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# Ultrasound-Mediated Cavitation-Enhanced Extravasation of Mesoporous Silica Nanoparticles for Controlled-Release Drug Delivery

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## Abstract

Mesoporous silica nanoparticles have been reported as suitable drug carriers, but their successful delivery to target tissues following systemic administration remains a challenge. In the present work, ultrasound-induced inertial cavitation was evaluated as a mechanism to promote their extravasation in a flow-through tissue-mimicking agarose phantom. Two different ultrasound frequencies, 0.5 or 1.6 MHz, with pressures in the range 0.5-4 MPa were used to drive cavitation activity which was detected in real time. The optimal ultrasound conditions identified were employed to deliver dye-loaded nanoparticles as a model for drug-loaded nanocarriers, with the level of extravasation evaluated by fluorescence microscopy. The same nanoparticles were then co-injected with submicrometric polymeric cavitation nuclei as a means to promote cavitation activity and decrease the required in-situ acoustic pressure required to attain extravasation. The overall cavitation energy and penetration of the combination was compared to mesoporous silica nanoparticles alone. The results of the present work

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