Research Article

Multifunctional Fluorocarbon-conjugated Nanoparticles of Varied Morphologies to Enhance Diagnostic Effects in Breast Cancer

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Abstract
A multifunctional trastuzumab-nanoparticle-fluorocarbon system was developed to maximize the diagnostic effects in human epidermal growth factor receptor 2 (HER2)-positive breast cancer. The mesoporous silica nanoparticle shape (e.g. amorphous, spherical, and tubular) was altered to optimize the ultrasound contrast potential. Fluorocarbon conjugated mesoporous silica nanoparticles produced higher mean pixel intensities. At lower non-toxic concentrations, tubular shaped nanoparticles produced a higher mean pixel intensity compared to amorphous and spherical particles. All systems displayed a clear binding preference towards HER2-positive breast cancer cells. Increased incubation times and conjugation of fluorocarbon to mesoporous nanoparticles increased binding preference to HER2-positive breast cancer cells. The highest binding affinity was seen with tubular shaped nanoparticles as compared to amorphous and spherical particles. The trastuzumab-nanoparticle-fluorocarbon system of each morphology displayed functionality of enhancing contrast in ultrasound.

Keywords: Mesoporous silica nanoparticles, Ultrasound, Contrast agent, Breast cancer, Diagnostic