Hydrogelation of a Naphthalene Diimide Appended Peptide Amphiphile and its Application in Cell-Imaging and Intracellular pH Sensing

Nilotpal Singha,[a] *Purnima Gupta,*[b] *Bapan Pramanik,*[a] *Sahnawaz Ahmed,*[a] *Antara Dasgupta,*[a*] *AninditaUkil,*[b*] *Debapratim Das*[a*]

[a] Department of Chemistry, Indian Institute of Technology Guwahati, Assam 781039, India

[b] Department of Biochemistry, University of Calcutta, 35, Ballygunge Circular Road, Kolkata-700019, India

Experimental Section

Synthesis of 1a:

1,4,5,8- naphthalenetetracarboxylic acid dianhydride (2.0 g, 7.46 mmol) was taken in a 500 mL round bottom flask and 350 mL of water was added to the solid. 1 M aqueous KOH solution (35 mL) was then added to the mixture and heated with vigorous stirring until the compound completely dissolved. Once the solution became clear, the pH was adjusted to 6.4 by adding 1 M H_3PO_4. To this solution, *n*-hexyl amine (0.98 ml, 7.46 mmol) was added and the pH of the solution was again adjusted to 6.4 with 1M H_3PO_4. The mixture was refluxed overnight. It was then allowed to cool to room temperature and filtered. To the filtrate, acetic acid (5 mL) was added to afford a solid precipitate, which was then filtered and washed with more water and dried over silica gel under vacuum to get 1.47g (56% yield) of **1a** as an off-white solid.

^{1}HNMR (DMSO-*d*6, 600 MHz): *δ*/ppm = 8.56-8.54 (d, *J* =12Hz, 2H), 8.19-8.18 (d, *J* = 6Hz, 2H), 4.04-4.01 (t, *J* = 9Hz, 2H), 1.65-1.61 (m, *J* = 6Hz, 2H), 1.35-1.28 (m, *J* = 6Hz, 6H), 0.86-0.84 (t, *J* = 6Hz, 3H).

Synthesis of 1b:

1a (1 g, 2.85 mmol) was first dissolved in dimethylformamide (DMF,15 mL), by heating at 60°C followed by the sequential addition of Glycine (0.44 g, 5.87 mmol) and DIPEA (0.98 ml, 5.87 mmol). The reaction mixture was heated at 90°C with stirring for 12 h. The solvent was evaporated under vacuum and the crude residue was suspended in 2:1 water/methanol (100 mL) and the pH of the solution was adjusted to 3 by adding hydrochloric acid (6 N). The obtained solid was thoroughly washed with water by centrifugation and then dried over silica gel under vacuum to afford 0.8 g (69% yield) of **1b** as a deep brown solid.

^{1}HNMR (DMSO-*d*6, 600 MHz): *δ*/ppm = 8.67 (s, 4H), 4.65 (s, 1H), 4.04-4.02 (t, *J* = 9Hz, 2H), 1.65-1.61 (m, *J* = 6Hz, 2H), 1.35-1.28 (m, *J* = 6Hz, 6H), 0.86-0.84 (t, *J* = 6Hz, 3H).

