

MULTIFUNCTIONAL CARBON-BASED QUANTUM DOTS FOR ENVIRONMENTAL AND MEDICAL APPLICATION

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Modern environmental monitoring and medical diagnostics increasingly require functional materials that combine optical sensitivity, chemical stability, and compatibility with complex systems. Conventional fluorescent materials often suffer from limited stability, toxicity concerns or restricted tunability. Carbon-based quantum dots have emerged as promising candidates due to their low toxicity, chemical robustness, and strong photoluminescence [1]. Among them, carbon nitride quantum dots (CNQDs) are particularly attractive because of their unique electronic structure and surface chemistry, which can be exploited for interaction with chemical and biological environments relevant to sensing and imaging applications [2, 3].

In this study, we focus on investigating the stability and optical properties of CNQDs prepared from bulk graphitic carbon nitride (G-C₃N₄) using LiOH-assisted ultrasonic exfoliation followed by mild thermal treatment. The resulting dispersions were purified by dialysis and characterised using UV-Vis absorption spectroscopy, steady-state photoluminescence spectroscopy, fluorescence lifetime measurements and Fourier transform infrared (FT-IR) spectroscopy.

To assess the imaging compatibility, CNQD fluorescence was also examined under live-cell fluorescence microscopy conditions using HeLa cells, demonstrating detectable optical signals under standard imaging parameters without additional labelling.

By addressing fundamental optical response and imaging visibility at an early stage of material development, this study highlights the relevance of CNQDs as versatile building blocks for future multifunctional platforms.

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