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Biocompatible poly(Aspartic Acid) derivative-coated USPIO nanoparticles incorporated with anticancer drug for theranostic applications

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As a theranostic MRI contrast agent with high relaxivity, USPIONP (ultrasmall superparamagnetic iron oxide nanoparticle) was prepared and characterized. The USPIONP was composed of an IONP core, amphiphilic poly(aspartic acid) copolymer (P) shell and an anticancer drug, epirubicin (EPI). The polymer P, poly(2-hydroxyethyl aspartamide)-C_{16}-mPEG, was synthesized using a ring-opening reaction of polysuccinimide. The polymer P-coated IONP (P-IONP) was prepared via synthesis of IONP and coating of P on the IONP by using co-precipitation method. The P-IONP was a USPIONP having a hydrodynamic diameter of about 40 nm. EPI-loaded USPIO (EPI-USPIO) had a hydrodynamic diameter of about 50 nm. Notably high T2 relaxivity of EPI-USPIO corresponded to MR contrast enhancement 2.7-fold compared with a commercial contrast agent. The relaxivity was proportional to EPI encapsulation efficiency of the EPI-USPIO. The encapsulated EPI was released from EPI-USPIONP in a sustained manner. USPIONP had no cytotoxicity against HeLa cells, whereas EPI-USPIONP showed cytotoxicity increasing in an EPI dose-dependent manner. Flow cytometry revealed that cellular uptake of EPI from EPI-USPIONP was comparable to free EPI and confocal microscopy showed nuclear uptake of EPI from EPI-USPIONP. These results suggest that USPIONP is a promising theranostic platform whose MR contrast enhancement can be controlled by modulating encapsulation efficiency of the therapeutics.

Biography

Hasoo Seong has completed his PhD from Seoul National University and postdoctoral studies from Purdue University. He is a senior research scientist in Bio & Drug Discovery Division of Korea Research Institute of Chemical Technology, an organization supported by South Korea Government. He has his expertise in the field of drug delivery system and biomaterials.

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