Electronic Supplementary Information

Bottom-up electrochemical preparation of solid-state carbon nanodots directly from nitriles/ionic liquids using carbon-free electrodes and the applications in specific ferric ion detection and cell imaging

Fushuang Niu[1,a], Yuanhong Xu[*1,a], Mengli Liu[a], Jing Sun[b], Pengran Guo[c] and Jingquan Liu[*a]

[a] College of Materials Science and Engineering; Laboratory of Fiber Materials and Modern Textile, the Growing Base for State Key Laboratory; Collaborative Innovation Center for Marine Biomass Fibers, Materials and Textiles of Shandong Province; Qingdao University, Ningxia Road 308, Qingdao 266071, China

[b] School of Polymer Science & Engineering, Qingdao University of Science and Technology, Zhengzhou Road 53, Qingdao, 266042, China

[c] Guangdong Provincial Key Laboratory of Emergency Test for Dangerous Chemicals, China National Analytical Center (Guangzhou), Xianlie Zhong Road 100, Guangzhou, 510070, China

E-Mail: yhxu@qdu.edu.cn (Y. H. Xu) and jliu@qdu.edu.cn (J. Q. Liu)

[1]Fushuang Niu and Yuanhong Xu contribute equally to this work.
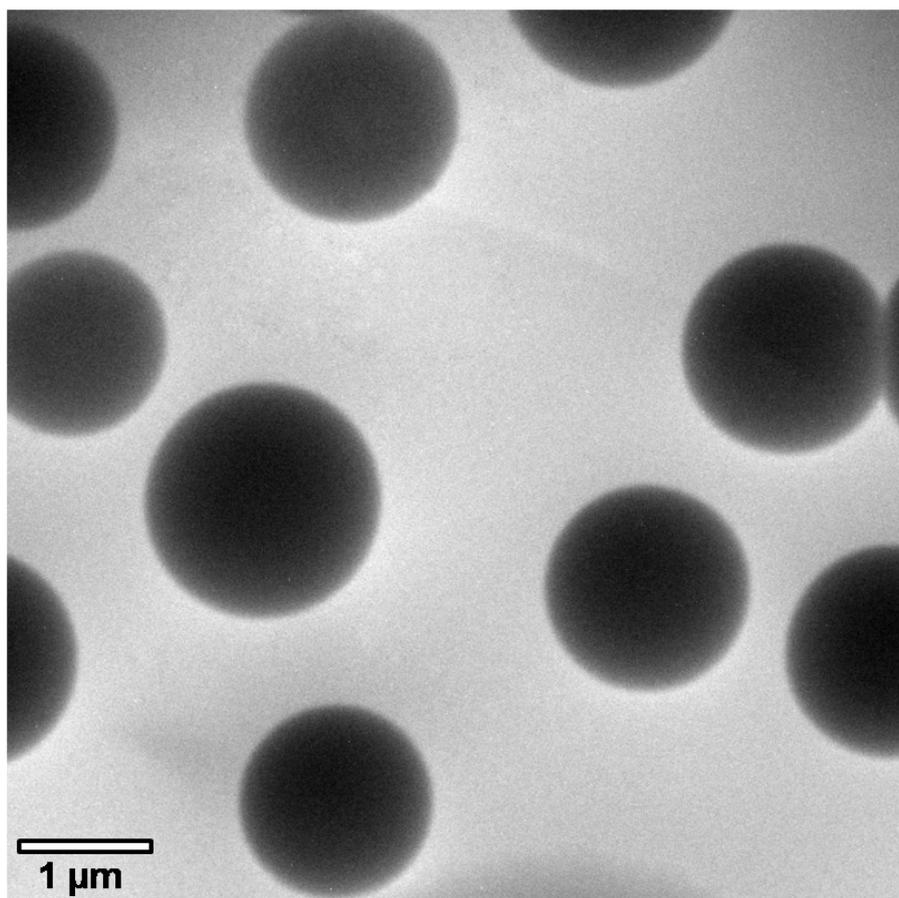
Fig. S1 TEM image of the products generated via electrochemical method using pure BMIMBF$_4$ aqueous solution as the electrolyte.

