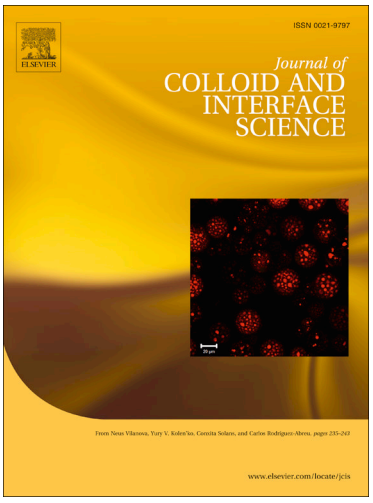

Facile assembling of novel polypyrrole nanocomposites theranostic agent for magnetic resonance and computed tomography imaging guided efficient photothermal ablation of tumors

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Facile assembling of novel polypyrrole nanocomposites theranostic agent for magnetic resonance and computed tomography imaging guided efficient photothermal ablation of tumors

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Abstract: Multifunctional nanocomposites for image-guided cancer therapy are highly desired in clinical application. Herein, a novel theranostic agent based on gold and ferroferric oxide nanoparticles coating polypyrrole particles (PPy@Fe_3O_4/Au nanocomposites) for computed tomography (CT) and magnetic resonance (MR) imaging guided photothermal therapy was successfully assembled by a very facile electrostatic adsorption method. PPy@Fe_3O_4/Au nanocomposites exhibit good biocompatibility *in vitro* and *in vivo*. Because of high r_2 relaxivity of Fe_3O_4 and high X-ray attenuation ability of Au, the PPy@Fe_3O_4/Au nanocomposites exhibited desirable CT and MR imaging performance, which provide more comprehensive and accurate diagnostic information. Moreover, PPy@Fe_3O_4/Au nanocomposites can efficiently kill cancer cells by hyperthermia with the guiding of CT and MR imaging, even completely ablate tumours. Hence, the electrostatic adsorption assembled PPy@Fe_3O_4/Au nanocomposites have great potential in clinical application for diagnosing and treating tumour in the future.

Keywords: photothermal therapy; computed tomography imaging; theranostic agent; polypyrrole nanocomposites

1 Introduction

Photothermal therapy (PTT) has been recognized as a noninvasive and cancer-specific therapy in comparison with traditional cancer treatments [1-6]. Photothermal agents were used to convert near-infrared (NIR) light into thermal energy to burn tumor cells under the laser irradiation [7-11]. PTT agents are the key for PTT, so more and more agents were explored to acquire high specificity, great efficiency and few side effects [12,13]. Compared with most PTT agents, polypyrrole nanoparticles (PPy NPs) have higher photothermal conversion efficiency due to strong NIR absorbance [14,15]. Moreover, PPy NPs have been widely used in many biomedical applications, such as biosensors and tissue engineering, demonstrating good biocompatibility and low long-term cytotoxicity *in vitro* and *in vivo* [16,17]. Nevertheless, single PPy NPs have some deficiency in comprehensive diagnosis and idealized imaging guided therapy, new powerful PPy-based theranostics nanoplatforms for cancer are still need to develop.

Magnetic resonance imaging (MRI) can provide superior vivid tomography information. The ferroferric oxide (Fe_3O_4) nanoparticles, US Food and Drug Administration (FDA) approved MRI contrast agent, can visualize the information and