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Cancer-Targeting Carbon Quantum Dots Synthesized by Plasma Electrochemical Method for Red Light Activated Photodynamic Therapy

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Carbon Quantum Dots (CQDs) with excellent water solubility, chemical stability and unique tunable photoluminescence features promising prospects in the biomedical applications. However, most of the carbon dots are prepared under the conditions of high pressure (6~Mpa) and high temperature (180℃) thermal process. Reliable approaches which can controllable prepare CQDs with ideal bio-functionality and long wavelength fluorescence property is still absent. Plasma mediated solution treatment provide an effective strategy for fast preparing CQDs in ambient temperature and pressure condition through electrochemistry reaction. Here, CQDs with excellent folate receptor cancer-targeting ability, red light absorption (654 nm)/ emission (660 nm), and pronounced photodynamic therapy (PDT) effect are prepared by plasma processing of folic acid (FA) and chlorin e6 (Ce6). It is shown that CQDs produced by the plasma chemical method preserved most of the functional groups originating from the precursor, thus making the synthesized CQDs fully inherit the bio-functionality and photophysical properties of the precursor. This work opens new opportunities to utilize plasma-based processes for the controllable synthesis of functionalized carbon quantum dots for diverse biomedical applications.

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