Electronic Supplementary Information (ESI)

Carbonaceous hydrogels based on hydrothermal carbonization of glucose with chitin nanofibers

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1. Preparation of chitin nanofiber

Chitin nanofiber (CNF) was produced by mechanical treatment according to the method described previously. Briefly, the dry squid pen were ground into powder by a high speend blender. The β-Chitin was first purified from squid pen by treating with Triton® X-100 and NaOH. Powdered squid pen (3 g) was suspended in 500 mL 0.5% Triton X-100 by stirring for 24 h at room temperature to remove lipoproteins. After thorough wash with DI water, the wet cake was suspended in 500 mL of 1 N NaOH solution by stirring 24 h to eliminate the remaining proteins. After washing thoroughly with DI water to neutral pH, the collected chitin wet cake (0.3 g) was dispersed in 100 mL DI water and adjusted pH to 3-4 with dilute HCl and NaOH solution. The transparent CNF viscose was produced by ultrasonication (Qsonica sonicator) with power of 27 W for 20 min at 4^{o}C.

2. Ninhydrin test for amine group

The presence of amine groups in purified chitin cake was determined by using ninhydrin reagent. Typically, 20 mg of chitin wet cake was added to 100 μL of ninhydrin reagent (ethanol 99.8%, 80 w/v% phenol and 5 w/v% ninhydrin) and 100 μL DI water. The reaction

carried out at 90 ^{o}C for 5 minutes. After cooling at room temperature added 800 μL DI water. Amine groups in the sample will react with the reagent produces purple colored solution.

Chitin wet cake

Ninhydrin Assay

Fig. S1 Ninhydrin assay for amine groups content in chitin cake.

3. Preparation of carbonaceous hydrogel

To prepare carbonaceous hydrogels, the as-prepared CNF viscose (12 mL) was transferred into a glass vial containing 0.1 M, 0.2 M, and 0.3 M of glucose and sealed in a stainless steel autoclave. The reactor was heated at 180 ◦C for 4 h and cooling at room temperature. Brownish suspension and hysrogels were obtained after hydrothermal carbonization. The hydrogels were washed with distilled water then with ethanol.

4. Dissolution test of carbonaceous hydrogels in 8 M urea

The different type of hydrogels (CG, CG1, CG2 and CG3) were immersed in 8 M urea for 24 h. The original 3D structure of carbonaceous hydrogels still maintained for CG1, CG2 and CG3.

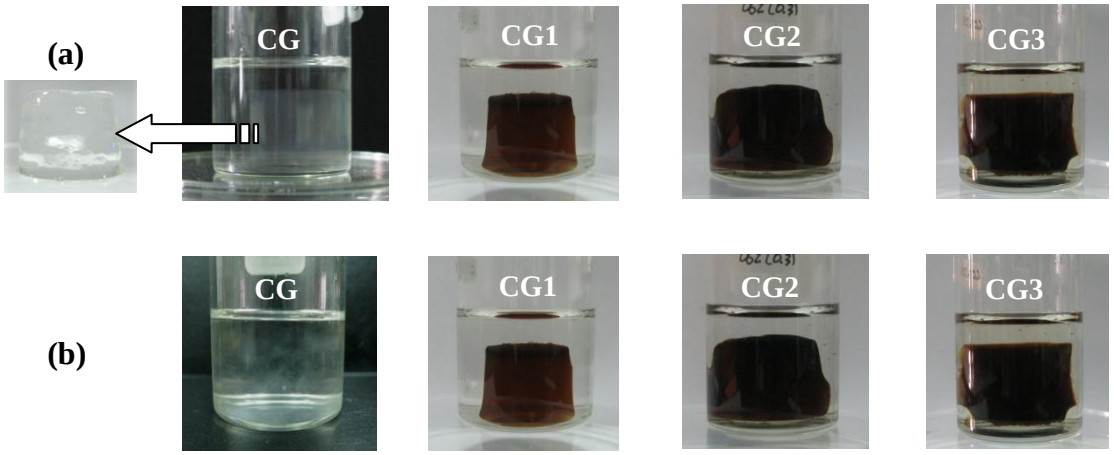

Fig. S2 The carbonaceous hydrogels before (a) immersed in the 8 M urea, and after 24 h immersion (b).

5. Chitin hydrogels cross linked with genipin and its stability in 8 M urea

The glucose-free hydrogel (CG) was immersed in a 25 mg/mL of genipin solution at 37 ^{o}C for 48 h for cross-linking. The clear and trasparent CG gel turned into light purple colour. After cross-linking reaction, the hydrogels was immersed in 8 M urea for 24 h. The original lightly colored 3D hydrogels remained its integrity.

