Supporting Information

Supramolecular Three-Component Amino Acid-Based Hydrogels with Superior Mechanical Strength for Controllable Promoting Nonpathogenic E. Coli Growth

Yibao Li,a, + Linxiu Cheng, a, + Chunhua Liu, a Wei Liu, a Lei Zhu, a Yulan Fan, a Yongquan Wu, a Xun Li, a Qingdao Zeng, c, * and Xiaolin Fan a, b, *

Key Laboratory of Organo-pharmaceutical Chemistry, Gannan Normal University, Ganzhou 341000, P. R. China. E-mail: Fanxl2013@gnnu.cn; Fax: +86 (0)797 8393536

Material and Chemical Engineering Department, Pingxiang University, Pingxiang 337055, China.

National Center for Nanoscience and Technology (NCNST), Beijing 100190, P. R. China. E-mail: zengqd@nanoctr.cn; Fax: +86 (0)10 82545548

1. Synthesis and characterization of amino acid derivatives (GP and TP)

**Scheme S1.** Synthesis route of amino acid derivatives.

**Synthesis of Glutamate-functionalized perylene derivatives (GP):** 0.392 g (1.0 mmol) perylene-3, 4, 9, 10-tetracarboxylic dianhydride, 0.266 g (2.0 mmol) L-phenylalanine and 2.0 g imidazole were heated at 120 °C for 6 hrs under nitrogen atmosphere. Then 50 mL of H2O was poured into the hot mixture, refluxed for 6 hrs and cooled down, then added 1.0 mol/L HCl in dropwise till the mixture into acidity. Keeping the mixture in ambient temperatures overnight to let it precipitate out. The precipitate was filtered and washed with H2O. The product was dried at room temperature to get mulberry powder (yield: 0.52g, 80.0 %). The structure and purity of the product were confirmed by 1H 25 NMR, FT-IR and MS.
1H NMR (400 MHz, DMSO-d, 20 °C, TMS, ppm): δ 8.76-8.78 (d, 4 H), 8.48-8.51 (d, 4 H), 5.59-5.63 (q, 2 H), 2.31-2.38 (m, 8 H).

FT-IR (KBr): 1124.8, 1402.0, 1501.9 cm⁻¹ (C=C), 1299.0 cm⁻¹ (-CH₂-), 1617.8, 1690.1, 1768.4 cm⁻¹ (C=O), 3236.7 cm⁻¹ (C-H), 3413.9, 3476.3, 3549.6 cm⁻¹ (O-H).

MS (MALDI-TOF): calcd for C₃₄H₂₂N₂O₁₂, 650.1.

Synthesis of Tyrosine-functionalized perylene derivatives (TP): Similar procedure as like preparation of TP was followed for the synthesis of GP (yield: 0.61g, 84.9%).

1H NMR (400 MHz, DMSO-d, 20 °C, TMS, ppm): δ 9.09 (s, 2 H), 8.16 (s, 4 H), 8.02 (s, 4 H), 7.06-7.08 (d, 4 H), 6.57 -6.59 (d, 4 H), 5.92-5.96 (q, 2 H), 3.40-3.54 (m, 4 H).

FT-IR (KBr): 1251.4, 1364.6, 1400.0, 1511.8 cm⁻¹ (C=C), 1342.8 cm⁻¹ (-CH₂-), 1645.3, 1693.6, 1732.3 cm⁻¹ (C=O), 2931.4 cm⁻¹ (C-H), 3414.4, 3469.9, 3544.8 cm⁻¹ (O-H).

MS (MALDI-TOF): calcd for C₄₂H₂₈N₂O₁₀, 718.1.

2. Photos of gel

Fig. S1 (a) Optical images of compounds in water under ultrasound at room temperature, from left to right, RF solution, MM solution, RF/MM=1:1, hydrogel of GP/RF/MM = 1/2/2, solution of GP, solution of GP/ RF = 1/2, solution of GP/ MM = 1/2; (b) Hydrogel of GP/RF/MM = 1/2/3 (ultrasound), solution of TP/ RF /MM = 1/2/0.05 (ultrasound), solution of TP/ RF /MM = 1/2/2 (ultrasound), solution of GP/ RF /MM = 1/2/2 (without ultrasound).
3. CLSM and SEM images of gels

![CLSM images of GP/RF/MM (1/2/2) hydrogel ([GP] = 10^{-3} M), (a) CLSM image; (b) brightfield image; (c) frequency sweep of the GP/RF/MM (1/2/3) gel at a strain of 0.1%.

Fig. S2 CLSM images of GP/RF/MM (1/2/2) hydrogel ([GP] = 10^{-3} M), (a) CLSM image; (b) brightfield image; (c) frequency sweep of the GP/RF/MM (1/2/3) gel at a strain of 0.1%.

4. Cell viability test of gels

![Cell viability test of GP/RF/MM at various ratios in different concentration: (a) at the molar ratio of 1/1/0.1; (b) at the molar ratio of 1/2/0.1; (c) SEM image of GP/RF/MM system (1/2/2) after incubating with E. coli for 32 h.

Fig. S3 24 h cell viability test of GP/RF/MM at various ratios in different concentration: (a) at the molar ratio of 1/1/0.1; (b) at the molar ratio of 1/2/0.1; (c) SEM image of GP/RF/MM system (1/2/2) after incubating with *E. coli* for 32 h.
5. FT-IR data

Fig. S4 FT-IR spectra diluted with KBr for a GP/RF/MM = 1/2/2 xerogel (bule), GP (black), RF (green), MM (red).
6. Proposed mechanism of self-assembling process (GP/RF/MM = 1/2/2)

Fig. S5 Another proposed mechanism of self-assembling process (GP/RF/MM = 1/2/2).