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A pH-Activatable Nanoparticle Self-Assembly Triggered by 7-Amino Actinomycin D Demonstrating Superior Tumor Fluorescence Imaging and Anticancer Performance

Authors : Han Xiao

Abstract : The development of nanomedicines has recently achieved several breakthroughs in the field of cancer treatment; however, the biocompatibility and targeted burst release of these medications remain a limitation, which leads to serious side effects and significantly narrows the scope of their applications. The self-assembly of intermediate filament protein (IFP) peptides was triggered by a hydrophobic cation drug 7-amino actinomycin D (7-AAD) to synthesize pH-activatable nanoparticles (NPs) that could simultaneously locate tumors and produce antitumor effects. The designed IFP peptide included a target peptide (arginine–glycine–aspartate), a negatively charged region, and an α-helix sequence. It also possessed the ability to encapsulate 7-AAD molecules through the formation of hydrogen bonds and hydrophobic interactions by a one-step method. 7-AAD molecules with excellent near-infrared fluorescence properties could be target delivered into tumor cells by NPs and released immediately in the acidic environments of tumors and endosome/lysosomes, ultimately inducing cytotoxicity by arresting the tumor cell cycle with inserted DNA. It is noteworthy that the IFP/7-AAD NPs tail vein injection approach demonstrated not only high tumor-targeted imaging potential, but also strong antitumor therapeutic effects in vivo. The proposed strategy may be used in the delivery of cationic antitumor drugs for precise imaging and cancer therapy.

Keywords : 7-amino actinomycin D, intermediate filament protein, nanoparticle, tumor image
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