Electronic Supplementary Material (ESI) for Lab on a Chip.

Supporting Information

An Integrated Microfluidic Flow-focusing Platform for On-chip Fabrication and Filtration of Cell-laden Microgels

*Mohamed.G.A. Mohamed[1], Sina Kheiri[1, 3], Saidul Islam[2], Hitendra Kumar[1], Annie Yang[1], and Keekyoung Kim[1, *]*

[1]School of Engineering, University of British Columbia, Kelowna, BC, V1V 1V7, Canada

[2]Irving K. Barber School of Arts and Sciences, University of British Columbia, Kelowna, BC, V1V 1V7, Canada

[3]Currently at Department of Mechanical and Industrial Engineering, University of Toronto

*Corresponding author: Dr. Keekyoung Kim (keekyoung.kim@ubc.ca)

1. Supporting Figures

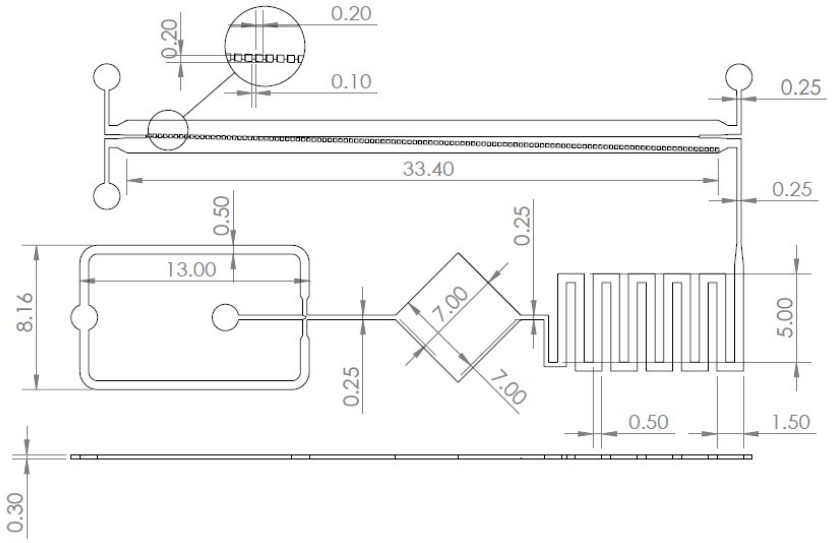

Figure S1. Detailed dimensional layout of the integrated microfluidic platform (unit: mm).

