Supplementary Material (ESI) for Lab on a Chip

"Sheathless Elasto-Inertial Particle Focusing and Continuous Separation in a Straight Rectangular Microchannel"

Electronic Supplementary Information

by Seungyoung Yang[1], Jae Young Kim[1], Seong Jae Lee[2], Sung Sik Lee[3,*], and Ju Min Kim[1,*]

[1]Department of Chemical Engineering, Ajou University, Suwon 443-749, Republic of Korea
[2] Department of Polymer Engineering, The University of Suwon, Hwaseong, Gyeonggi 445-743 Republic of Korea
[3] Institute of Biochemistry, ETH Zurich, Zurich, CH 4055, Switzerland

**To whom correspondence should be addressed.*

**[1]E-mail: jumin@ajou.ac.kr; Fax: +82-31-219-1612; Tel: +82-31-219-2475*
or

**[3]E-mail: leesu@ethz.ch; Fax: +41-44-633-1228; Tel: +41-44-633-4430*

Submitted: June 14, 2010

Revised: August 26, 2010

List of Supplementary Information

SI Fig. S1. Side view of particle (diameter = 5.9 *μm*) distribution in viscosleastic fluid (0.05wt% PEO). It reveals out Elasto-Inertial focusing in three-dimension. The size of channel is 50 μm

SI Fig. S2. Smaller particle (2.4 *μm*) distribution in non-Newtonian fluid (0.05wt% PEO). The focusing efficiency is weaker than larger particles (5.9 μm) at same flow rate (refer to Figure 3(a))

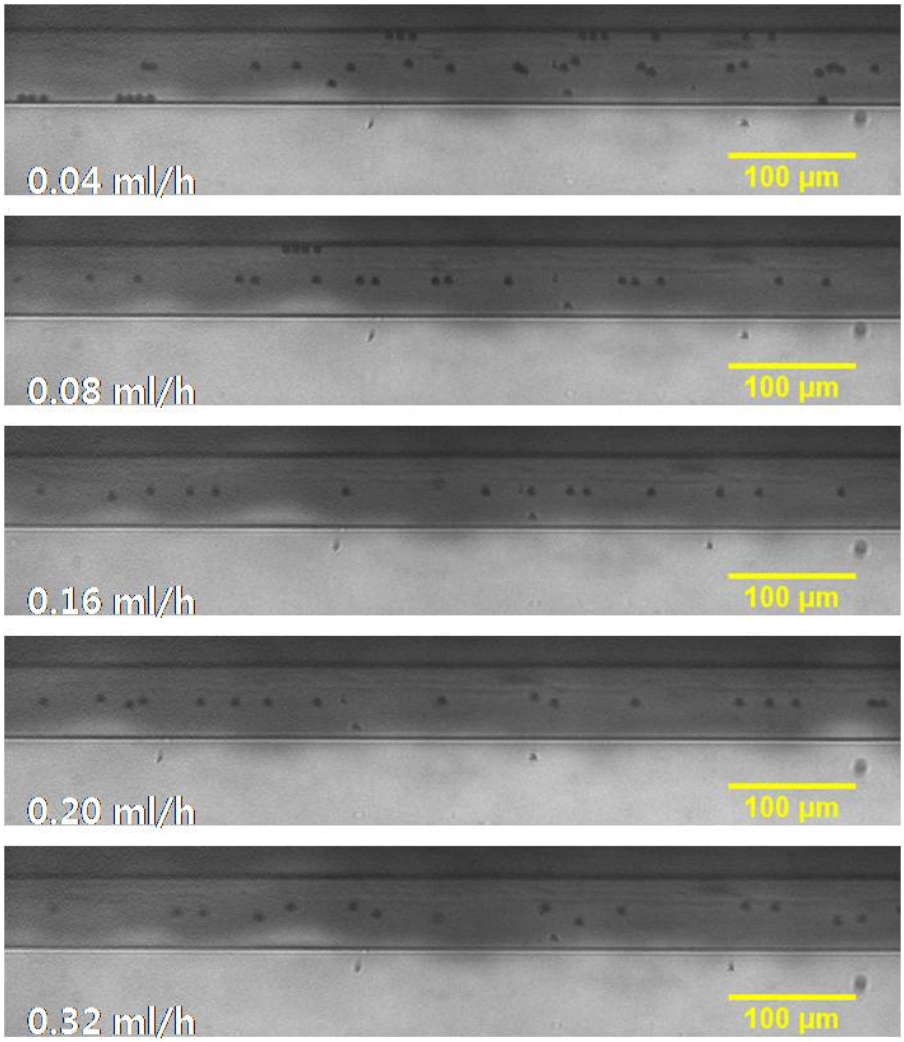
SI Table 1. Dimensionless number in experimental condition for PVP solution

SI Table 2. Dimensionless number in experimental condition for PEO solutions.

