Facile preparation and characterization of new green emitting carbon dots for sensitive and selective off/on detection of Fe3+ ion and ascorbic acid in water and urine samples and intracellular imaging in living cells

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Abstract

Carbon dots (CDs) have gained great attention as multifunctional materials because of their interesting properties and general applicability. However, there are some reports for the preparation of highly luminescent green-emitting CDs (G-CDs), although these reports seem not to be extensible. Herein, new G-CDs (quantum yield: 27.2%) were synthesized from a facile hydrothermal treatment of *p*-aminosalicylic acid and ethylene glycol dimethacrylate as both carbon and nitrogen source and cross-linking agent, respectively. The chemical composition and optical properties of the as-prepared G-CDs were successfully investigated using transmission electron microscopy, atomic force microscopy, dynamic light scattering, X-ray diffraction, energy dispersive X-ray spectroscopy, Fourier transform infrared spectroscopy and fluorescence and UV–vis spectroscopies. Interestingly, the fluorescence intensity of G-CDs was selectivity quenched by Fe^{3+} in the range of 0.05–10.0 μmol L^{-1}, with a detection limit of 13.7 nmol L^{-1}. Meanwhile, ascorbic acid found to reduce Fe^{3+} to Fe^{2+}, thereby causing restoration of the fluorescence of G-CDs. The detection limit for ascorbic acid detection was estimated as 82.0 nmol L^{-1} over a linear range from 0.2 to 11.0 μmol L^{-1}. Furthermore, the designed sensing platform was successfully utilized to the detection of Fe^{3+} and ascorbic acid in water and urine samples and to intracellular imaging without surface modification.