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

Sheathless separation of microalgae from bacteria using a simple straight channel based on viscoelastic microfluidics

Dan Yuan[a], Qianbin Zhao[a], Sheng Yan[b], Shiyang Tang[a], Yuxin Zhang[a], Guolin Yun[a], Nam-Trung Nguyen[c], Jun Zhang[c,*], Ming Li[f,*] and Weihua Li[a,*]

[a] *School of Mechanical, Materials, Mechatronic and Biomedical Engineering, University of Wollongong, Wollongong, NSW 2522, Australia*

[b]*Department of Chemistry, University of Tokyo, Tokyo, Japan*

[c]*Queensland Micro and Nanotechnology Centre, Griffith University, Brisbane QLD 4111, Australia*

[d]*School of Engineering, Macquarie University, Sydney, NSW 2122 Australia*

[*]*Corresponding authors:* weihuali@uow.edu.au

ming.li@mq.edu.au

jun.zhang@griffith.edu.au

Fluorescent images at inlet

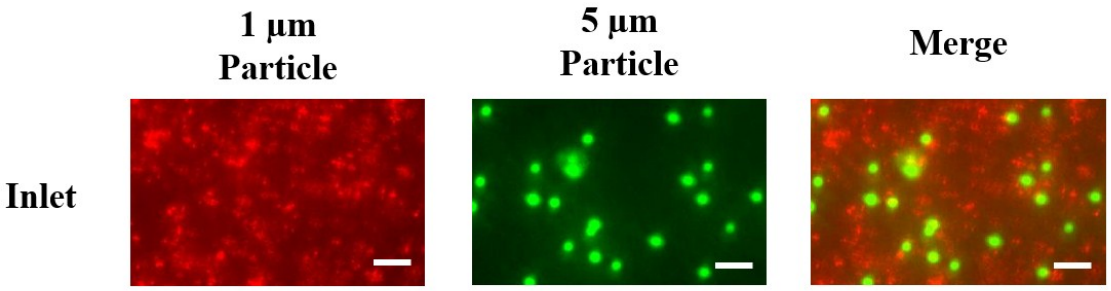

Figure S1 Fluorescent images for 1 μm, 5 μm, Merge of 1 μm and 5 μm fluorescent microparticles at inlet, respectively. Scale bar = 20 μm.

Rheological property of 1000 ppm PEO solutions

The rheological property of the fluids was measured using a rotational rheometer (Antonpaar MCR 301) that has a parallel plate configuration and a diameter of 20 mm. The measurement was performed at room temperature (24 ± 1°C). Figure S2 shows the viscosity of the Newtonian fluid and 1000 ppm PEO solution as a function of the shear rate. The shear viscosity of the viscoelastic fluid was measured in shear rates ranging from 100 s^{-1} to 10^3 s^{-1}. The shear viscosity of the Newtonian fluid remains constant at about 3×10^{-3} Pa·s. In this range, the PEO solutions show a slight shear thinning behavior. The average viscosity of 1000 ppm PEO solution within the tested shear rate region is 5×10^{-3} Pa·s.

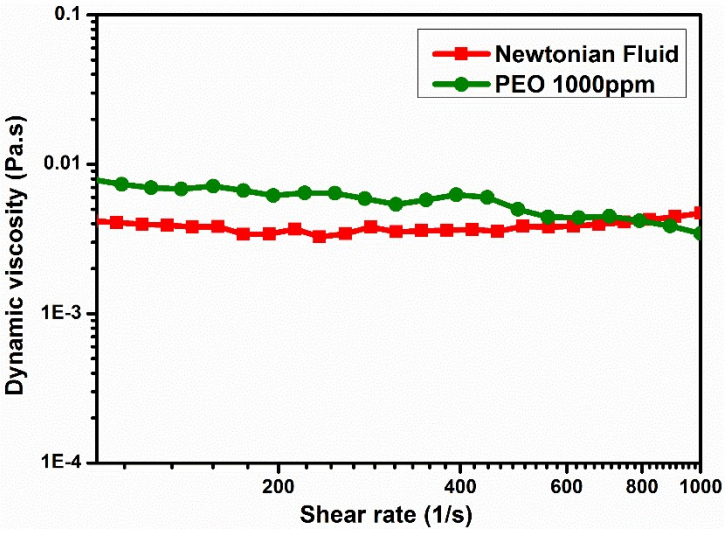

Figure S2: Viscosity of Newtonian fluid and 1000 ppm PEO solution as a function of shear rate

Calculation results of R_c and W_i for Newtonian fluid (0 ppm), and 1000 ppm PEO solutions with AR=3, AR=5, AR=10, from flow rate Q= 0.01 μl/min to Q = 20 μl/min

	0 ppm	1000 ppm (AR=3)	1000 ppm (AR=5)	1000 ppm (AR=10)
Q= 0.01 μl/min	R_c=2.8×10^{-3} W_i=0	R_c=1.6×10^{-3} W_i=0.46	R_c=1.1×10^{-3} W_i=0.16	R_c=0.4×10^{-3} W_i=2.7×10^{-2}
Q= 0.1 μl/min	R_c=2.8×10^{-2} W_i=0	R_c=1.6×10^{-2} W_i=4.6	R_c=1.1×10^{-2} W_i=1.6	R_c=0.4×10^{-2} W_i=0.27
Q= 1 μl/min	R_c=0.28 W_i=0	R_c=0.168 W_i=46	R_c=1.1×10^{-1} W_i=16	R_c=0.4×10^{-1} W_i=2.7
Q= 5 μl/min	R_c=1.4 W_i=0	R_c=0.84 W_i=230	R_c=5.5×10^{-1} W_i=80	R_c=0.2 W_i=13.5
Q= 10 μl/min	R_c=2.8 W_i=0	R_c=1.68 W_i=460	R_c=1.1 W_i=160	R_c=0.4 W_i=27
Q= 15 μl/min	R_c=4.2 W_i=0	R_c=2.52 W_i=690	R_c=1.65 W_i=240	R_c=0.6 W_i=40.5
Q= 20 μl/min	R_c=5.6 W_i=0	R_c=3.36 W_i=920	R_c=2.2 W_i=320	R_c=0.8 W_i=54

Migration phenomenon of 0.8μm and 3μm particle, RBC cells and E.coli

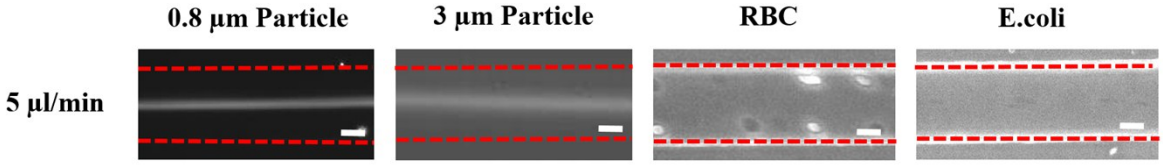

Figure S3 The migration phenomenon of 0.8μm and 3μm particle, RBC cells and ecoli in 1000ppm PEO fluid under the flow rate of 5 μl/min in the same straight channel (AR=3)"