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Superparamagnetic iron oxide nanoparticles: Promising tools in cancer nanotheranostics

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The superparamagnetic iron oxide nanoparticles (SPIONs) with multifunctional diagnostics and therapeutic abilities are gaining huge popularity in cancer nanotheranostics due to their unique properties. The aim of the work was to develop SPIONs tagged with tumor specific antibodies, fluorescent dyes and chemotherapeutic drugs for efficient diagnostic purposes such as magnetic resonance imaging (MRI), fluorescence imaging and pH-dependent intracellular drug release. The core size of the SPIONs was found to be 11.2±1.3 nm using transmission electron microscopy. The SPIONs were coated with polyethylene glycol and bound with the fluorescent dye 5-FAM, antibody HuCC49ΔCH2, and chemotherapeutic drug doxorubicin (Dox) and this surface modified SPIONs were encapsulated in 1-palmitoyl-2-oleoyl-sn-glycero-3-phosphocholine liposomes. The colonic adenocarcinoma cell line LS174T was used to assess the targeting and imaging efficiency of using MRI and fluorescent microscopy. The pH-dependent drug release, intracellular distribution, and cytotoxicity were evaluated using microscopy and MTT assay. The enhanced effect of SPIONs in targeting was depicted using fluorescent imaging, MRI and Prussian blue staining results. Fluorescent imaging results demonstrated the accumulation of SPION conjugates in endosomes/lysosomes and Dox was released in acidic lysosomes and diffused into cytosol and nuclei. The MTT assays have shown that the SPION-antibody conjugates delivered more Dox to the target cancer cell, their (IC50) value was 1.2 μM, which was drastically less in case of plain SPIONs without antibody conjugation with (IC50) value of 0.3 μM.

Biography

Poornima Budime Santhosh received her Master's degree in Biochemistry in 2004 and MPhil in Biotechnology in 2005 from Bharathidasan University, India. She is currently a PhD student in Nanoscience at the University of Ljubljana, Slovenia. Her research interests include preparation of liposomes-nanoparticles hybrids for biomedical applications, investigating the interaction of nanoparticles with cell membrane, multimodal imaging and cancer nanotherapeutics.

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