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TITLE

Cancer cell targeting using folic acid-conjugated fluorescent CdSe/CdS/ZnS-MPA and CdTe-MSA quantum dots

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Hydrophobic core-shell CdSe/CdS/ZnS and CdTe-MSA (Mercaptosuccinic acid) quantum dots (QDs) were synthesized by successive ion layer adsorption and reaction (SILAR) technique and direct aqueous synthesis using thiol stabilizers respectively. Synthesized QDs (CdSe/CdS/ZnS) were made water dispersible by ligand exchange with 3-mercaptopropionic acid (MPA). Characterization of the QDs was done by UV-vis spectroscopy, spectrofluorometry and transmission electron microscopy (TEM), Fourier Transform infrared spectroscopy (FTIR), Confocal laser scanning microscopy (CLSM) and atomic force microscopy (AFM). CdSe/CdS/ZnS-MPA QDs with a size of 7-8 nm and CdTe-MSA QDs with a size of 3-3.5 nm were conjugated with folic acid (FA) using various techniques for targeting human cancer cells expressing folate receptor. Breast cancer cell line (MCF-7) was used for the cellular uptake studies, cellular QDs quantification and cytotoxicity studies. In vitro cellular uptake studies and cellular QDs (CdSe/CdS/ZnS-MPA) quantification was investigated with CLSM and spectrofluorometry which demonstrated higher internalization of the folate-conjugated QDs by MCF-7 cells compared with the free QDs. In this study we also investigated in-vivo toxicity of folated QDs (CdSe/CdS/ZnS-MPA) in BALBc mice. For toxicity evaluation of injected QDs sample, body weight, organ coefficient, complete blood count (CBC), biochemistry panel assay (AST, ALT and ALP), histology were determined. The QDs (CdSe/CdS/ZnS-MPA) concentration (500nM) used for this study is suitable for in-vivo imaging. These experiments confirms that FA conjugated QDs are specifically internalized by MCF-7 tumor cells and safe in concentration used for in-vivo studies, suggesting their potential utility as targeted fluorescent imaging agent for early stage cancer detection.

Keywords: CdSe/CdS/ZnS, CdTe, MPA, MSA, bioconjugation, folic acid, MCF-7, BALBc mice