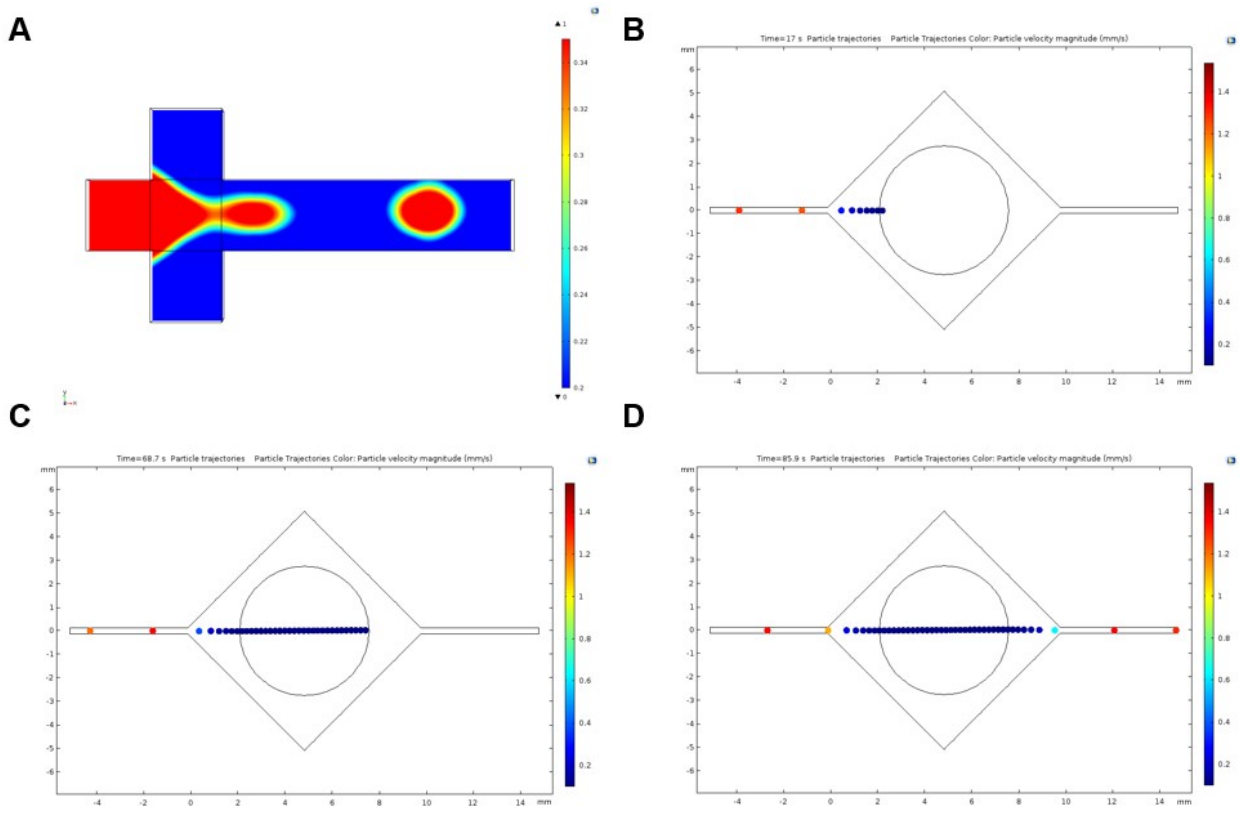

Figure S2. Computational simulation results of hydrogel droplets generation and crosslinking. (A) GelMA prepolymer droplet generation at the flow focusing cross junction (the color bar specifies the volume fraction of the dispersed phase). (B-D) Travel time estimation in the on-chip photocrosslinking chamber (diamond shape) with a laser beam spot (circular area). Droplets enter the crosslinking chamber (B), travel through the area of laser spot (C), and leave the crosslinking chamber (D).

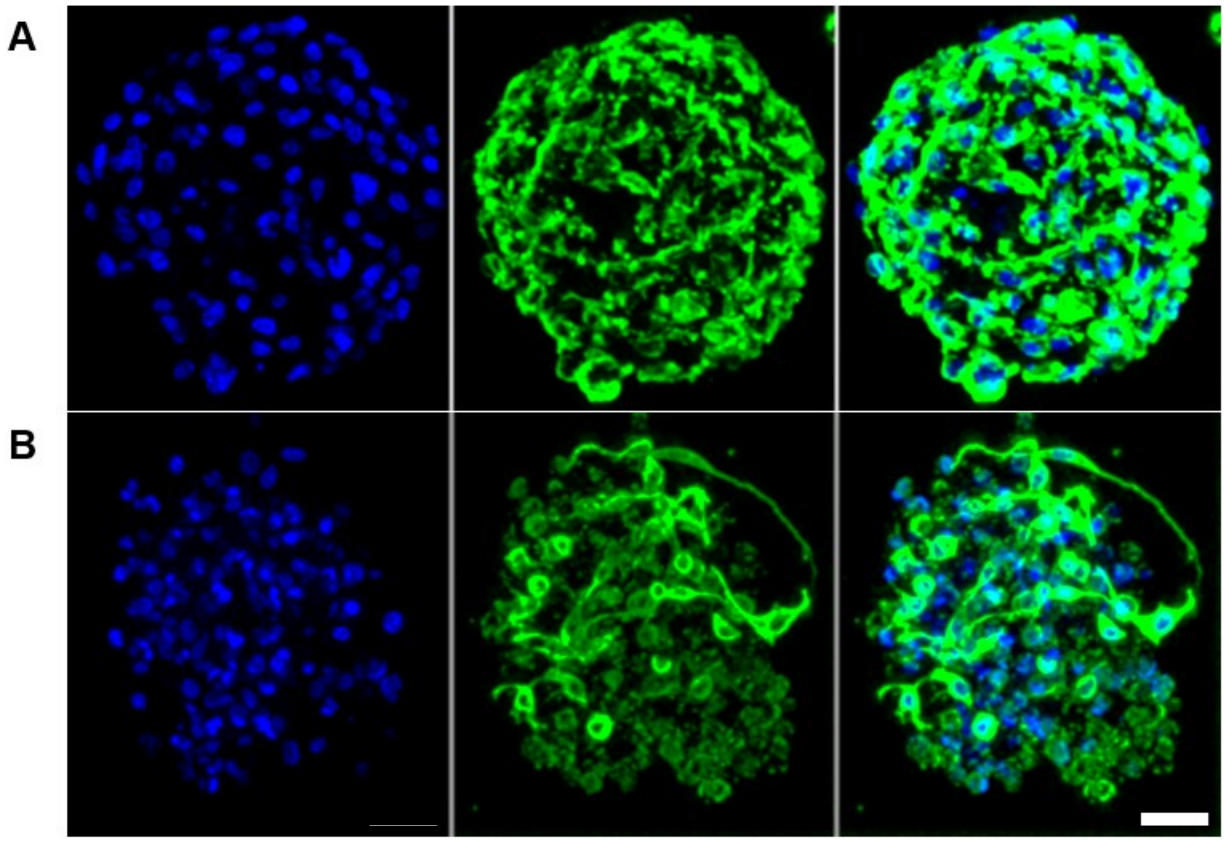

Figure S3. Effect of GelMA concentration on cell spreading within the microgels. Representative fluorescent images of immunostained cell nuclei and actin with (A) 7.5% w/v GelMA microgel and (B) 10% w/v GelMA microgel. Scale bar = 50 μm. Cells are more spread out in 7.5% w/v GelMA to form 3D network.

