DEVELOPMENT OF A DRUG DELIVERY SYSTEM USING MICROCAPSULES WITH ULTRASOUND

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Abstract

Micrometer-sized microcapsules collapse upon exposure to ultrasound. Use of this phenomenon for a drug delivery system (DOS), not only for local delivery of medication but also for gene therapy, should be possible. However, enhancing of efficiency of medication is limited because the capsules in suspension diffuse in the human body after injection, since the motion of the capsules in blood flow cannot be controlled. To control behavior of the microcapsules, an acoustic radiation force was introduced. We detected local changes in the microcapsule density by producing of acoustic radiation force in an artificial blood vessel. Furthermore, we theoretically estimated the conditions required for an active path selection of the capsules at a bifurcation point in the artificial blood vessel. We observed the difference in the capsule density at both in the bifurcation point and in alternative paths downstream of the bifurcation point for the different acoustic radiation forces. We also confirmed that the microcapsules are trapped against flow with the condition when the acoustic radiation force is more than the fluid resistance of the capsules. The possibility of controlling of the capsule flow towards a specific point in a blood vessel was demonstrated.

Keywords: microcapsule, acoustic radiation force, drug delivery, artificial blood vessel