

A Disposable Microfluidic Device for Controlled Drug Release from Thermal-Sensitive Liposomes by High Intensity Focused Ultrasound

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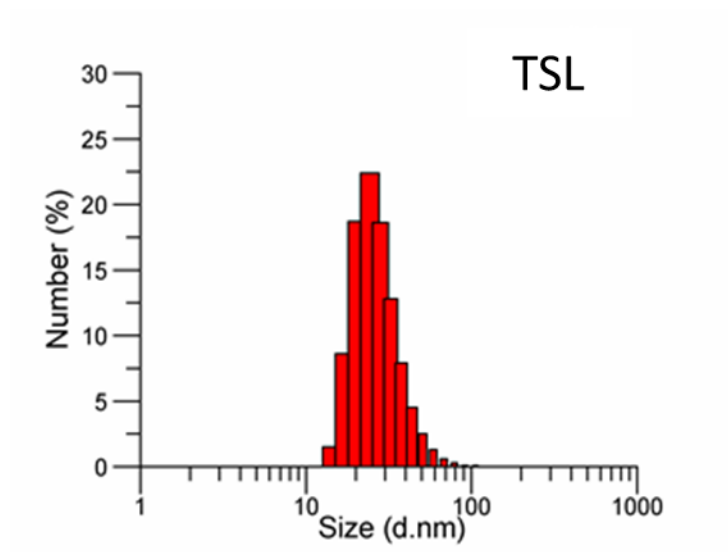


Figure S1. The size distribution of TSL and average diameter of TSL was 79.51 nm.

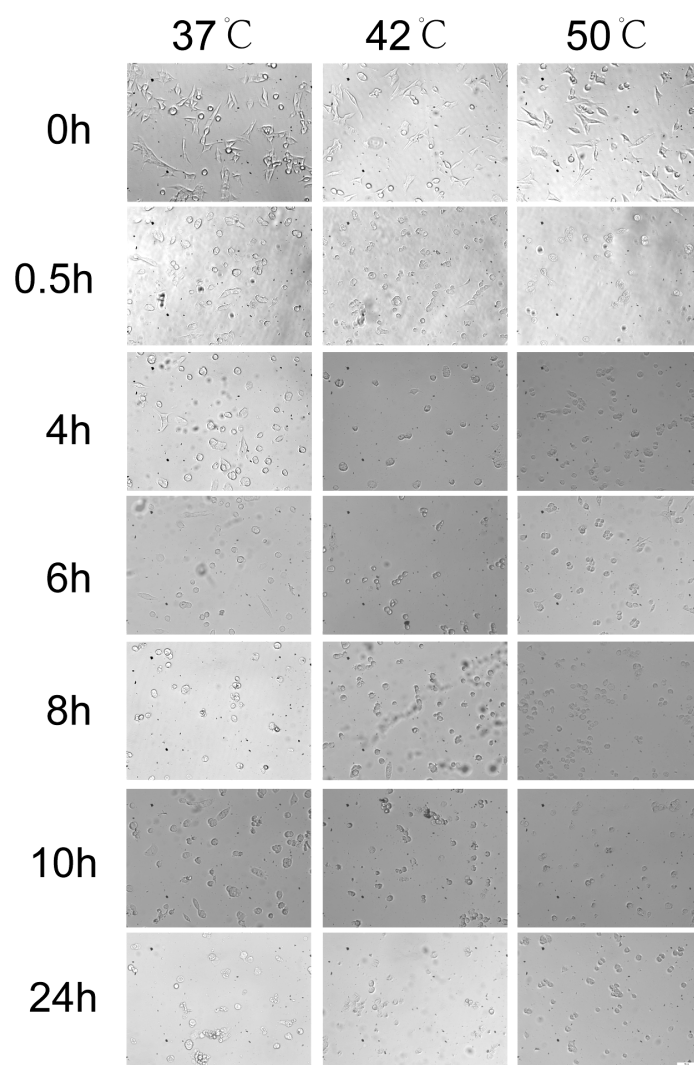


Figure S2. The changes in cell morphology over time after cell uptake the TSL by MHIFU treatment. The cells detached from the PDMS film immediately after MHIFU insonation at 50 °C. At 42 °C, the cells started to atrophy at 4 h after cell uptake the TSL by HIFU treatment. Similarly, the cell morphology began to change at 8 h after MHIFU irradiation for 37 °C. After 24 h, almost all the cells were detached from the substrate and suspended in the PDMS cavity. In the experiments, the TSL was always co-cultured with cells. The scale bar is 100 μm .

