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

Supplemental Information for

A fully automated microfluidic micellar electrokinetic chromatography analyzer for organic compound detection

Lee-Woon Jang [1], Md Enayet Razu [1], Erik C. Jensen[2], Hong Jiao[2], and Jungkyu Kim*[1]

[1] *Department of Mechanical Engineering, Texas Tech University, Lubbock, TX, USA.*

[2] *HJ Science and Technology, Berkeley, CA, USA.*

* Address correspondence to: Jungkyu (Jay) Kim

E-mail: jungkyu.kim@ttu.edu

Department of Mechanical Engineering

Texas Tech University

Lubbock, Texas 79409, USA

Phone: (806) 834-6106

E-mail: jungkyu.kim@ttu.edu

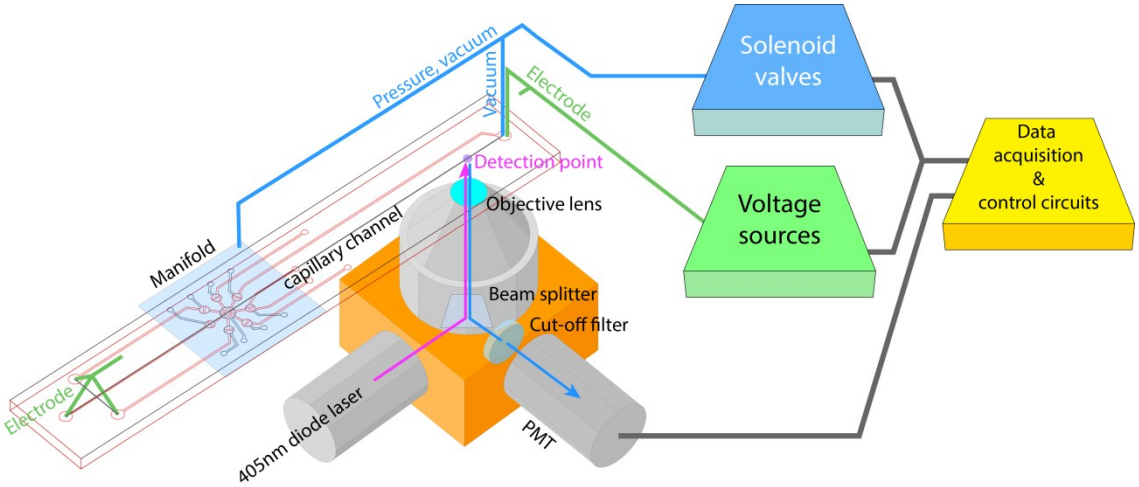

Fig.S1. Diagram of a fully automated MEKC platform including solenoid valves, voltage control, and optical setup. The solenoid valve controls various solution movements by pneumatic action. The voltage source applies high electrical potential into the waste, anode, sample, and cathode well. The detection system is located under the CZE microchip, and it consists of laser diode, PMT, objective lens, beam splitter, and cut-off filter. A 405nm laser beam is injected and focused on the capillary channel by the beam splitter and objective lens, respectively. The reflected laser beam is blocked by the cut-off filter, and only excited fluorescence light over 430 nm is detected by PMT. All devices are controlled by data acquisition and control circuit.

