

Multi-Photon Photodynamic Therapy and Imaging

Probe with Graphene-based Materials

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Abstract

A graphene quantum dot (GQD) used as the photosensitizer with high two-photon absorption in the near-infrared region, a large absolute cross section of two-photon excitation (TPE), strong two-photon luminescence and impressive two-photon stability could be used for dual modality two-photon photodynamic therapy (PDT) and two-photon bioimaging with an ultrashort pulse laser (or defined as TPE). In this study, a GQD efficiently generated reactive oxygen species coupled with TPE, which highly increased the effective PDT ability of both of gram-positive and -negative bacteria, with ultra-low energy and an extremely short photoexcited time yielded by TPE. Because of its two-photon properties, a GQD could serve as a promising two-photon contrast agent for observing specimens in-depth from three-dimensional biological environment and simultaneously proceeding with PDT action to eliminate bacteria, particularly in multidrug-resistant (MDR) strains. This provides an efficient alternative approach to easily cope with MDR bacteria.

Keywords: graphene quantum dot, two-photon photodynamic therapy, reactive oxygen species, three-dimensional two-photon bioimaging, multidrug resistant bacteria