

Supporting Information

A Photosensitizer-conjugated Magnetic Iron Oxide/Gold Hybrid Nanoparticle as an Activatable Platform for Photodynamic Cancer Therapy

Li Li,^a Md Nurunnabi,^b Md Nafiujjaman,^c Yong Yeon Jeong,^d Yong-kyu Lee*^c and Kang Moo Huh*^a

^a Department of Polymer Science and Engineering, Chungnam National University, Daejeon, South Korea. Tel: 82 42 821 6663; E-mail: khuh@cnu.ac.kr

^b Department of Polymer Science and Engineering, Korea National University of Transportation, Chungbuk, South Korea.

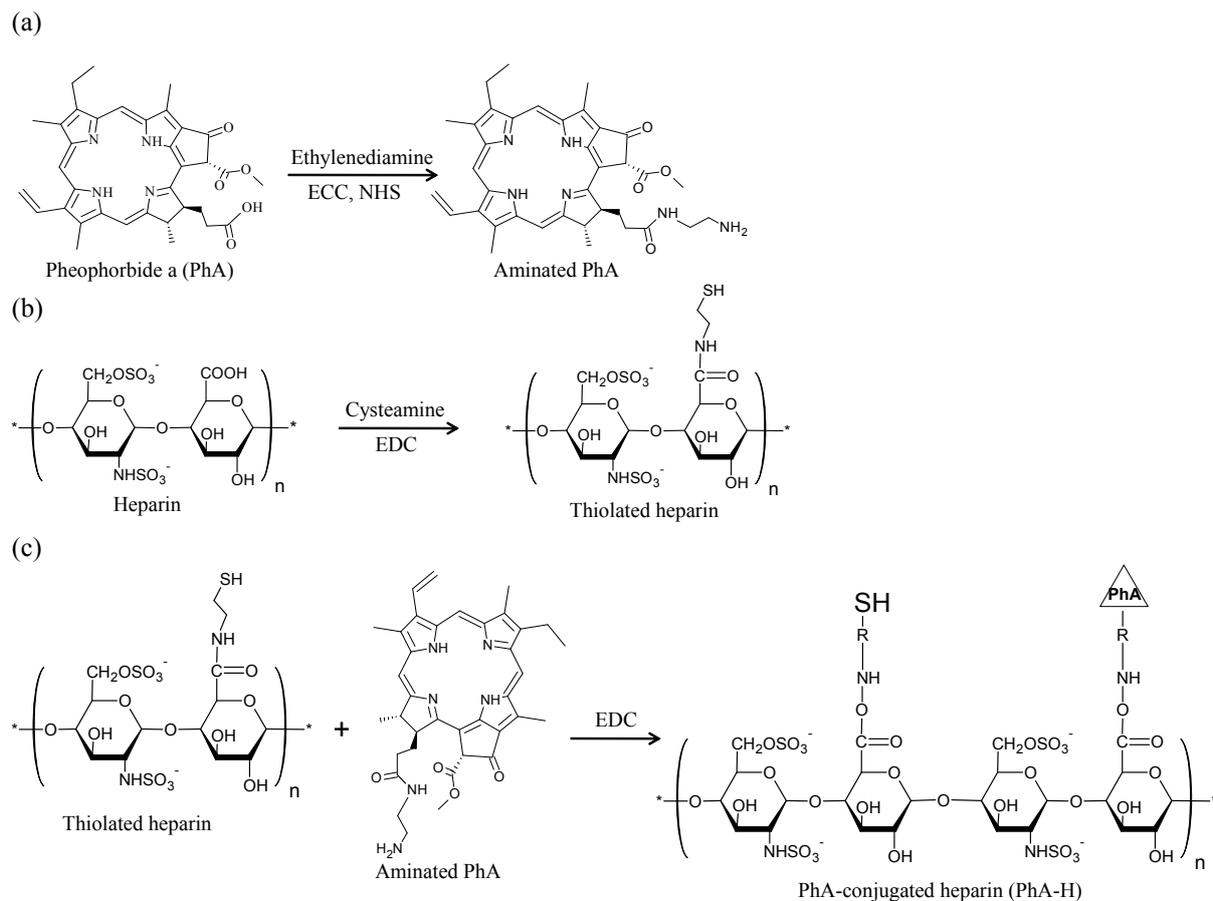
^c Department of Green Bio Engineering/Department of Chemical and Biological Engineering, Korea National University of Transportation, Chungbuk, South Korea. Tel: 82 43 841 5224; E-mail: leeyk@ut.ac.kr

^d Department of Radiology, Chonnam National University Hwasun Hospital, Chonnam National University Medical School, South Korea.

*Co-corresponding Authors

Synthesis and characterization of thiolated pheophorbide a-heparin conjugates (H-PhA):

In order to immobilize heparin chains to the surface of Fe₃O₄/Au nanoparticles (NPs), thiolated heparin was synthesized. Briefly, heparin (200 mg) was reacted with cysteamine (15.4 mg) and EDC (95.8 mg) in MES buffer (0.1 M, pH 5.5). After 24 h reaction, dialysis was performed to remove byproduct and uncoupled compounds. Thiolated heparin was obtained after freeze-drying. The coupling ratio of cysteamine was 3.0 as determined by Ellman's assay. H-PhA was synthesized as described in our previous report. Aminated PhA was firstly synthesized and conjugated to heparin through covalent amide bond. Typically, 40 mg of aminated PhA and 150 mg of heparin were dissolved in formamide (5 mL) and DMF (5 mL), respectively. The two solutions were mixed with vigorous stirring, and then 90 mg of EDC was added to the mixture. The reaction was carried out at room temperature for 36 h under nitrogen gas. After the reaction, the mixture was dialyzed and freeze-dried. The product was further purified by washing three times with methanol. The coupling ratio of PhA was 3.1 as characterized by colorimetric method as described in our previous study.^[1]



Scheme S1. Overall synthetic scheme for H-PhA: (a) thiolated heparin; (b) aminated PhA; and (c) H-PhA.

Table S1. Elemental analysis of Fe₃O₄/Au NPs

Formulation	Element	Wavelength (nm)	Concentration (ppm)
Fe ₃ O ₄ /Au NP	Fe	238.20	7.18
	Au	267.69	0.92

[1] L. Li, M. Nurunnabi, M. Nafiujjaman, Y. K. Lee and K. M. Huh, *J. Control. Release*, 2013, **171**, 241.