Electronic Supplementary Material (ESI) for Lab on a Chip.
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Reduction of Taylor-Aris dispersion by lateral mixing for chromatographic applications – Supplementary information

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S1 Microfluidic Chip

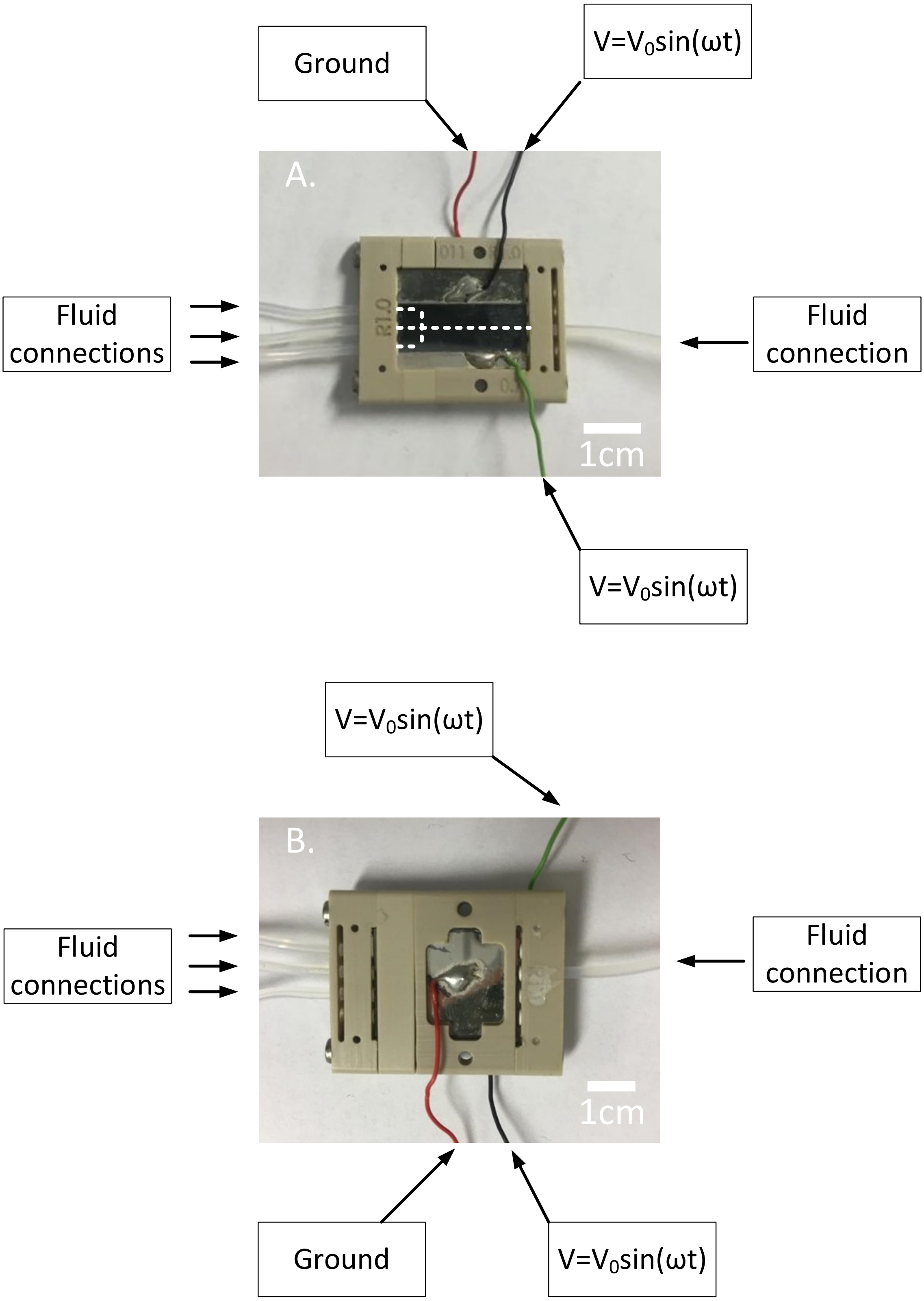

Fig. S1 Chip in microfluidic chip holder a) front side, the microfluidic channels are indicated with a white dashed line. b) back side. Two electrodes at the top are connected to the same potential.

S2 Stability when applying AC-potential

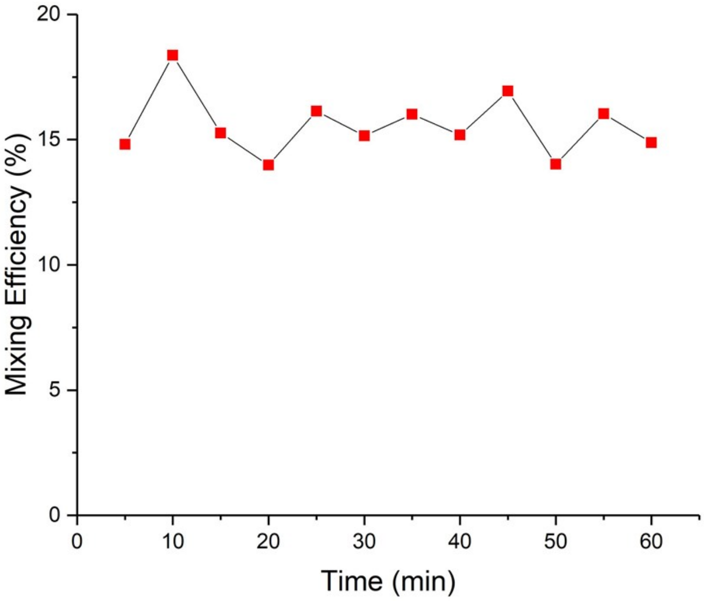

Fig. S2 Mixing efficiency over time, the chip was actuated at 10 Vpp at a frequency of 10kHz.

