Electronic Supplementary Information (ESI)

Amphibious fluorescent carbon dots: one-step green synthesis and application for light-emitting polymer nanocomposites

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EXPERIMENTAL SECTION

Chemicals. Gum exudates of peach (Prunus persica) tree trunk were collected at Xishan Park (Guilin, China). Acrylamide (AAm), N-isopropylacrylamide (NIPAM), methylene-bis-acrylamide (MBA), tetramethylenediamine (TEMED) and potassium persulfate ($K_2S_2O_8$) were purchased from Aladdin Chemistry Co. Ltd. (Shanghai, China) and used as received. Poly(N-isopropylacrylamide) (PNIPAM) was prepared in our lab according to literature.[1] All other chemicals were analytical grade and used as received without further purification. Milli–Q water (18.2 MΩ) was used for all experiments.

Synthesis of peach gum polysaccharide (PGP). In a typical procedure, dried crude gum exudates (5 g) were grounded into powder before stirring overnight in water (250 mL) to give a dispersion containing swelling gum. Then the pH of dispersion was adjusted to 10 by adding 0.1 M NaOH. The dispersion was stirred at 95 ^{o}C for 5 h. After hydrolysis was completed, the solution was cooled to room temperature, filtrated, dialyzed and freeze-dried to obtain a peach gum polysaccharide (4.75 g,

Yield: 95%).

Synthesis of photoluminescent carbon dots (CDs). Typically, peach gum polysaccharide (300 mg) was dissolved in 50 mL of water. Then the mixture was transferred into a 100 mL Teflon-lined autoclave and heated at 180 ^{o}C for 12 h. After the reaction, the autoclave was cooled down naturally. The obtained yellow solution was centrifuged at 14000 rpm/min for 15 min to remove the less-fluorescent deposit. The final product was obtained by freeze-drying (104 mg, Yield: 34.6%).

The solubility of the obtained CDs in various solvents (e.g., water, ethanol, DCM or THF) was determined as follows. 10 mg of dried CDs was dispersed in 1 mL of solvent with shaking (100 rpm/min) for 0.5 h at room temperature. Then the dispersion was centrifuged at 10000 rpm/min for 10 min. The supernatant was collected, dried and weighed to calculate the solubility of the CDs in the corresponding solvents.

Synthesis of poly(N-isopropylacrylamide) (PNIPAM). Typically, 100 mL of aqueous solution of NIPAM (0.4 M) and $K_2S_2O_8$ (16 mM) were mixed in flask. The flask was nitrogen purged for at least 15 min before 0.6 mL of TEMED (7 mM) aqueous solution was added. Then the flask was closed and kept under agitation for 24 h at room temperature. The resulting PNIPAM was purified by precipitation in water at 60 °C.

Synthesis of Synthesis of polyacrylamide/poly(N-isopropylacrylamide)-CDs (PAAm/PNIPAM-CDs) hydrogels. For synthesis of the hydrogels, two solutions were prepared. Solution A contains CDs, AAm, MBA, PNIPAM, and TEMED. The

concentration of CDs, AAm, MBA, PNIPAM and TEMED were maintained in 0.4 mg/mL, 3 M, 25 mM, 9.6 mg/mL and 32 mM, respectively. Solution B contains $K_2S_2O_8$ in the concentration of 50 mM. Then 9 mL of solution A and 1 mL of solution B were mixed and the mixture was quickly cast to a glass plate. After keeping the system at room temperature for 8 h, photoluminescent PAAm/PNIPAM-CDs hydrogels were obtained.

Characterization. Transmission electron microscope (TEM) was performed on a JEOL-2010 TEM at 200 kV. Atom force microscope (AFM) was measured by a NT MDT (Ntegra Prima) SPM, operating at tapping mode. Fourier transform infrared (FTIR) spectra were recorded using a FTIR 2500 spectrometer (KBr disk). X-ray photoelectron spectroscopy (XPS) measurements were made on Kratos AXIS UltraDLD (Kratos Analytical Ltd) with mono Al Kα radiation (hv =1487.71 eV) at a power of 75 W. Raman spectra were collected on a LabRam-1B Raman spectroscope equipped with a 632.8 nm laser source. Emission spectra were collected using a Varian Cary 100 spectrometer equipped with a thermocell. Absorption spectra were recorded on a UV-3600 UV-VIS-NIR spectrophotometer (Shimadzu). Dynamic light scattering (DLS) measurements were performed using a Malvern Zetasizer Nano S apparatus equipped with a 4.0 mW laser. Photoluminescence quantum yield (QY) was measured using quinine sulfate as the standard, with a quantum yield of 55% in H_2SO_4 (0.1 M).

