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Self-Quenched Semiconducting Polymer Nanoparticles for Amplified In Vivo Photoacoustic Imaging

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Abstract

Development of photoacoustic (PA) imaging agents provides opportunities for advancing PA imaging in fundamental biology and medicine. Despite the promise of semiconducting polymer nanoparticles (SPNs) for PA imaging, the molecular guidelines to enhance their imaging performance are limited. In this study, semiconducting polymers (SPs) with self-quenched fluorescence are synthesized and transformed into SPNs for amplified PA imaging in living mice. The self-quenched process is induced by the incorporation of an electron-deficient structure unit into the backbone of SPs, which in turn promotes the nonradiative decay and enhances the heat generation. Such a simple chemical alteration of SP eventually leads to 1.7-fold PA amplification for the corresponding SPN. By virtue of the targeting capability of cyclic-RGD, the amplified SPN can effectively delineate tumor in living mice and increase the PA intensity of tumor by 4.7-fold after systemic administration. Our study thus provides an effective molecular guideline to amplify the PA brightness of organic imaging agents for *in vivo* PA imaging.

Keywords: Photoacoustic imaging; Semiconducting polymer nanoparticles; Tumor imaging; Contrast agents