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Albumin-mediated Gold/Platinum Nanocomposites for Dual Mode CT/MR Imaging Applications

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Abstract

Contrast agents play a vital role in the enhanced examination of biomedical imaging. However, traditional clinical small-molecule agents face a variety of drawbacks, such as low blood circulating time, difficult modification and potential toxic and side effects. Herein, a simple albumin directed fabrication of gold (Au) or platinum (Pt) nanoparticles was achieved for exploring the utilization in CT and MR imaging. Firstly, ultra-small nanoagents (Pt@BSA) with a mean core size of 2.1 nm were obtained through a facile one-pot synthesis by the reduction of chloroplatinic acid hexahydrate using bovine serum albumin (BSA) as the biotemplate under room temperature. It was demonstrated that the nanocrystals could serve as potential new and potent CT contrast agents, especially vital for in vivo imaging with prominent enhancement and metabolizable behaviours due to the combination of the higher X-ray attenuation property and prolonged imaging time [1]. Then gold nanoparticles (Au@BSA) were also prepared with BSA as a biotemplate following with conjugation of diatrizoic acid (DTA) for a potential CT imaging contrast agent (Au@BSA-DTA). The biomimetic material Au@BSA-DTA with double radiodense elements of Au and iodine displayed much stronger CT imaging effect compared with the traditional small molecule contrast agents [2]. Finally, a novel CT/MR contrast agent Au@BSA-Gd-DTPA was fabricated by modifying the as-prepared Au@BSA with diethylene triamine pentoacetic acid (DTPA), followed by the chelation of Gd (III) ions. For the CT phantoms, the formed nanocomplex showed an improved contrast in CT scanning than that of Au@BSA as well as small molecule iodine-based CT contrast agents, and for the T_1-weighted MRI images, the nanoagents displayed a relatively higher r_1 relaxivity than that of the commercial MR contrast agents. Importantly, the above mentioned nanoagents exhibited not only good colloid stablility and water dispersibility, but also satisfying low-cytotoxicity and hemocompatibility. In summary, we have constructed a series of novel biomaterials that can be used as contrast agents for both X-ray CT and MR phantoms, which paves the potential clinical applications in cancer early diagnosis.

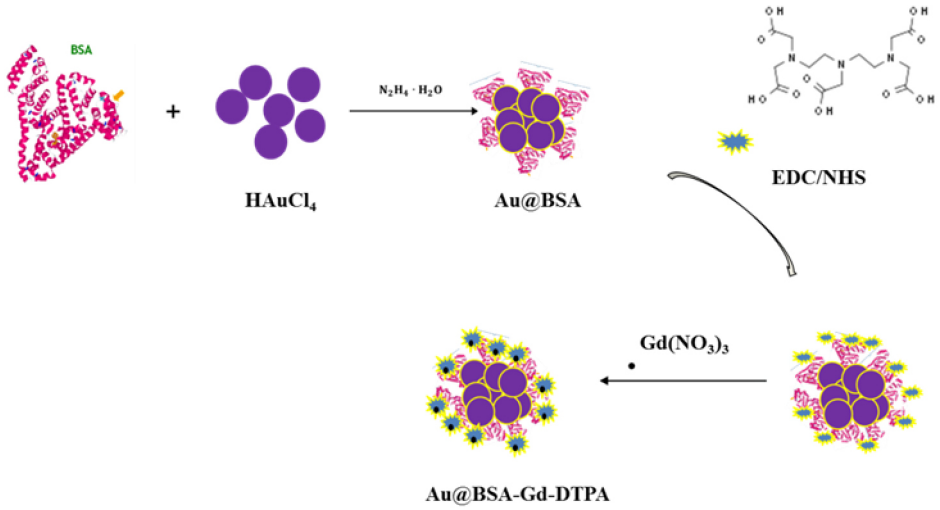

Figure 1. A schematic illustration of the preparation of the Au@BSA-Gd-DTPA.

References

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