

Supporting Information

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

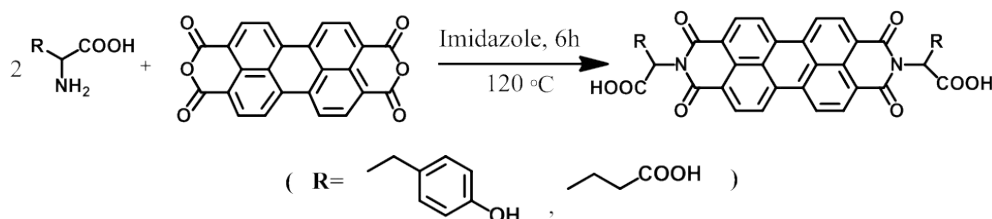
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15 1. Synthesis and characterization of amino acid derivatives (GP and TP)



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 NMR, FT-IR and MS.

^1H NMR (400 MHz, DMSO- d_6 , 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} (-CH $_2$ -), 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).

5 MS (MALDI-TOF): calcd for C $_{34}$ H $_{22}$ N $_2$ O $_{12}$, 650.1.

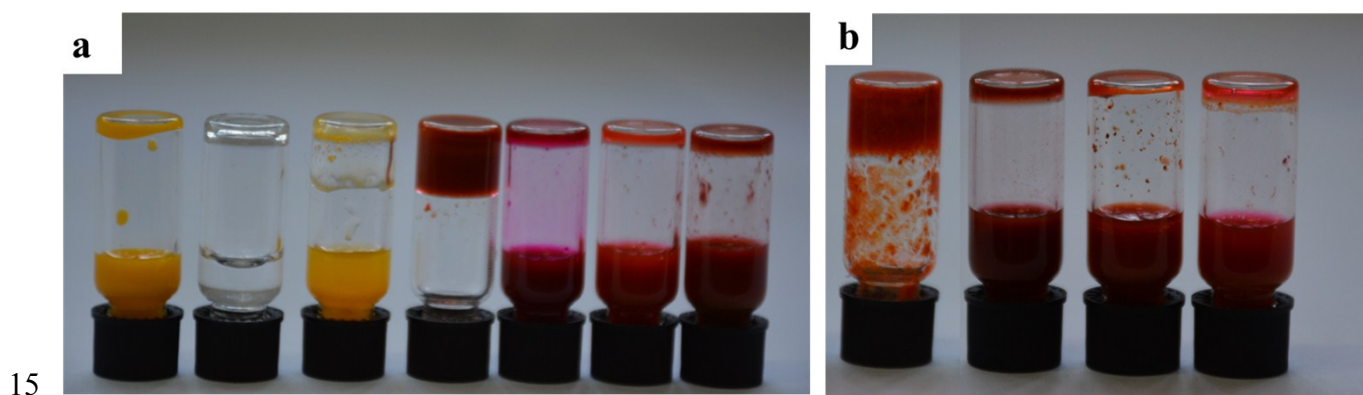
Synthesis of Tyrosine-functionalized perylene derivatives (TP): Similar procedure as like preparation of TP was followed for the synthesis of GP (yield: 0.61g, 84.9%).

^1H NMR (400 MHz, DMSO- d_6 , 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).

10 FT-IR (KBr): 1251.4, 1364.6, 1400.0, 1511.8 cm^{-1} (C=C), 1342.8 cm^{-1} (-CH $_2$ -), 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 C $_{42}$ H $_{28}$ N $_2$ O $_{10}$, 718.1.

2. Photos of gel



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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), 20 solution of GP/ RF /MM = 1/2/2 (without ultrasound).