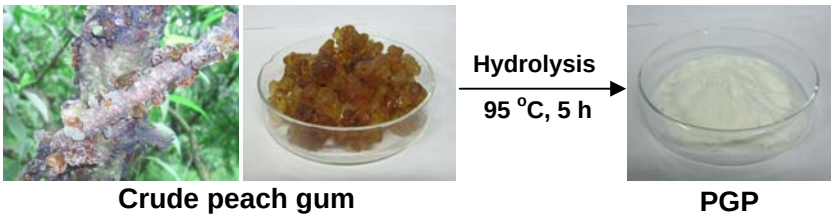

Fig. S1. A schematic illustration of the synthesis procedure of peach gum polysaccharide from natural peach gum.

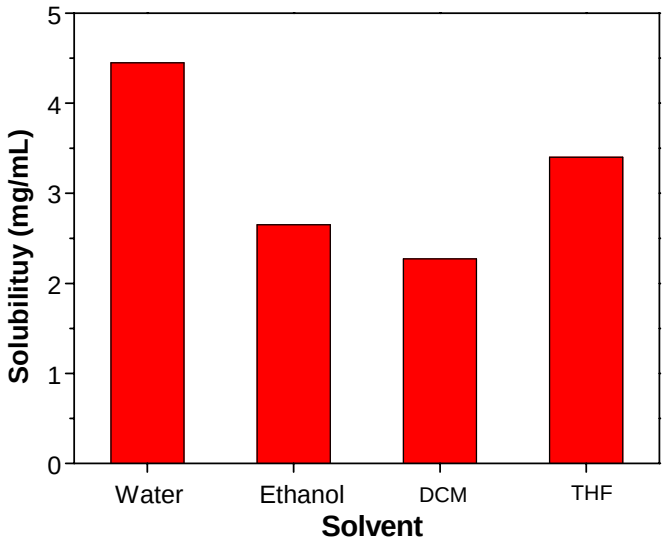

Fig. S2. The solubility of CDs in various solvents.

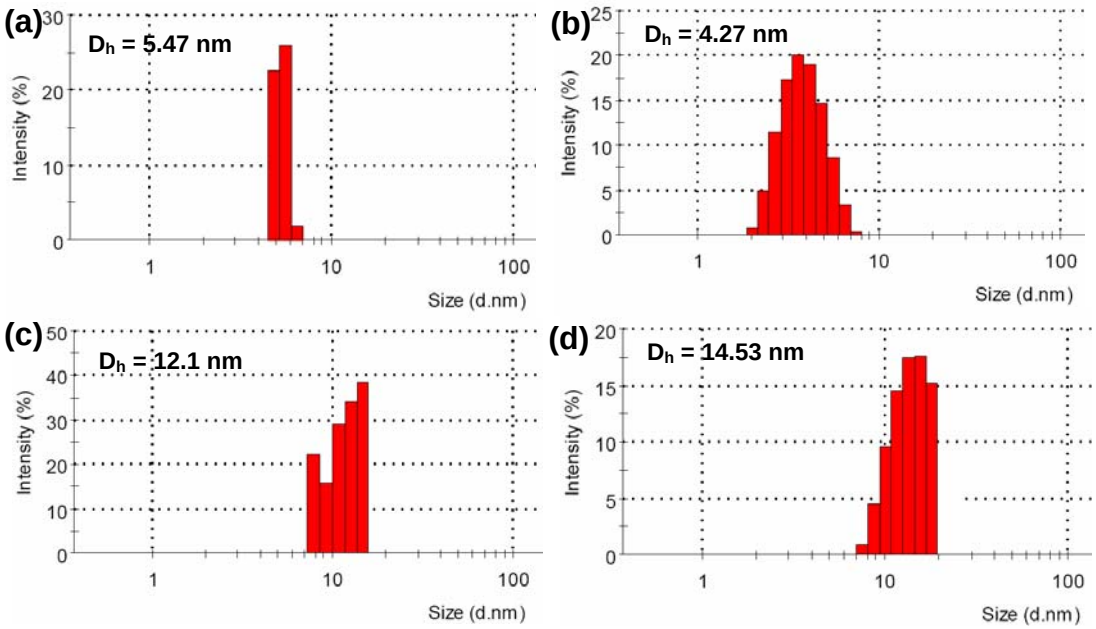

Fig. S3. Dynamic light scattering (LLS) results of CDs in water (a), ethanol (b), THF (c) and DCM (d) (0.1 mg/mL).

