

Covalent Multifunctional Carbon Nanodots for NIR Laser-Triggered Therapy

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Carbon nanodots (CNDs) are the latest members to join the carbon nanomaterial family. They have been recently explored for multiscale imaging and therapeutic applications due to their intrinsic resistance to photobleaching, low toxicity, and superior biocompatibility.^[1] Due to abundant reactive groups on their surface, CNDs show big potential to be modified by different kinds of molecules to increase their functionality.^[2] These multifunctional CNDs (MCNDs) display great demand for the next generation nanomedicines.^[3,4] However, covalent multi-functionalization and characterization of these CNDs to obtain stable architectures, is still a challenge because of their small size (below 10 nm). Here, we present a complete strategy for the synthesis and characterization of MCNDs. In our work, NIR-responding carbon nanodots were synthesized via a hydrothermal method from a conjugated polymer. Then, folic acid and chlorin e6 (Ce6), a commercial photosensitizer, were both covalently attached to the surface of CNDs via the classic amidation reaction to form the MCNDs. Folic acid owns the specific recognition of folate receptor, which is overexpressed on many diseased cells. Subsequently, a variety of techniques, including TGA, HRTEM, XPS, IR, DLS, UV, were used to characterize their morphology and structure. The as-prepared MCNDs own core-shell architectures with a narrow size distribution and good solubility in different physiological environment. Significantly, MCNDs displayed photothermal conversion efficiency under 808 nm laser irradiation and high singlet oxygen quantum yield under 660 nm laser irradiation. These promising results predict their potential ability as a NIR laser-triggered nanosystem for precision medicine. We believe that this research effort could provide a good strategy to covalent multi-functionalization and characterization of CNDs for the next generation nanomedicines.

References

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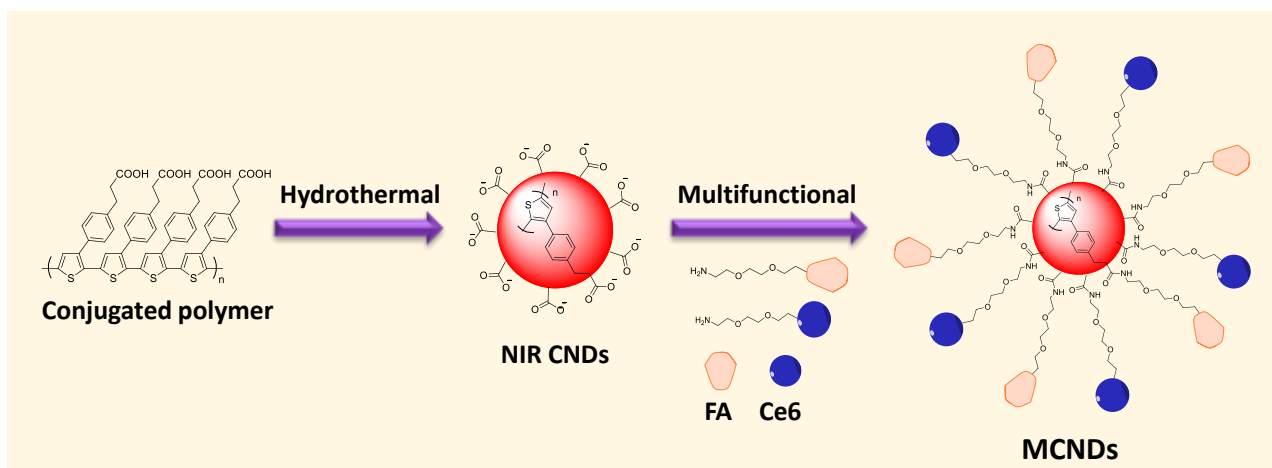


Figure 1: Schematic illustration of the synthesis of multifunctional carbon nanodots