3. CLSM and SEM images of gels

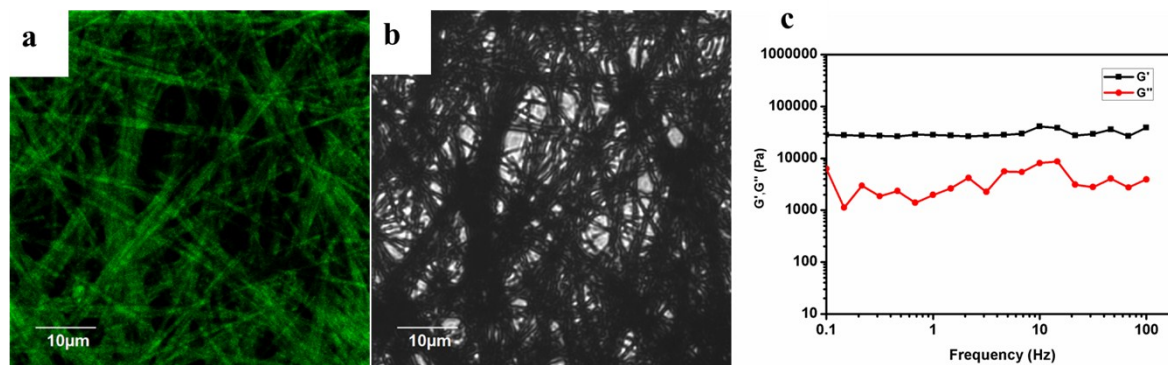


Fig. S2 CLSM images of GP/RF/MM (1/2/2) hydrogel ($[GP] = 10^{-3}$ M), (a) CLSM image; (b) brightfield image; (c) frequency sweep of the GP/RF/MM (1/2/3) gel at a strain of 0.1%.

4. Cell viability test of gels

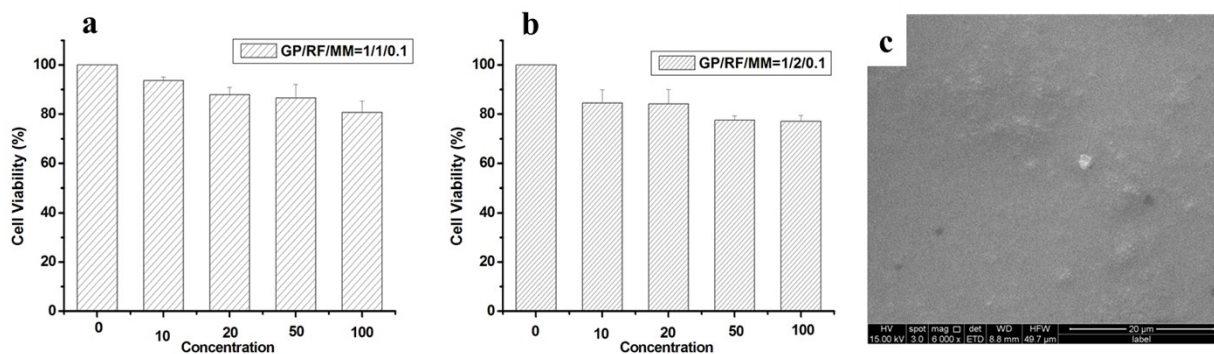


Fig. S3 24 h cell viability test of GP/RF/MM at various ratios in different concentration: (a) at the molar ratio of 1/1/0.1; (b) at the molar ratio of 1/2/0.1; (c) SEM image of GP/RF/MM system (1/2/2) after incubating with *E. coli* for 32 h.

