T1-weighted images and MR signal intensity changes of 4T1 cells incubation with PEG-PepMMP2-MNP-Gd at various concentrations (0, 50, 100, 200, 400, and 800 μg/mL).
Fig. S7 MR and PA imaging studies of PEG-PepMMP2-MNP-Gd after intratumoral administration. T1-weighted MR axial images of tumor-bearing mice before (Prescan) and at various time points (0 h, 2 h, 4 h, 12 h, 24 h) after injection of PEG-PepMMP2-MNP-Gd (A) and PEG-MNP-Gd using 3.0 T clinical MRI equipment (B). PA images in the tumor region collected by MOST imaging system before (Prescan) and at various time points (0 h, 2 h, 4 h, 12 h, 24 h) after intratumoral injection of PEG-PepMMP2-MNP-Gd (C) or PEG-MNP-Gd (D). The white circles point the tumor sites. In the image of pre injection, there were little intrinsic contrast between the tumors and surrounding tissue. After 2 hours, a remarkable brightened effect could be clearly detected in the local injection site of tumor in both groups. At 12 h after injection, the
MRI signals and PA signals of active nanoprobe reached a maximum. But in the inactive nanoprobe, the signal intensity diminished quickly within 24 h. The results indicated that the active nanoprobe had a longer residence time signal in tumor tissue as compared with inactive nanoprobe.

![Blood chemistry indexes](image)

**Fig.S8** Blood chemistry indexes (ALT, AST, BUN and SCr) of mice for the control, and 1 d and 7 d after treatment with PEG-PepMMP2-MNP-Gd (A) and PEG-MNP-Gd (B). (C) Complete blood panel indexes of mice after PEG-PepMMP2-MNP-Gd and PEG-MNP-Gd treatments.