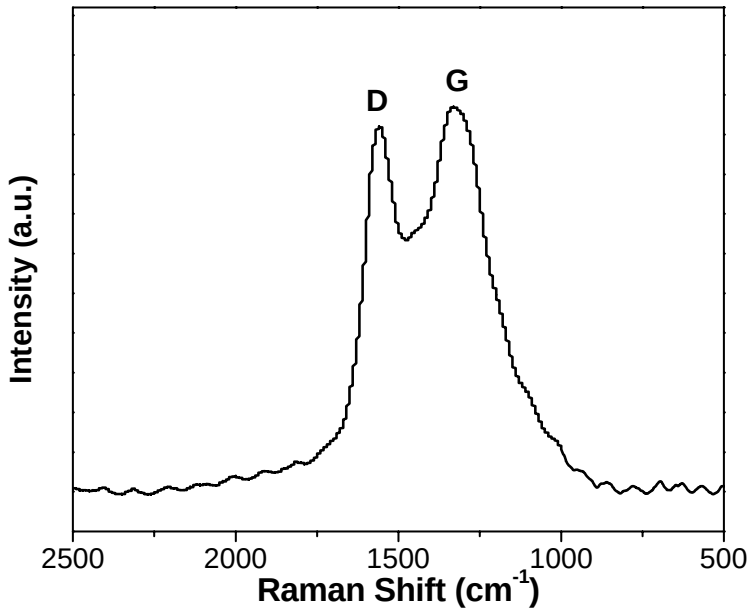

Fig. S4. Raman spectrum of CDs.

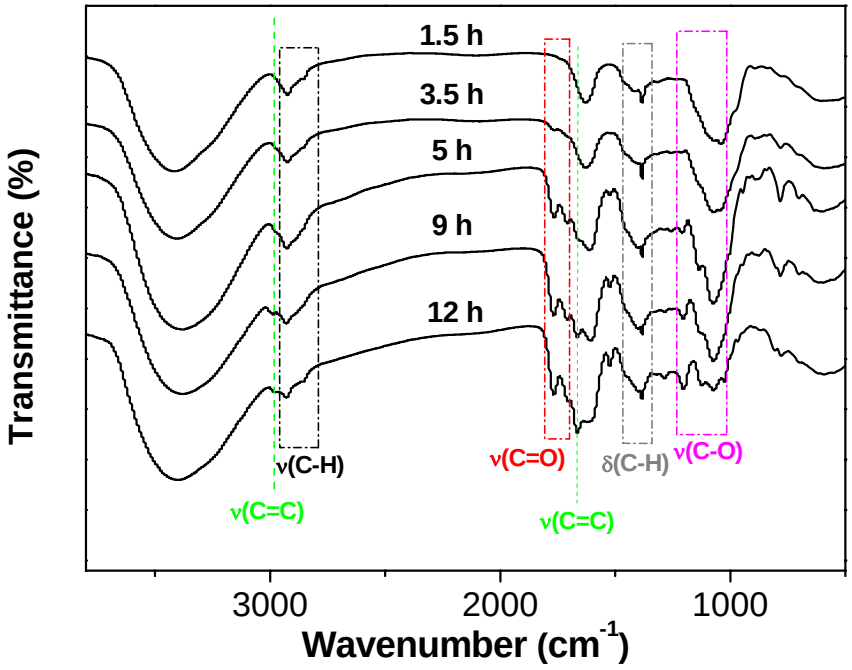

Fig. S5. FTIR spectra of CDs that obtained at different reaction time.

