Nanoparticles with pH-triggered contrast amplification for precision tumor imaging and therapy

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Polymeric nanocomposites have demonstrated high performance for tumor-targeted drug delivery with improved therapeutic efficacy and reduced side effects, while several candidates are under clinical trial, demonstrating high potential for future clinical application. Polymeric nanocomposites provide a tumor tropism platform to incorporate a myriad of molecules, including nucleic acids, anticancer drugs, probes etc., for tumor imaging and targeted therapy. By loading probes inside nanocomposites, it could highly increase the diagnostic sensitivity and selectivity to improve the diagnostic accuracy for proper therapy, while the imaging of tumors could further guide the tumor treatments, such as pinpoint tumor radiotherapy [1, 2]. We have constructed several polymeric nanocomposites, which could specifically deliver the contrast agents (CAs) to tumors for magnetic resonance imaging (MRI). The MRI CAs-incorporated polymeric nanocomposites could specifically enhance the contrast of tumor tissues for MR imaging of solid tumors. Besides anatomical imaging, the tumor pH-activatable polymeric nanocomposites could respond to the pH drop in tumors and amplify the contrast when the released CAs react with environmental proteins for tumor malignancy imaging, such as hypoxia and metastasis [3]. Moreover, the MRI CAs-loaded polymeric nanocomposites could be applied for dual MR tumor imaging and imaging-guided therapy [2]. For instance, the Gd-based MRI CAs could capture thermal neutrons to emit killing irradiations, such as γ-rays and auger electrons, to suppress the tumor growth, which also called as gadolinium neutron capture therapy (GdNCT). Overall, the imaging-functionalized polymeric nanocomposites have demonstrated high performance for high accuracy tumor diagnosis and imaging-guided therapy.

References