Green One-Step Synthesis of Mushroom-Derived Carbon Dots as Fluorescent Paper-Based Sensors for Iron (III) Detection

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The blue fluorescent carbon dots with a good photostability using Lentinus polychrous Lèv mushroom (LCDs) were synthesized via an efficient, one-step hydrothermal carbonization process. LCDs are turn-off probes in both solution-based and paper-based systems for iron (III) ions, which play a significant role in the environment and the human body. The spherical LCDs, with an average diameter of 6.0 nm, generated blue photoluminescence under UV irradiation. Due to hydroxyl and amine functional groups, LCDs were shown to be effective fluorescent sensors for iron (III) ions. A fluorescent quenching of LCDs in the presence of iron (III) ions resulted from the inner filter effect and static quenching. The fluorescent LCDs solution can be quenched by iron (III) in the linear range of 0.0-2.0 mM with the limit of detection (LOD) of 16 μM. The sensing results could be obtained within 30 seconds, allowing a rapid visual response to iron (III). LCDs-based analytical devices exhibit significant potential for the practical determination of Fe(III) concentrations in real water samples, particularly at trace levels. With good stability in PBS buffer and NaCl solutions, LCDs have the potential to be used in biological fluids and saline environments. Consequently, LCDs provide an eco-friendly fluorescent sensing platform as a user-friendly, portable, and green environmental monitoring tool with high potential to be used as an optical probe for diagnostic applications.

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