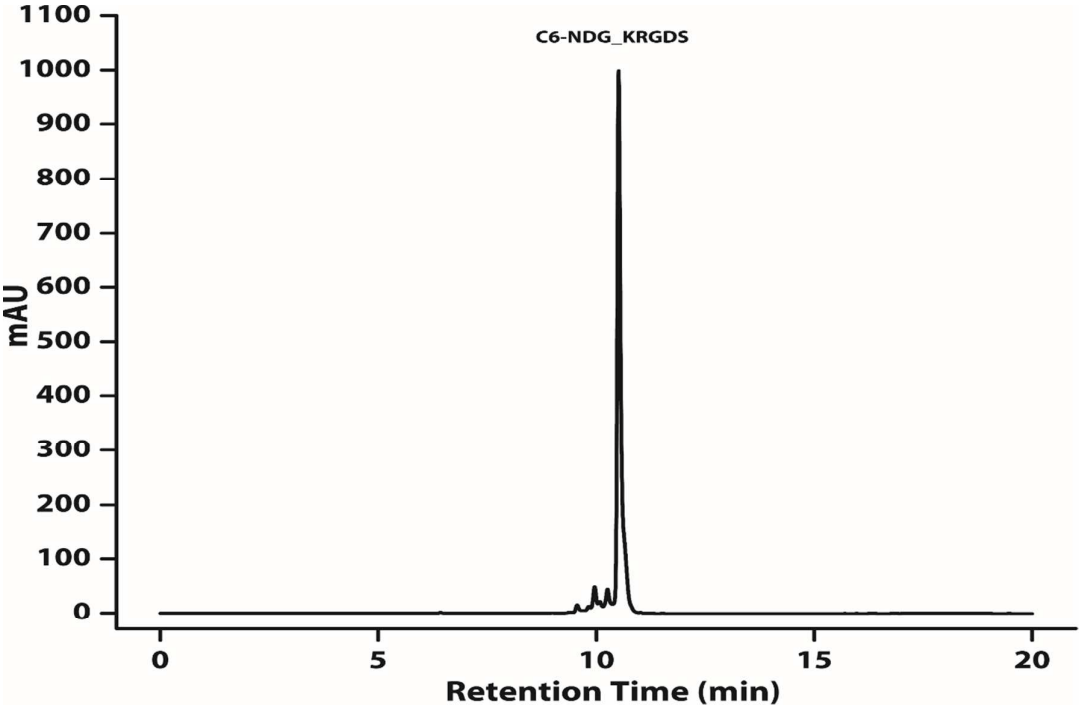

Figure S1. Analytical HPLC chromatogram of **PA-1**.

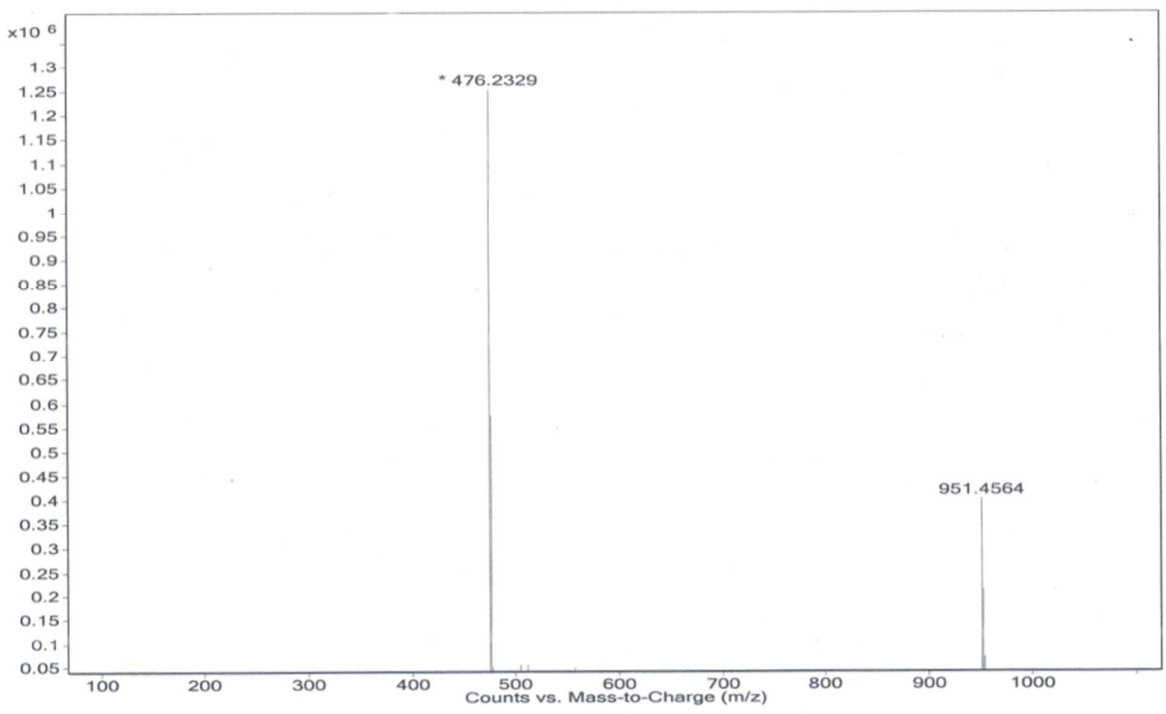

Figure S2. ESI-MS of **PA-1**.