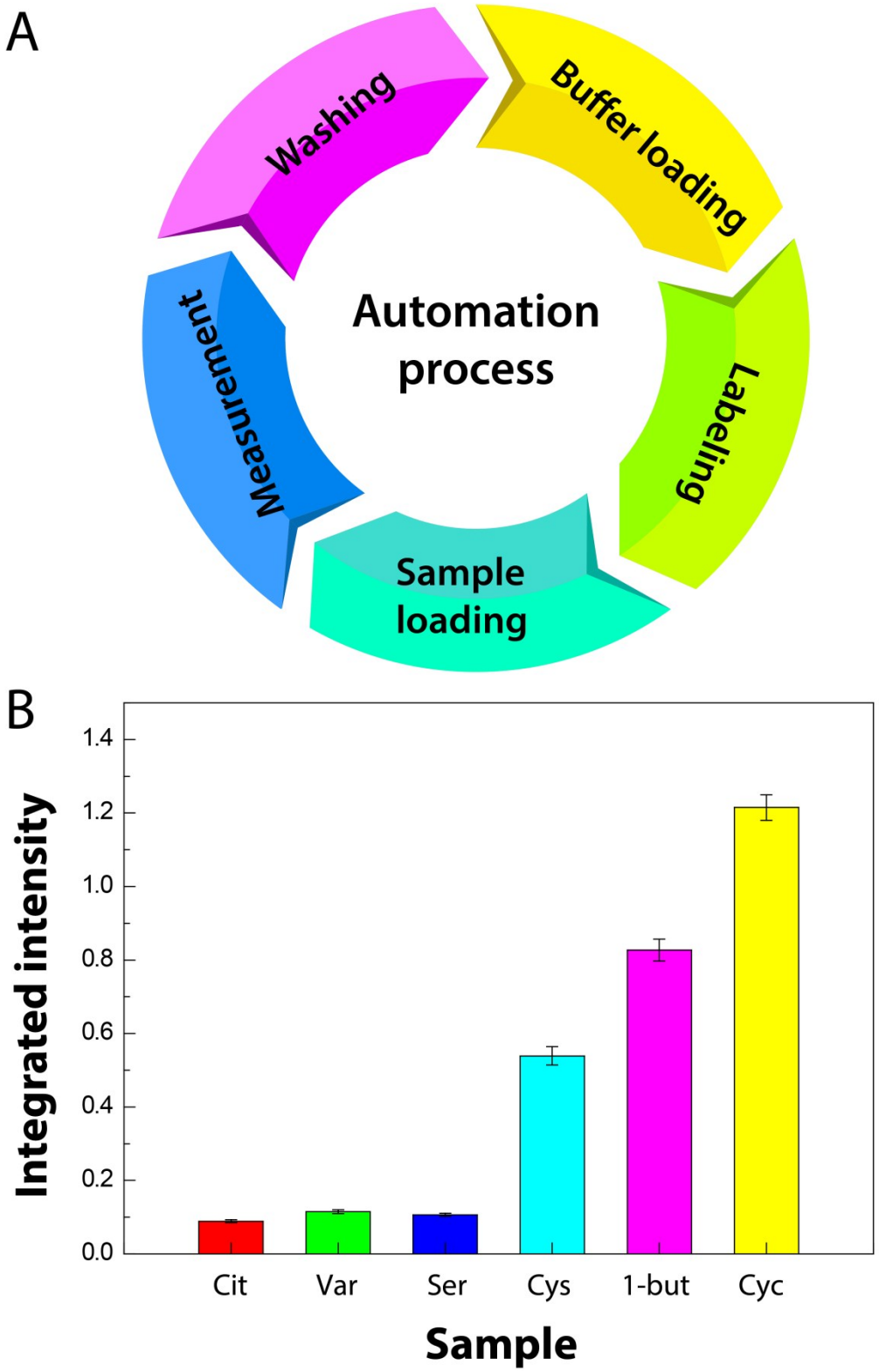

Fig.S2. (A) Flow diagram of a fully automated process. One cycle contains the borate solution loading, labeling, sample loading, electropherogram measurement, and

washing step. With this flow process, a repeatability of electropherograms with amino acids and thiols was estimated. (B) Repeatability results of amino acids and thiols for 3 cycles. Integrated intensities of amino acids and thiols were calculated from each electropherogram.