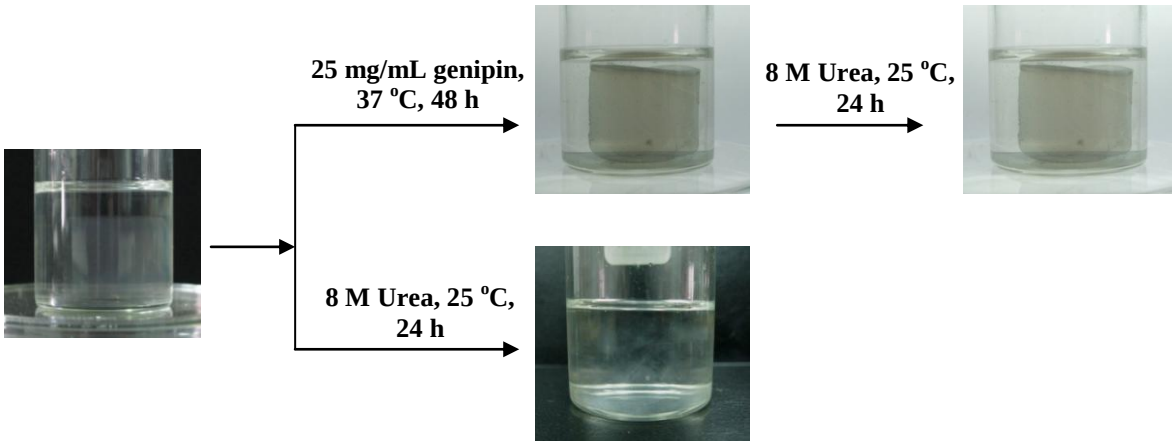

Fig. S3 The effect of chemical cross-linking with genipin on CG hydrogel stability in 8 M urea

6. TGA- derrivative curve

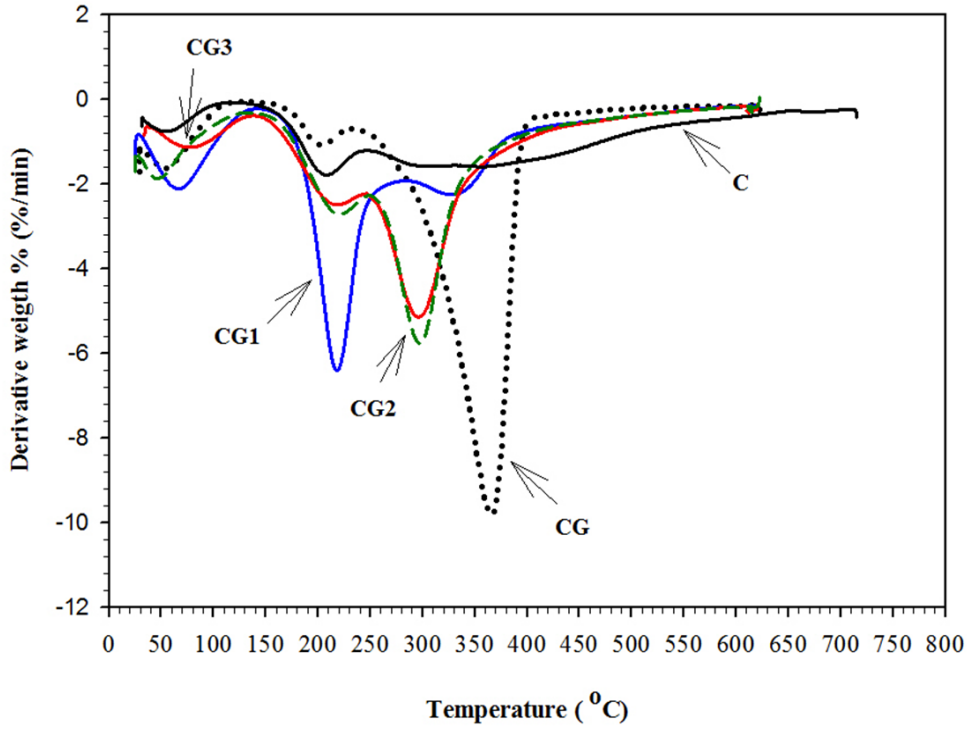

Fig. S4 TGA-derivative curves of glucose-free hydrogel CG, carbonaceous hydrogels CG1, CG2, CG3, and carbonaceous microspheres particle (C).