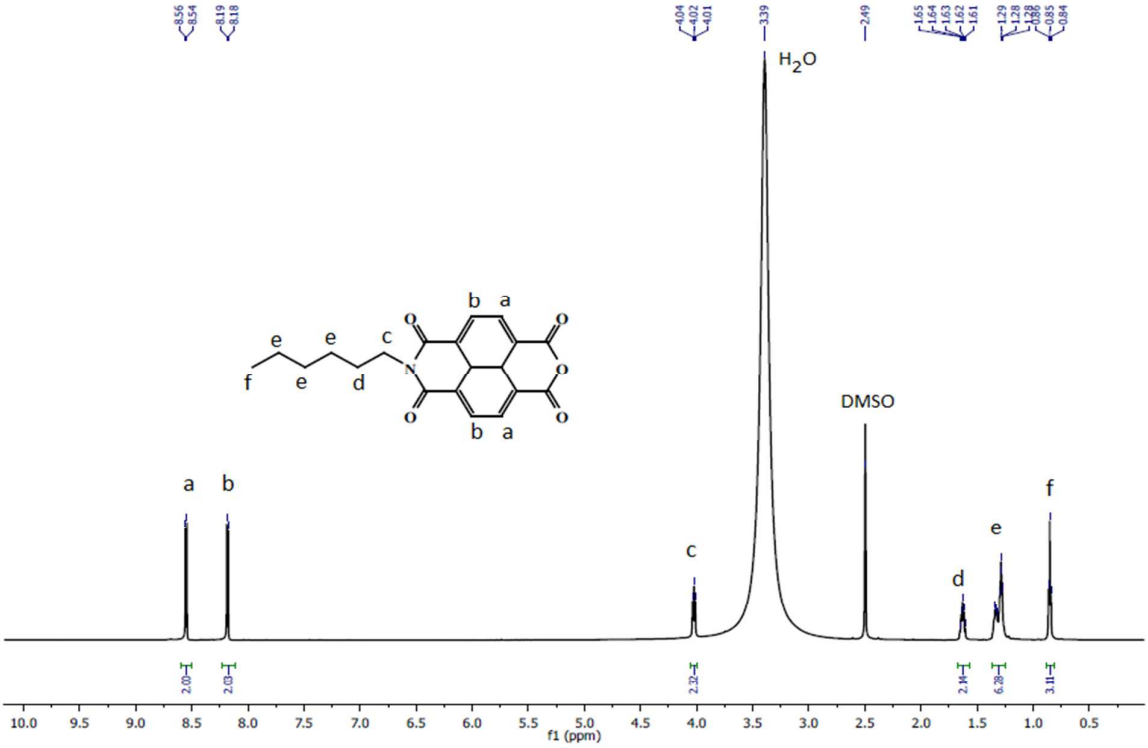

Figure S3. ^{1}H NMR spectra of **1a** in DMSO-d_6.