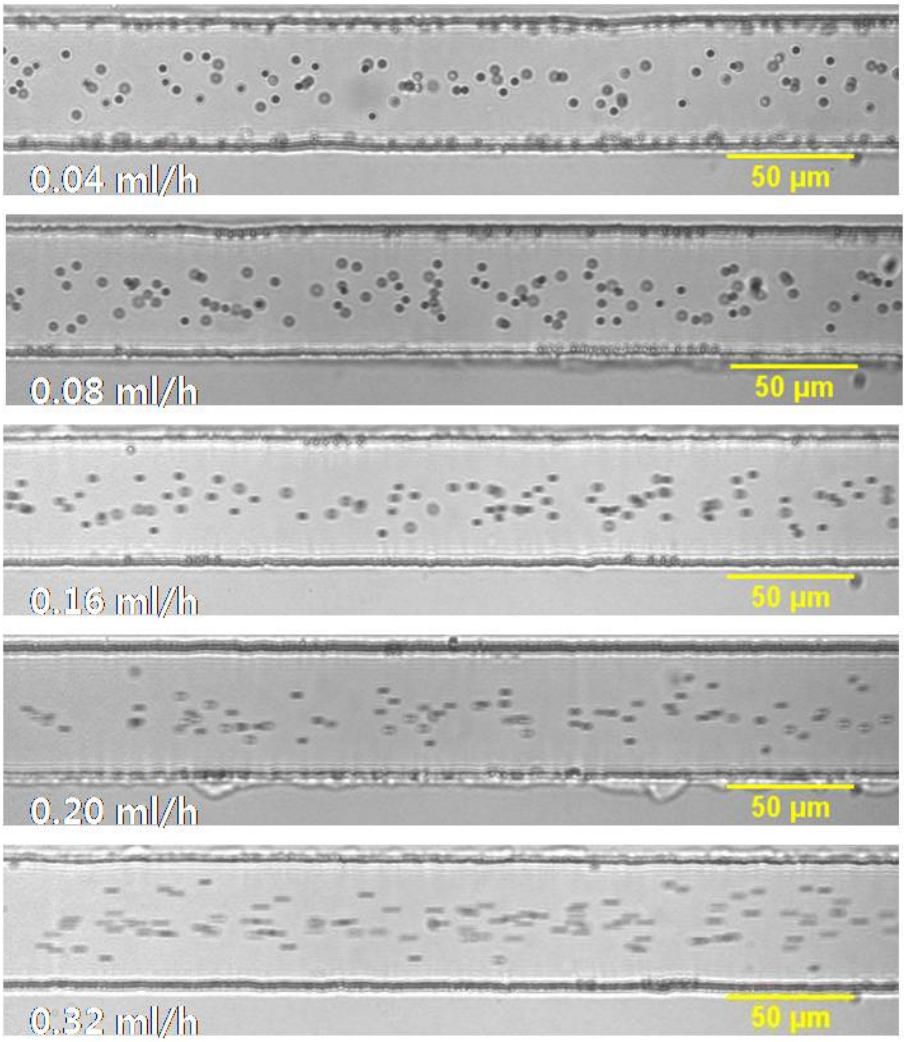
The viscosities for 50, 100, 250, and 500 ppm PEO solutions are measured to be 2.08 x 10^{-3}, 2.18 x 10^{-3}, 2.46 x 10^{-3}, and 3.12 x 10^{-3} *Pa.s*, respectively. The viscosity of the Newtonian medium, i.e., 0.0 wt% case in the table, is 2.05 x 10^{-3} *Pa.s*.

SI Movie 1. Three-dimensional Elasto-Inertial particle focusing

The particle (diameter = 5.9 *μm*) is dispersed in PEO 0.05wt%. Flow rate is tuned from 0.01-0.64ml/hr (refer to the labels inserted in the movie for flow conditions). Images were captured at 2000 frames per second (fps) with x10 objective and high speed CCD (Photron, MC2) mounted on the inverted microscope (Olympus, IX71) and the movie is played at 30 fps for all flow rates



SI Fig. S1 **Yang** *et al.*



SI Fig. S2 **Yang** *et al.*

Flow rate (*ml/h*)	Concentration of PVP 8wt% *El*=258	
	Wi	***Re***
0.01	0.10	4.00×10^{-4}
0.02	0.20	7.90×10^{-4}
0.04	0.41	1.59×10^{-3}
0.08	0.82	3.17×10^{-3}
0.16	1.64	6.35×10^{-3}
0.20	2.04	7.94×10^{-3}
0.24	2.45	9.52×10^{-3}
0.32	3.27	1.27×10^{-2}

Flow rate (*ml/h*)	Concentration of PEO									
	0.0wt%		**0.005wt%**		**0.010wt%**		**0.025wt%**		**0.050wt%**	
	El=0		***El***=3.21		***El***=5.28		***El***=10.81		***El***=21.51	
	Wi	***Re***	***Wi***	***Re***	***Wi***	***Re***	***Wi***	***Re***	***Wi***	***Re***
0.01	0.00	0.03	0.09	0.03	0.14	0.03	0.26	0.02	0.40	0.02
0.02	0.00	0.06	0.18	0.06	0.28	0.05	0.51	0.05	0.80	0.04
0.04	0.00	0.11	0.36	0.11	0.57	0.11	1.03	0.09	1.61	0.07
0.08	0.00	0.23	0.72	0.22	1.13	0.21	2.05	0.19	3.22	0.15
0.16	0.00	0.46	1.44	0.45	2.26	0.43	4.10	0.38	6.43	0.30
0.20	0.00	0.57	1.80	0.56	2.83	0.54	5.13	0.47	8.04	0.37
0.24	0.00	0.68	2.16	0.67	3.39	0.64	6.15	0.57	9.65	0.45
0.32	0.00	0.91	2.88	0.90	4.52	0.86	8.20	0.76	12.87	0.60
0.64	0.00	1.82	5.76	1.79	9.04	1.71	16.40	1.52	25.74	1.20
1.28	0.00	3.64	11.52	3.59	18.08	3.43	32.80	3.04	51.47	2.39
2.56	0.00	7.28	23.05	7.18	36.16	6.85	65.60	6.07	102.94	4.79