5. FT-IR data

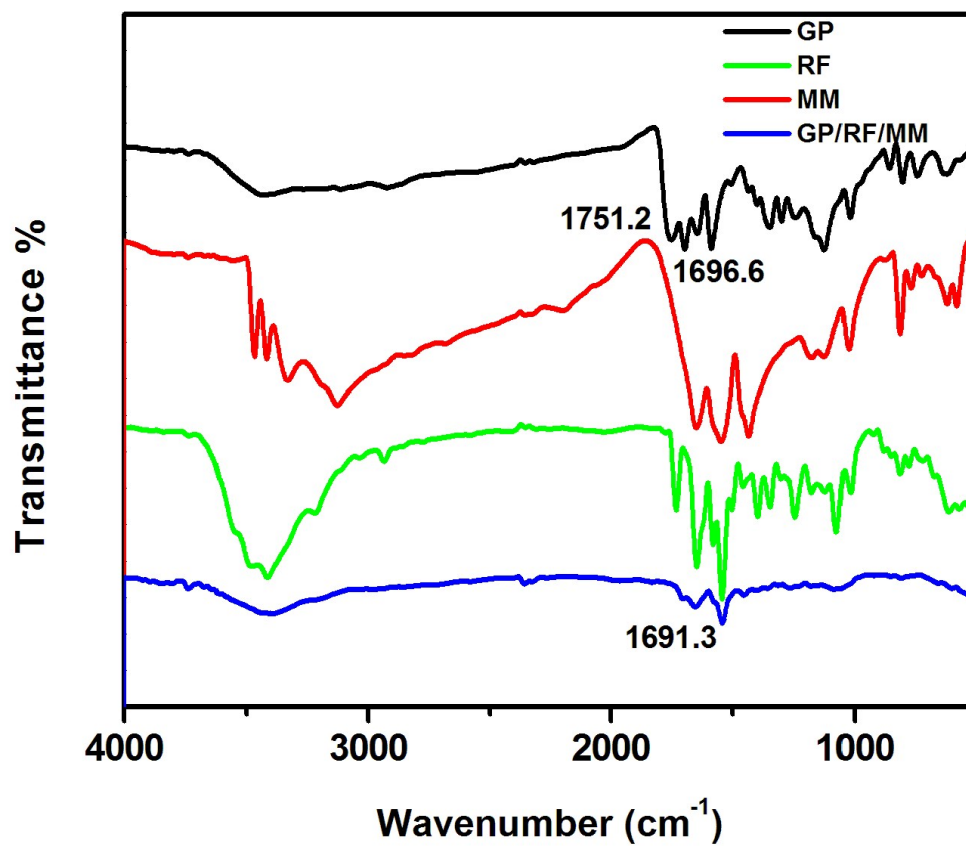


Fig. S4 FT-IR spectra diluted with KBr for a GP/RF/MM = 1/2/2 xerogel (blue), GP (black), RF (green), MM (red).

6. Proposed mechanism of self-assembling process(GP/RF/MM = 1/2/2)

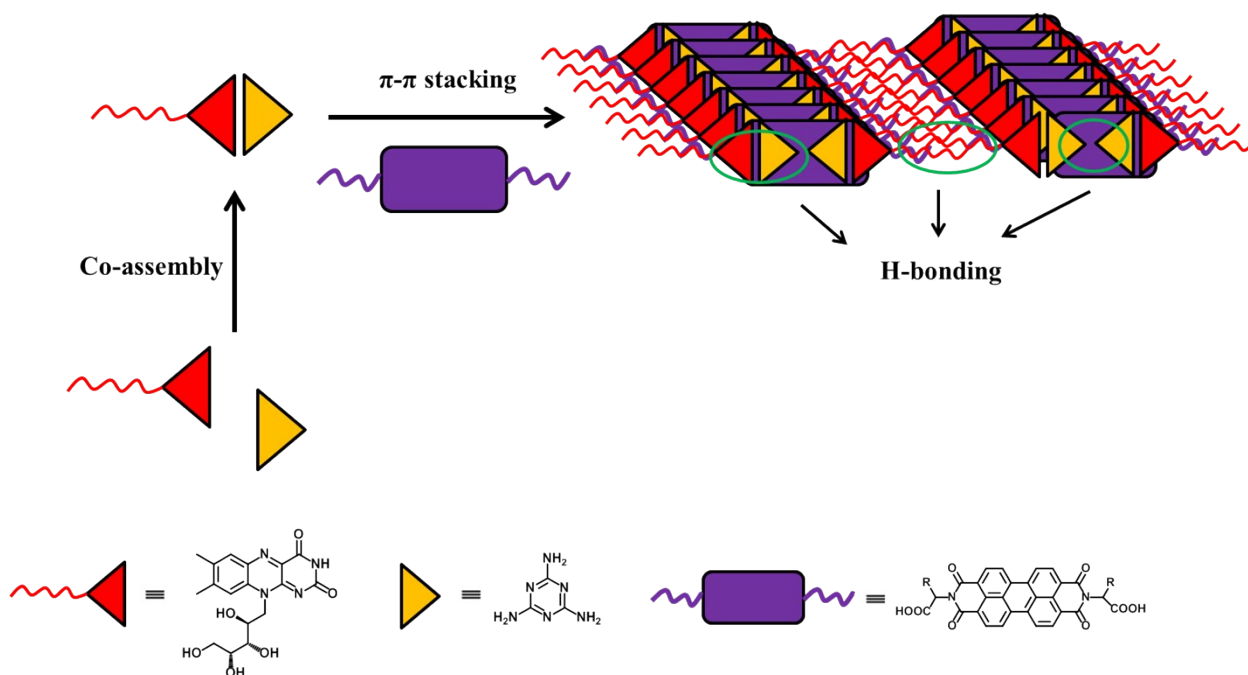


Fig. S5 Another proposed mechanism of self-assembling process (GP/RF/MM = 1/2/2).