When two Pt sheets were used as the working and auxiliary electrodes, respectively, and 1-butyl-3-methylimidazolium tetrafluoroborate (BMIMBF$_4$) aqueous solution was used as the electrolyte, the color of the electrolyte changed from colorless to yellow after 24 h. However, only large spherical particles (more than 1 μm in diameter) were observed, while no carbon nanodots were found as evidenced by TEM analysis.
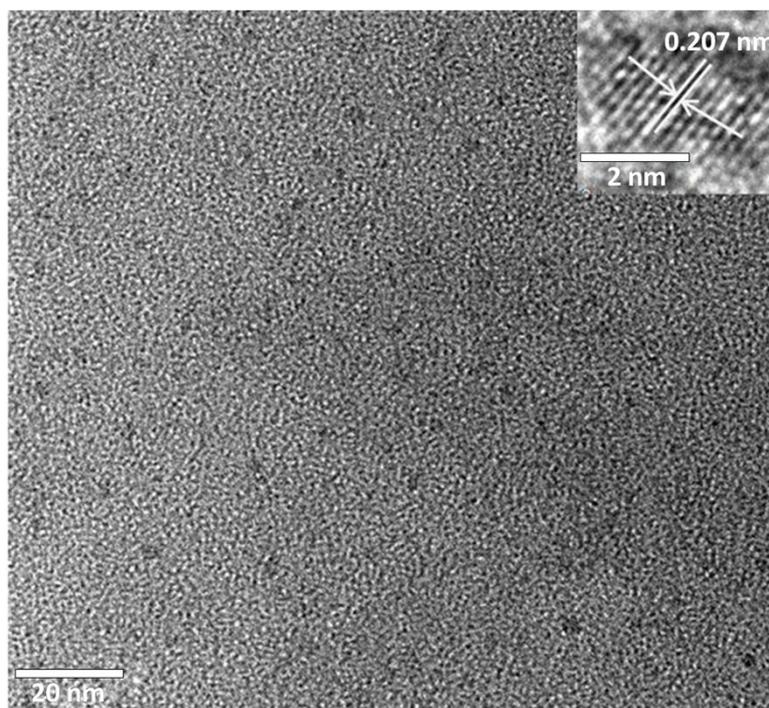
Fig. S2 TEM and HRTEM (inset) images of the water-dispersed solution of C-dots generated from EC process using electrolyte with BMIMPF$_6$/3-methylaminopropionitrile volume ratio of 1:9.
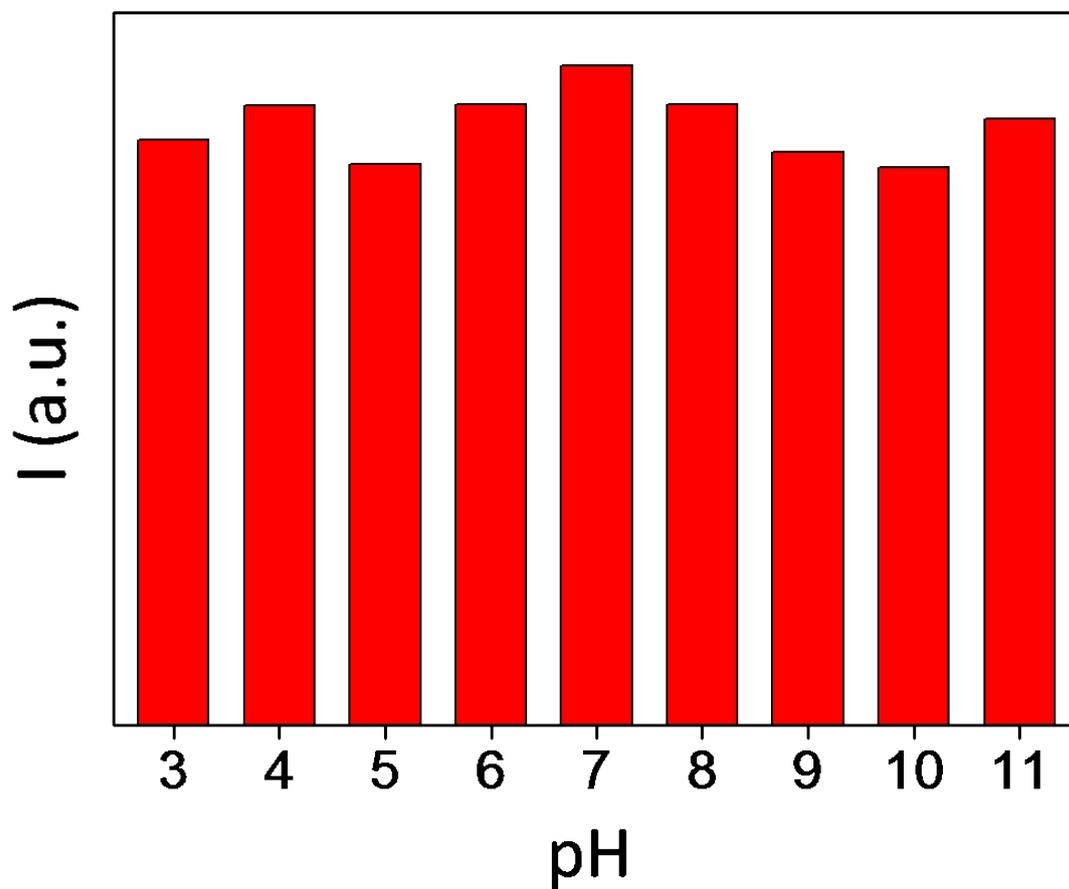
Fig. S3 The effect of pH on the fluorescence intensity (I) of the C-dots.