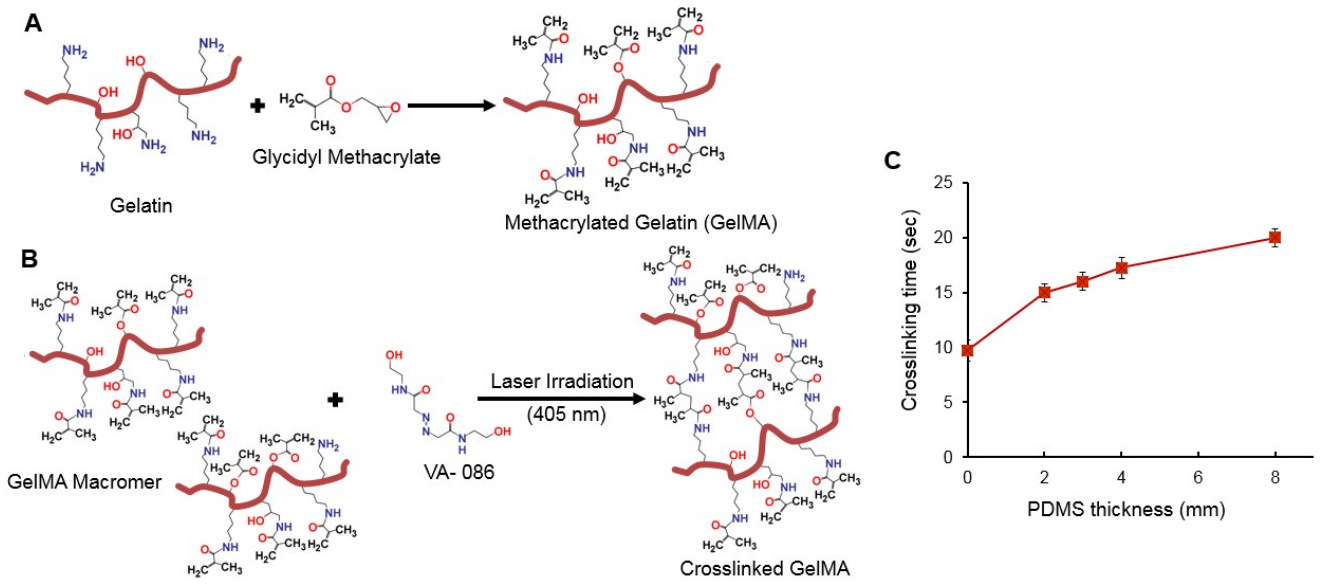

Figure S4. GelMA synthesis and photocrosslinking. (A) A schematic of the chemical reaction of gelatin and glycidyl methacrylate for conjugating methacryloyl groups. (B) A schematic of the GelMA photocrosslinking reaction under 405 nm blue laser irradiation in the presence of VA-086 photoinitiator. (C) Macroscale off-chip GelMA crosslinking time test under different thicknesses of PDMS pieces.

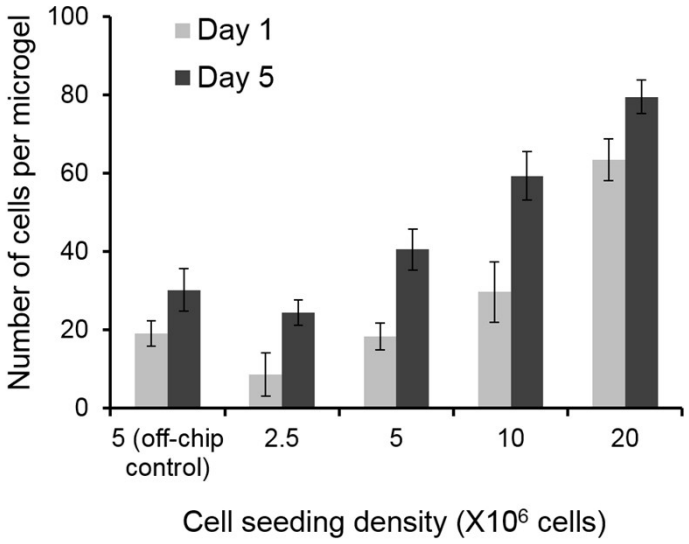

Figure S5. A plot to show cell number changes in microgels with different cell seeding densities including the off-chip control (5 x10^6 cells) at day 1 and day 5.

2. Supporting Videos

Video S1. Video shows the spherical droplets generation with no friction with the channel walls, and the stable and unstable cell-laden spherical droplet generation with and without applying the magnetic mixer and the BSA cellular pre-treatment, respectively.

Video S2. Video shows that the railing microposts help microgels to pass the interface between oil phase and aqueous phase in the presence of Tween 80 surfactant (right) and the microgels are accumulated and unable to cross the interface in the absence of surfactant (left).