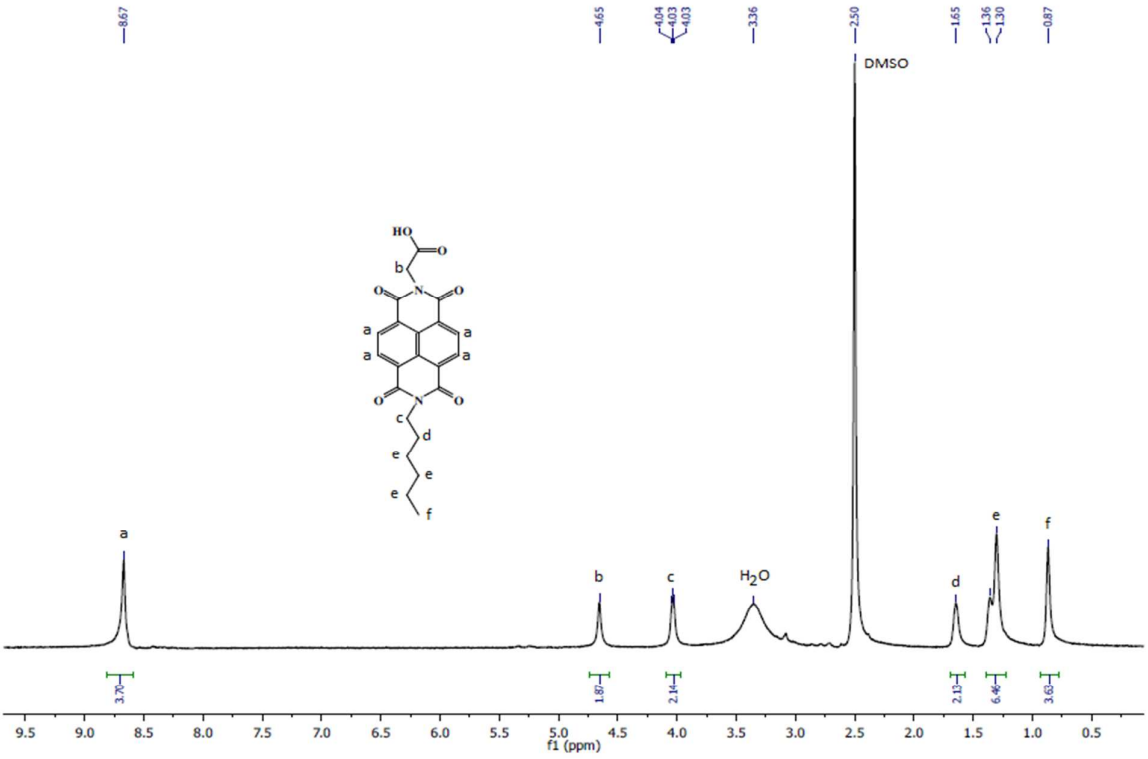

Figure S4. ^{1}H NMR spectra of **1b** in DMSO-d_6.

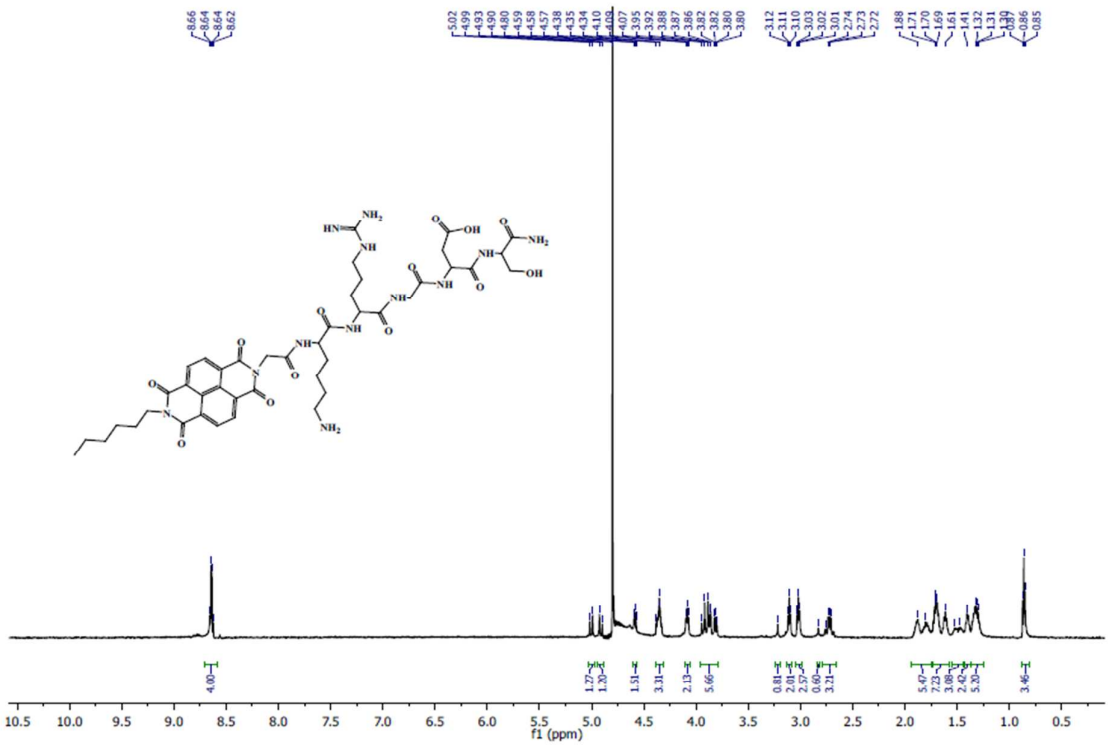

Figure S5. ^{1}HNMR spectra of **PA-1** in D_2O.

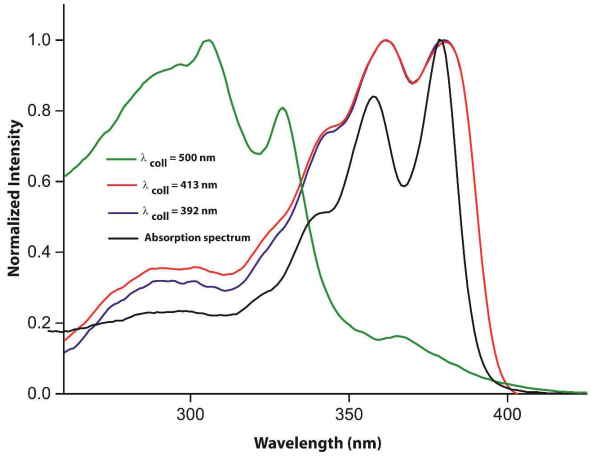

Figure S6. Normalized excitation spectra of an aqueous solution of **PA-1** (75 μM) collected at 500, 413 and 392 nm and merged with its corresponding absorption spectrum.

