

## **Supporting Information**

# **Facile route to highly photoluminescent carbon nanodots for ions detection, pH sensors and bioimaging**

Chen Shen, Yupeng Sun, Jing Wang, Yun Lu\*

Department of Polymer Science and Engineering, State Key Laboratory of Coordination Chemistry, Key Laboratory of High Performance Polymer Materials and Technology (Nanjing University), Ministry of Education, School of Chemistry and Chemical Engineering, Nanjing University, Nanjing 210093, PR China

\* Prof. Dr. Yun Lu, Corresponding author

Department of Polymer Science and Engineering, State Key Lab Coordination Chemistry, School of Chemistry and Chemical Engineering, Nanjing University, Nanjing 210093, China

E-mail: [yunlu@nju.edu.cn](mailto:yunlu@nju.edu.cn)

**Experimental details for application of the CDs**

**Fluorescence images drawn by CD ink** A kind of commercial paper without fluorescent brightener was chosen as written paper which showed no background fluorescence under the UV lamp. Aqueous CDs solution ( $1 \times 10^{-3}$  mg/mL) as ink was injected into a pen tool. The desired words were directly written onto a piece of paper by the pen and the fluorescence images were observed under 365 nm UV light.

**Detection of metal ions** Different metal ions ( $\text{Zn}^{2+}$ ,  $\text{Ni}^{2+}$ ,  $\text{Cu}^{2+}$ ,  $\text{Pb}^{2+}$ ,  $\text{Mn}^{2+}$ ,  $\text{Al}^{3+}$ ,  $\text{Co}^{2+}$ ,  $\text{Fe}^{2+}$ ,  $\text{Fe}^{3+}$ , each at a concentration of  $0.01 \text{ mol} \cdot \text{L}^{-1}$ ) were added into a CD dispersion ( $0.001 \text{ mg} \cdot \text{mL}^{-1}$ ). The detection of PL signal for the CDs containing different concentration of metal ions was performed by the addition of different ion concentrations from 40 ppm to 400 ppm. All these PL spectra were recorded immediately upon the additions of metal ions.

**Measurement of pH-switched UV/vis spectra** The pH-switched UV/vis spectra were recorded by modulating the sample pH from 1.00 to 13.00 or the contrary. An appropriate amount of NaOH solid or concentrated HCl solutions were employed to adjust the pH value of the samples. A pH meter was used for real-time monitoring. The color acid-base responses of the CDs were filmed by a digital video.

**Cellular toxicity test and cellular imaging** In toxicity test, cells in the exponential growth phase were washed by PBS twice. After digesting by 0.25% trypsin solution for 2 min, cells were suspended by PBS and washed twice. Then whole culture medium was added and cells suspension was transferred to 96-well plate with 200  $\mu\text{L}$  in each well. In control group, 20  $\mu\text{L}$  PBS was added to each well. In experimental group, 20  $\mu\text{L}$  CDs solution in different concentrations was added to each well. Cells were then cultured at 37 °C under 5%  $\text{CO}_2$  in standard incubator for 12 hours, 24 hours and 48 hours, respectively. Then combined EB/AO

staining was executed for cell state examination. 10  $\mu\text{L}$  EB/AO ( $100 \mu\text{g}\cdot\text{mL}^{-1}$ ) was added to each well. The resulting fluorescence images of the cells were monitored by the Leica DMIRE2 microscope fluorescence analyzing system. Cell viability data was captured by Image-Pro Plus (IPP) program.

Hela cells were cultured and propagated in a cover-glass-bottom dish in DMEM cell culture medium (Gibco) with 10% fetal bovine serum and  $100 \text{ mg}\cdot\text{L}^{-1}$  penicillin and  $100 \text{ mg}\cdot\text{L}^{-1}$  streptomycin at  $37 \text{ }^\circ\text{C}$  under 5%  $\text{CO}_2$  in standard incubator. After 12 hours incubation, fresh culture medium with 5% CDs (The final concentration is about  $200 \mu\text{g}\cdot\text{mL}^{-1}$ ) was added to the cell culture dishes. Then, the cells were washed with PBS for three times to remove the excess CDs. Immediately after the incubation and washing steps, the images observation were taken by a confocal laser scanning microscope. The confocal analysis was performed on a ZEISS LSM710 laser scan confocal microscope at an excitation wavelength of 405 nm and emission length of 450 nm.