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Monodispersed Polypyrrole Nanoparticles Prepared via Water Padiolysis and their Photothermal Therapy on Cancer Cells

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The combination of NIR photothermal therapy and chemotherapy is considered as the promising technique for the future cancer therapy.[1] The key point for this technique is the design and synthesis of photothermal agents with high-efficiency photothermal effect and high chemical drug loading capacity.[2] Herein, submicron-sized raspberry-like hollow-structured polypyrrole microspheres (H-PPy) were easily prepared through the in-situ polymerization of pyrrole on monodispersed polystyrene (PS) template microspheres with a diameter of 220 nm, followed by the chemical etching of the PS templates. The prepared H-PPy microspheres show rapid and remarkable photothermal effect in water under the irradiation of NIR laser (808 nm) only for 5 min. Further, a model small molecular drug, (S)-(+)-camptothecin (CPT), were loaded into the void core by a simple dispersion-permeation process through the micro-pores on the raspberry-like PPy shell, with a load capacity of 0.14 mg/(mg H-PPy). The MTT assay and the in vitro NIR-laser triggered release behavior indicated that the pure H-PPy microspheres have good biosafety, but the release of loaded CPT in H-PPy microsphere can be achieved with remarkable spatial/temporal resolution after NIR laser irradiation, which results in the excellent synergistic effect of photothermal and chemical ablation on HeLa cells, as proved by the fluorescence microscopy. This work provides a convenient synthesis of a promising cancer therapy agent with high drug-loading capacity and efficient NIR light photothermal effect, which can perfectly achieve the synergistic NIR photothermal therapy and chemotherapy of PPy microspheres.

[1] K. Dong, Z. Liu, Z. H. Li, J. S. Ren and X. G. Qu, Adv. Mater., 2013, 25, 4452-4458.

[2] J. P. Yang, D. K. Shen, L. Zhou, W. Li, X. M. Li, C. Yao, R. Wang, A. M. El-Toni, F. Zhang and D. Y. Zhao, Chem. Mater., 2013, 25, 3030-3037.

Country/Organization invited to participate

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