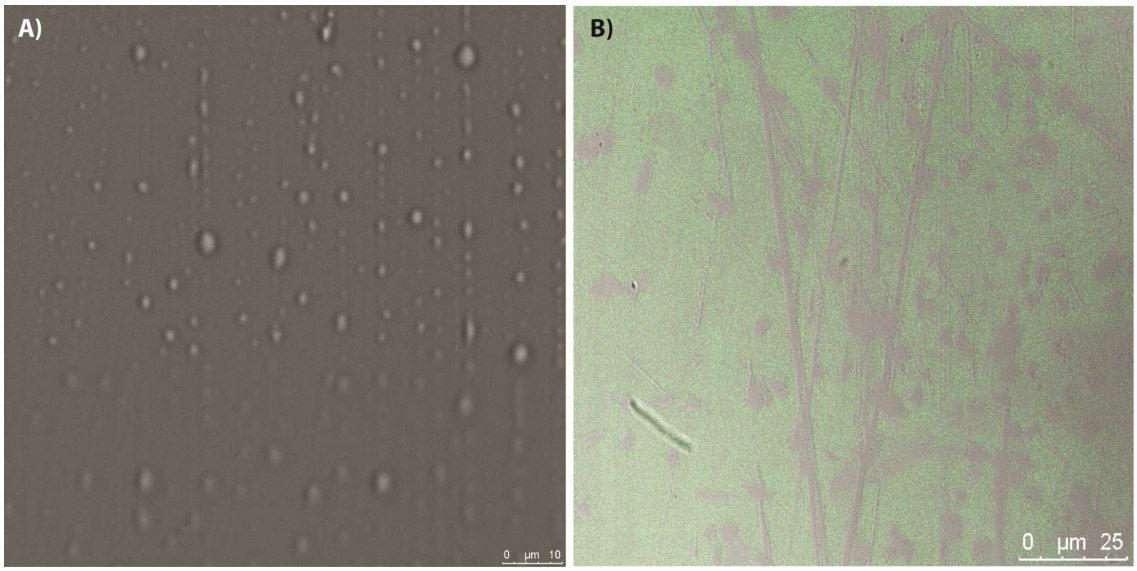

Figure S7. CLSM images of A) 500 μM and B) 900 μM aqueous solutions of **PA-1**.

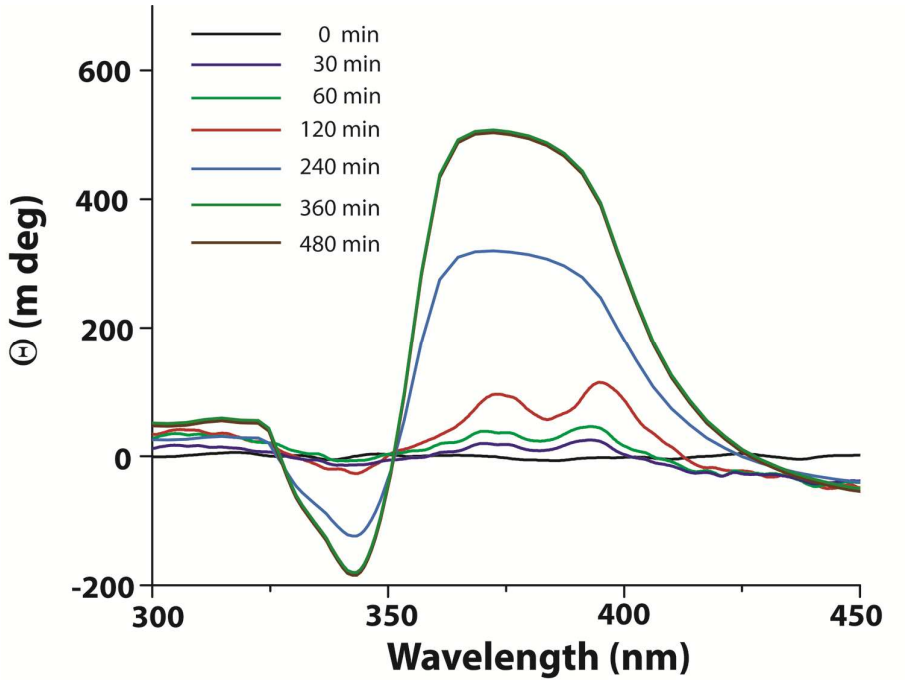

Figure S8. CD spectra of a 1 wt% solution of **PA-1** at different time interval.