Possibly further electrochemical oxidation of the silicon could lead to an increase in the thickness of the insulating layer, reducing the double layer charging currents and in time the AC-electroosmotic flow. To study the performance of the chip over time, the mixing efficiency was determined over the course of an hour, as displayed in figure S2. A pressure driven parallel co-flow of electrolyte (KNO_3 0.1 mM) and electrolyte with FITC-dextran (50 µM) was induced. An AC-potential was applied over the course of an hour, every ten minutes the coefficient of variation of the intensity over the width of the channel was determined with and without the AC-potential applied. The mixing efficiency was thereby determined as the difference in the coefficient of variation between operation while mixing and not mixing. As can observed from figure S2, the mixing efficiency remained constant.

S3 Electrochemical characterization

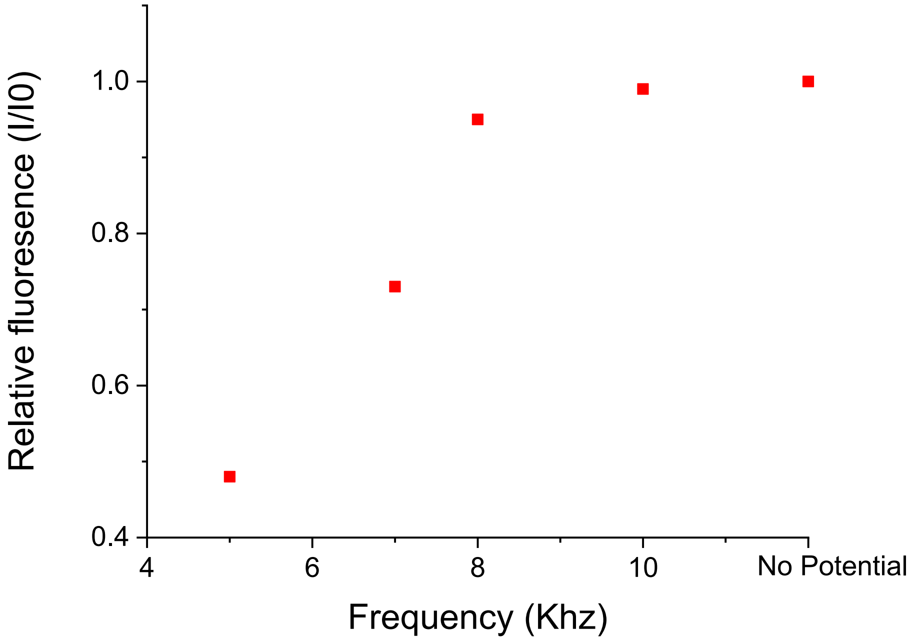

Fig. S3 Change in relative fluorescence after applied AC-potential at 10 Vpp for 30 seconds, without any axial flow. During the AC-actuation the chip was not illuminated to prevent photobleaching of the dye.

AC-potentials at high voltages and low frequencies are known to cause Faradaic reactions at the electrode-electrolyte interface. These reactions are known for causing an acidification of the electrolyte, with the production of H^+ as the main reaction. By monitoring the change in fluorescent signal of the Fluorescein (50 µM) , (which is a pH sensitive dye) over time, we studied the occurrence of Faradaic reactions in our system[1]. Figure S1 shows the change in fluorescent signal after applying a 10 Vpp AC-potential at different frequencies over 30 seconds. Above circa 8 kHz the change in fluorescence intensity disappears. For frequencies below 3 kHz, bubble generation at the electrode-electrolyte (0.1 mM KNO_3) interface occurred. These results indicate that no change in fluorescence is observed when comparing absence of AC actuation with actuation at 10 kHz. The flow induced phenomena described below are therefore not caused by a reduction in intensity due to acidification or more general, by Faradaic reactions.

S4 Coating procedure

Table S1 coating procedure for Reverse Phase chromatographic coating.

Step	*Solvent*	*duration*
1	Methanol	3 hours
2	Toluene/Methanol 1:1 (v:v)	3 hours
3	Toluene	3 hours
4	C18/Toluene 1:9 (v:v)	12 hours
5	Toluene	3 hours
6	Toluene/Methanol 1:1 (v/v)	3 hours
7	Methanol	3 hours

References

1. An, R., Massa, K., Wipf, D. O. & Minerick, A. R. Solution pH change in non-uniform alternating current electric fields at frequencies above the electrode charging frequency. *Biomicrofluidics* **8,** 1–13 (2014).