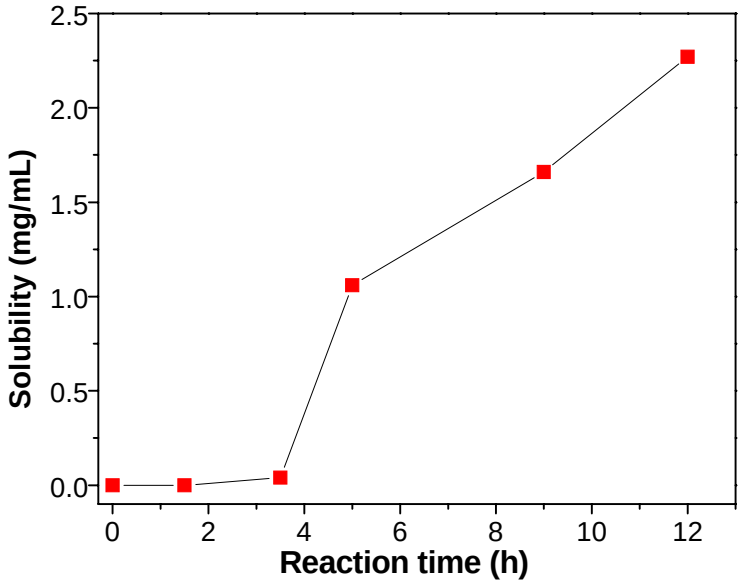

Fig. S6. The effect of reaction time on the solubility of CDs in DCM.

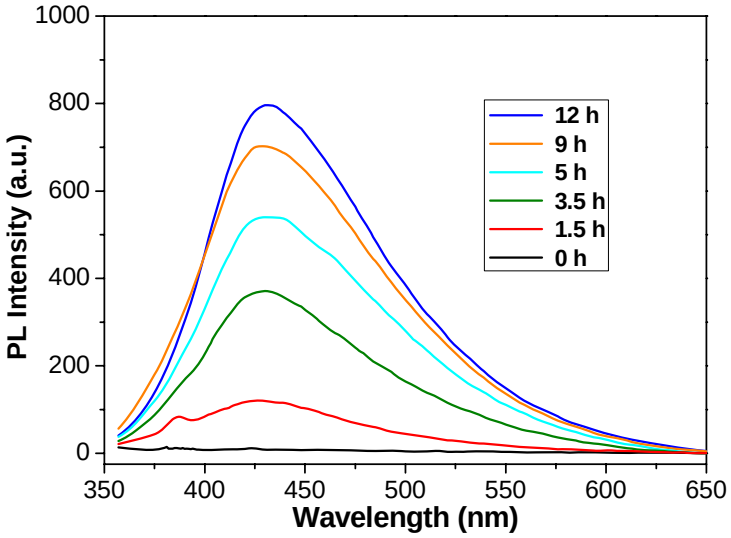

Fig. S7. Emission spectra of CDs in aqueous solution that obtained at different reaction time (λ_{ex} = 340 nm).

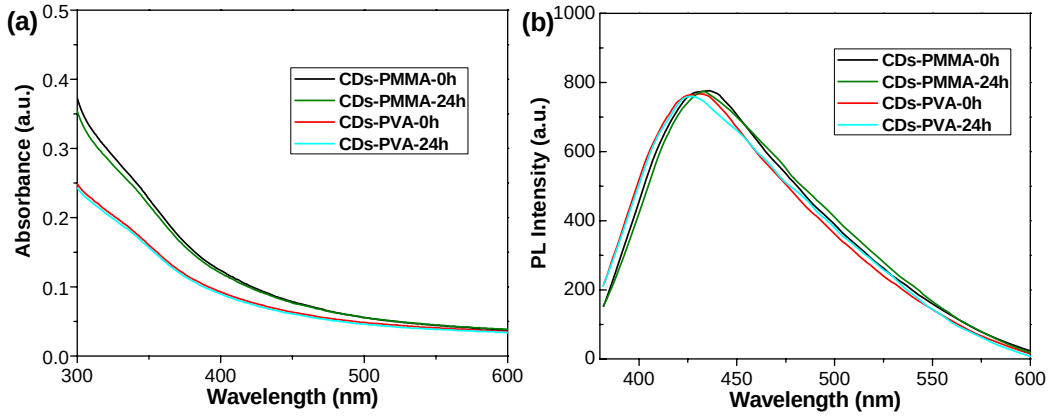

Fig. S8. UV-vis absorption spectra (a) and emission spectra (λ_{ex} = 340 nm) (b) of CDs-PMMA and CDs-PVA nanocomposite films before and after illumination under UV-light (365 nm) for 24 h.