Self-Assembly of Small Molecules Affords Multifunctional Supramolecular Hydrogels for Topically Treating Simulated Uranium Wounds

Supporting Information

General: ε-Fmoc-lysine and Fmoc-leucine were purchased from GL Biochem (Shanghai) Ltd., Pamidronate disodium from Duqiao chemicals of Linhai (Zhejiang), and $UO_2(NO_3)_2{\cdot}2H_2O$ from 404 Chemicals (Lanzhou, China). CD spectra was recorded on JASCO J-810, emission spectra on Perkin Elmer LS55 ($\lambda_{excitation}$ = 265 nm, slit width = 2.5 nm), rheology data on a control strain rheometer (Rheometrics ARES) with a cone and plate (25mm diameter plate and 0.0999 rad cone angle. The samples were prepared via cryo-drying for electron micrograph. SEM was recorded on JEOL-6300, and TEM on Philips CM20.

Uptake of UO_2^{2+} by the hydrogel III: 14.7 mg of ε-Fmoc-lysine, 14.2 mg of Fmoc-leucine and 50.4 mg of pamidronate disodium (1:1:4) were suspended in 2.0 mL water, heated to about 70 °C and cooled to room temperature. After the gel was formed, 1.0 mL of water containing 100 mg of $UO_2(NO_3)_2{\cdot}2H_2O$ was added to the gel's surface. The hydrogel was kept in passive contact with the aqueous solution of UO_2^{2+}. 10 μL of the solution was taken out by a syringe and diluted to 1mL, then UV absorbance was measured after 0.5h, 1.0h, 1.5 h, 2.5 h, 3.5 h, 4.5 h, 5.5 h and 6.5 h, respectively. After the absorption experiment, the gel remains stable with its color change to pale yellow. Figure S-1 shows the decrease of $UO_2(NO_3)_2$ in the solution.

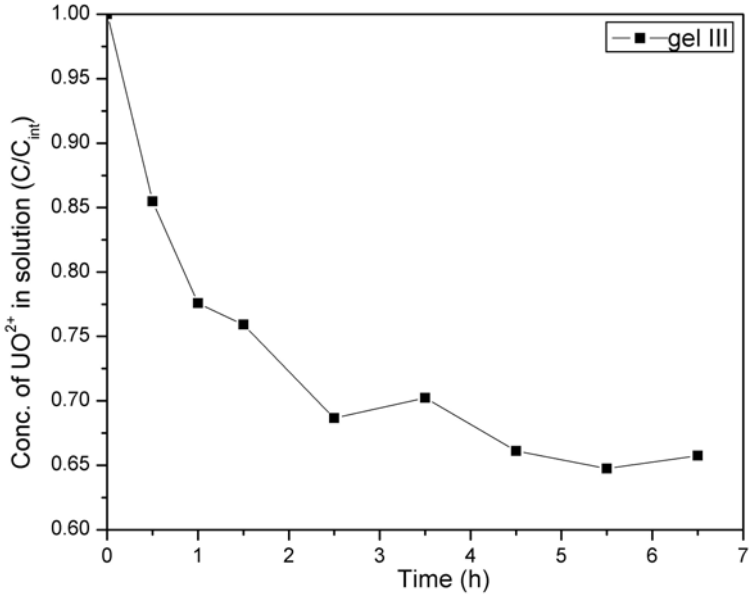


Figure S-1. The ratio of the concentration of UO_2^{2+} in the solution after adding on top of the gel III and the initial concentration of UO_2^{2+} in the solution vs. time.

CD and emission spectra of the hydrogels I, II, and III:

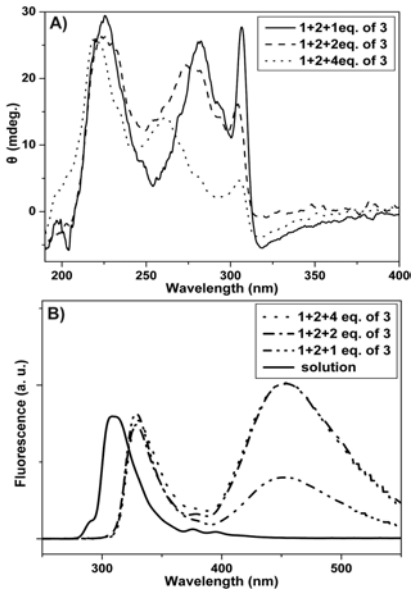


Figure S-2. The (A) CD and (B) the emission spectra (λ_{ex} = 265 nm) of the hydrogels.