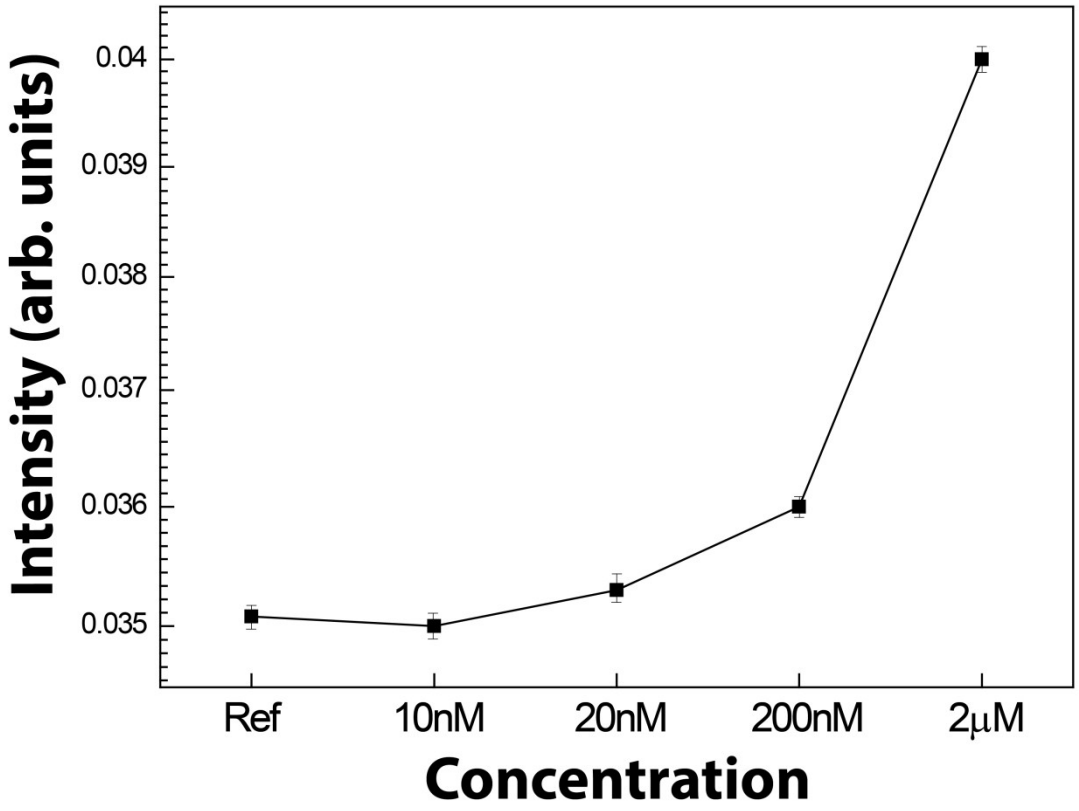

Fig.S3. The LOD result of the automated MEKC analyzer. All samples showed similar behaviors, and the citrulline result was presented due to data overlapping. By decreasing the concentration of the citrulline, the integrated intensity was decreased and it showed approximately 18 nM LOD.

Table S1. Separation characteristics from figure 4.

Species	***Total analysis***				**Retention time (t_R)**	**On-chip**		**Off-chip**	
	On-Chip		**Off-chip**			**Thiol**	**Amino acid**	**Thiol**	**Amino acid**
	N[a]	***Resolution***[b]	***N***[a]	***Resolution***[b]		W_h	W_h (W_b)	W_h	W_h (W_b)
PBM (1)	1.8×10^4		6.0×10^3		32.4	0.57		0.98	
Citrulline	1.2×10^5	5.5	8.6×10^4	3.53	36.2		0.245		0.29
Cysteine	3.5×10^3	2.02	3.2×10^3	1.9	39.3	1.56		1.635	
Valine	6.5×10^4	0.43	8.6×10^4	0.422	40		0.368		0.32
Serine	1.3×10^5	5.96	7.8×10^4	5.69	43.3		0.285		0.364
PBM (2)	9.8×10^3	4.5	9.8×10^3	4.25	48.8	1.16		1.16	
PBM (3)	4.2×10^3	2.08	1.2×10^4	2.82	54.3	1.96		1.14	
PB (1)	NA[c]	5.75*	NA[c]	3.58*	64.5		(2.4)		(2.22)
PB (2)	3.5×10^4	2.63*	3.6×10^4	2.19*	69.8		0.875 (1.636)		1.81 (0.867)
1-butanethiol	6.6×10^3	2.16	6.9×10^3	2.78	75.4	0.82		2.13	
Cyclohexanethiol	8.9×10^3	5.83	1.0×10^4	6.17	98.3	1.09		2.25	

[a]Peak efficiency (theoretical plates): $$N = 5.545\left(\frac{t_R}{W_h}\right)^2$$

[b]Resolution: $$R = 1.18\left(\frac{t_{R2} - t_{R1}}{W_{h1} + W_{h2}}\right), R^* = 2\left(\frac{t_{R2} - t_{R1}}{W_{b1} + W_{b2}}\right)$$

t_{R1}=retention time of first peak, t_{R2}=retention time of second peak, W_{h1}=peak width at half height of the first peak, W_{h2}=peak width at half height of the second peak, W_{b1}=peak width at base of the first peak, W_{b2}=peak width at base of the second peak.

The data calculated by R^* equation is labeled with an asterisk (*).

[c]Cannot be calculated in this electropherogram due to detector saturation.