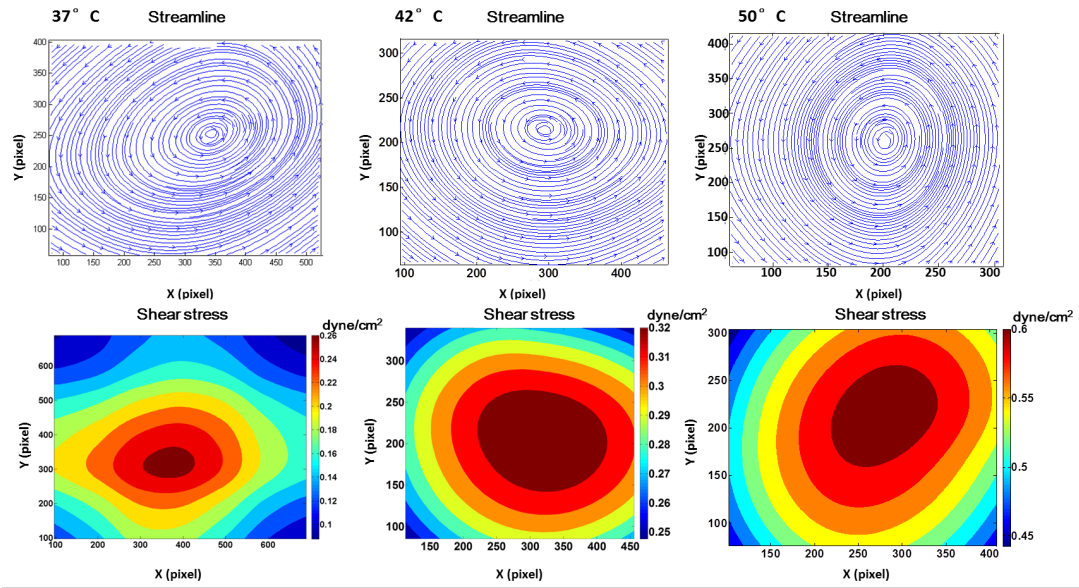


Figure S3. The PIV images and shear stress mappings at 28.6%, 52.8%, and 79.2% duty cycles corresponding to temperature maintenance at 37 °C, 42°C and 50 °C. Rotational flow was observed in the three cases and the shear stress increased with duty cycle.

Table S1. Characterization of TSL.

	Encapsulation Efficiency (EE)	PDI	Zeta Potential (mV)	Liposome stability, release (%) at 37 °C in 90% FCS in 24 h
TSL	97.5% ± 4.0%	0.181 ± 0.02	-21.8 ± 0.6	65.6% ± 10.5%

Movie Legends

Movie S1. Driving 2 μl of droplet movement in the propagation direction. The droplet was placed at the focus of MHIFU on the substrate directly. The average velocity of the movement was about 20 mm/s. The input voltage was 20 $V_{\text{p-p}}$. The movie is in a real time.

Movie S2. Controlling the temperature of fluid at 42 °C. The continuous wave and burst wave were utilized to heat and maintain the temperature at 42 °C. In both heating and maintaining temperature processes, the thermal distribution in PDMS cavity was relatively uniformly. The input voltage was 20 $V_{\text{p-p}}$. The movie is in a five-speed.

Movie S3. The acoustic streaming during the MHIFU drug delivery. When burst wave (2.6k cycles of 30 MHz at 3.3 kHz PRF) was connect to the MHIFU to maintain the temperature, significant acoustic streaming can be observed. The movie is in a real time. The size of tracer particle is 10 μm .