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One-pot synthesis of dual carbon dots using only an N and S co-existed dopant for fluorescence detection of Ag^+

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Abstract: luminescent carbon-based nanoparticles, named often as carbon dots (CDs), were synthesized from citric acid (CA) and guanidine thiocyanate (GITC) via an N and S co-doped hydrothermal procedure. In the present structure characterization, N and S elements could be sufficiently doped by means of the heteroatom or the functional groups bonded on the surface of CDs. The as-prepared CDs solution showed blue color fluorescence under ultraviolet exciation, yet the PL spectra exhibited a repetitive emission process from excitation-independent to excitation-dependent. In view of the triexponential feature of fluorescence lifetimes of CDs, one possibility was proposed to be co-existence of two types of CDs with different surface states. Additionally, the as-prepared CDs were used as a sensing probe for the detection of Ag^+ taking into consideration of the possible interactions between Ag^+ and various fluorophores attached to the CD surface. As expected, the changes of fluorescence intensities were linearly proportional to the different concentration ranges of Ag^+, which suggests the complex nature of the quenching mechanism. And for the first time, the –S-C≡N group was found to accelerate the quenching of CDs towards Ag^+, promising a new approach for efficient detection of Ag^+ for the application in industrial pollutants.

Keywords

S, N-CDs, co-existence, triexponential, Ag^+, -S-C≡N