Detection of Fe^{3+} in tap water

The tap water sample was acidified by diluted hydrochloric acid prior to analysis. Fe^{3+} aqueous solutions at different concentrations (0, 10, 20, 30 and 40 μM) were spiked into the tap water containing 50 μg mL^{-1} C-dots, respectively. The PL intensity of the spiked sample was then recorded accordingly. The decrease in PL intensity ($\Delta I = I_0 - I_i$) was plotted against the spiked Fe^{3+} concentration to obtain a calibration curve. The concentration of Fe^{3+} in tap water was calculated based on the absolute value of x-intercept from the calibration curve (Fig. S4). The reproducibility of the analysis method was determined by measuring the relative standard deviations of replicate measurements (n = 3).
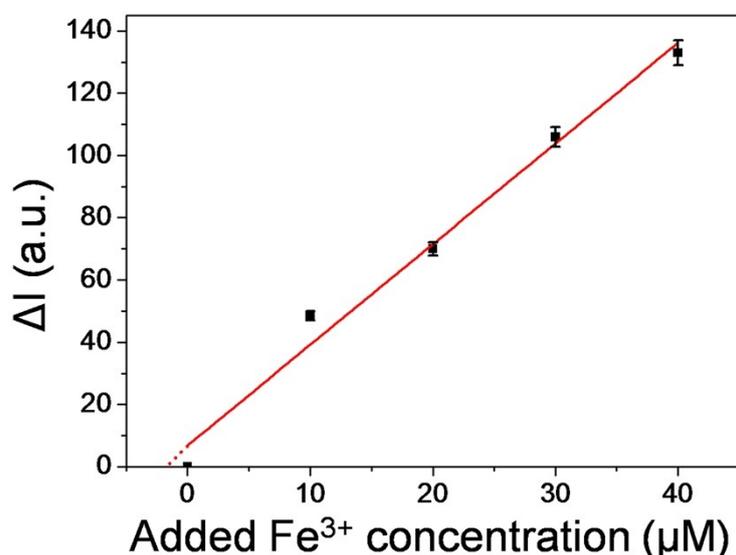
Fig. S4 Calibration curve for detection of Fe^{3+} in tap water using standard addition method. Excitation at 355 nm was applied. Error bars indicate the standard deviations of the means (n=3).

For comparison, atomic absorption spectrophotometer (AAS) equipped with hollow cathode lamp (HCL) was used for iron determination. The optimum conditions for AAS were applied as follows: wavelength 248.3 nm; HCL current 10 mA; acetylene flow rate 0.5 L/min; air flow rate 4.0 L/min; slit width 0.2 nm. After the acid pretreatment by nitric acid, Fe^{3+} aqueous solutions at different concentrations (0, 10, 20, 30 and 40 μM) were spiked into the tap water, respectively. The spiked water

samples were determined by AAS method under the above analytical conditions. Concentrations of Fe^{3+} in tap water were calculated by the standard curve method [S1].

[S1] M. Yaman, G. Kaya, *Anal. Chim. Acta.,*2005, **540**, 77-81.