SEM and TEM of hydrogels I and II:

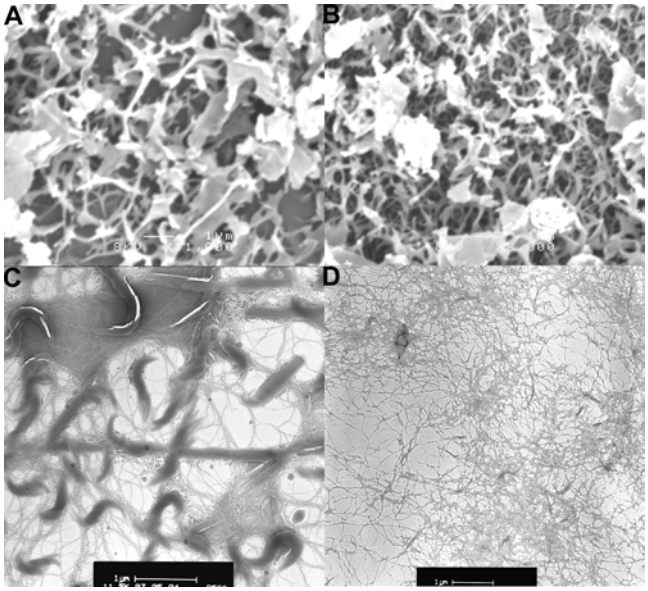
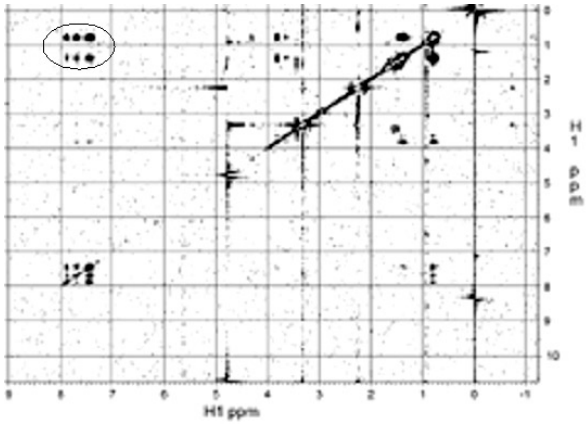


Figure S-3. SEM of gels (A) I and (B) II and TEM of gels (C) I and (D) II.

2D NOESY spectra of gel III at the near-gelation stage:



In vivo experiment: Outbred/ICR mice of weight around 30g were divided into 3 groups for experiments. In the negative control (-) group, hair on the back of mice was first removed, and a wound that covered an area of 1x1 cm^2 was made via scratching by a razor blade while the mice were anaesthetized. The anesthesia was applied similarly to each mouse of the other two groups via i.p. injection of a 0.2 mL of 2:1 ratio mixture of 10% Katamine and 20 mg/mL Xylasine. The mice were unconscious during a period of 30 min so that pain was maximally reduced in the experiments. And the wound site was finally sealed by liquid plaster on all groups of mice to avoid further inflammation when the mice recovered from anesthesia. In the positive control (+) group, after hair removal and wound formation, each mouse was administered 3 drops of 1 g/mL uranium (238) nitrate (UN) solution on the wound site. And in the healing group, UN was applied at the wound site similarly as in the positive control group. 20 min after the UN administration, the hydrogel (0.5 mL, the concentration of **1**, **2**, and **3** are 20, 20, and 80 mM, respectively) was administered to the wound site to reduce the toxicity of UN as much as possible. All the mice were kept in the same condition in the next 10 days, and their daily behavior and weight change were observed.

Animal experiments were conducted via HKUST animal care facility under license from Department of Health, the government of the Hong Kong Special Administrative Region, PRC. The license ref no. is (316) in DHNTE 007/5 Pt.25, valid until 29.10.2005 (HKUST animal care facility handles animals based on the following book from National Research Council: Guide for the Care and Use of Laboratory Animals, National Academy Press).