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Fluorescence imaging-mediated cancer/normal cell differentiation based on carbon quantum dots

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Early detection of cancer can extend patient survival through the therapeutic treatment in the early stages of the disease. It is essential to develop materials and methods to realize the cancer/normal cell differentiation. Meanwhile, photoluminescent nanomaterials are attracting increasing interest in biological field due to their unique optical characteristics. Herein, we prepared a series of fluorescent carbon quantum dots (or carbon dots, CDs) with cancerous/normal cell differentiation capabilities through the inherent ability for mitochondrial targeting/imaging. Specifically, the CDs were prepared by one-pot solvothermal treatment of glycerol and silane molecule. Glycerol acts as the solvent and carbon source, and the silane molecule acts as the passivation agent. The as-prepared CDs could specifically and stably (for at least 24 h) visualize the mitochondria of various cells (including cancerous cells, normal cells and macrophages) without the introduction of mitochondria-targeting ligands (such as triphenylphosphonium). More importantly, the CDs could efficiently distinguish cancerous cells from normal cells with high fluorescence contrast due to their differences in mitochondrial membrane potential and substance uptake efficiency. Apart from that, multifunctional CDs co-doped with silicon and nitrogen that use glycerol and N-[3-(trimethoxysilyl) propyl]ethylenediamine were also prepared using solvothermal synthesis. The as-prepared CDs exhibited a rapid fluorescence response and good selectivity towards Fe^{3+}, realizing Fe^{3+} detection *in vitro* and *in vivo*. Moreover, the mixed solution of CDs and Fe^{3+} (CDs/Fe^{3+}) could efficiently distinguish cancerous cells from normal ones based on the reductive environment of cancerous cell, mainly their difference in the content of glutathione (GSH). The extraordinary features including facile synthesis, good water-solubility, favorable biocompatibility and excellent photostability of the above CDs make them excellent fluorescent probes for cancerous cell recognition and further biomedical applications.

Biography

Yao-Wen Jiang has completed his BS and MS in the School of Biological Science and Medical Engineering, Southeast University and now is a PhD candidate in Southeast University. He majors in Biointerface and Nanomaterial for biomedical application.

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