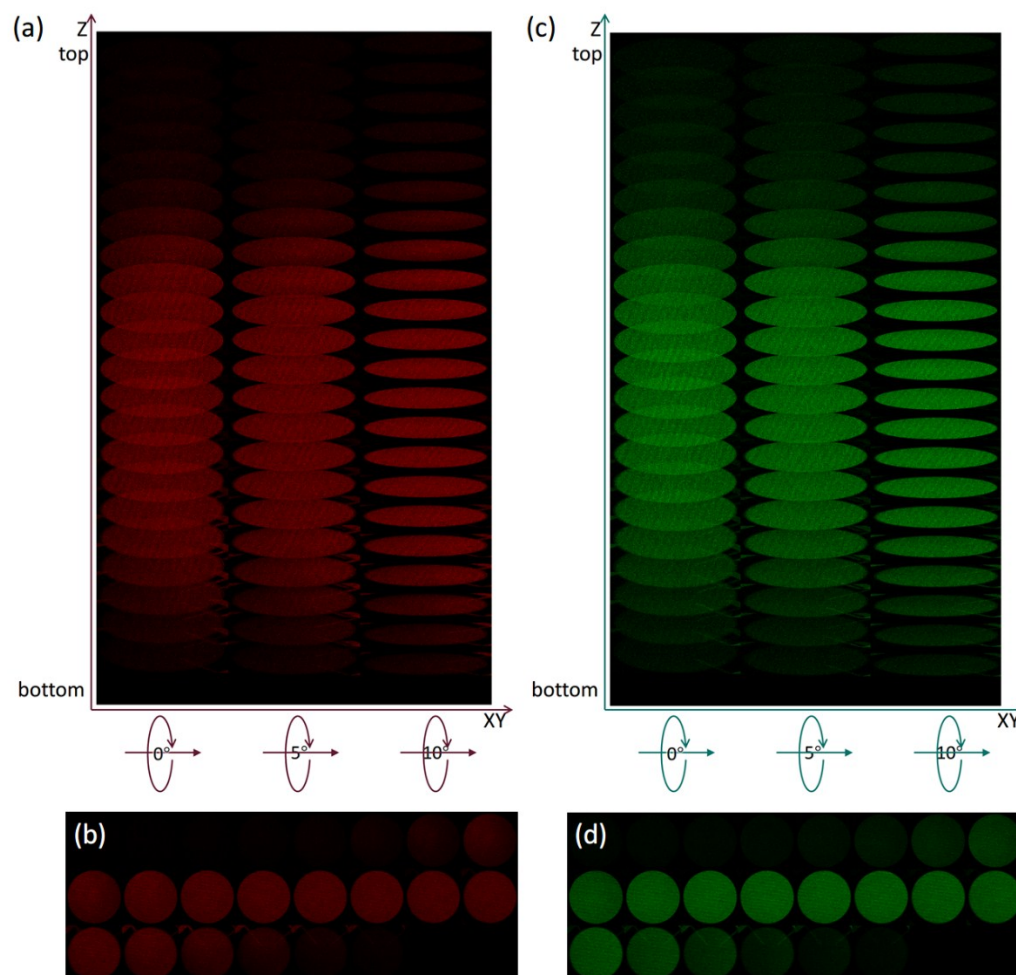


Supplementary information

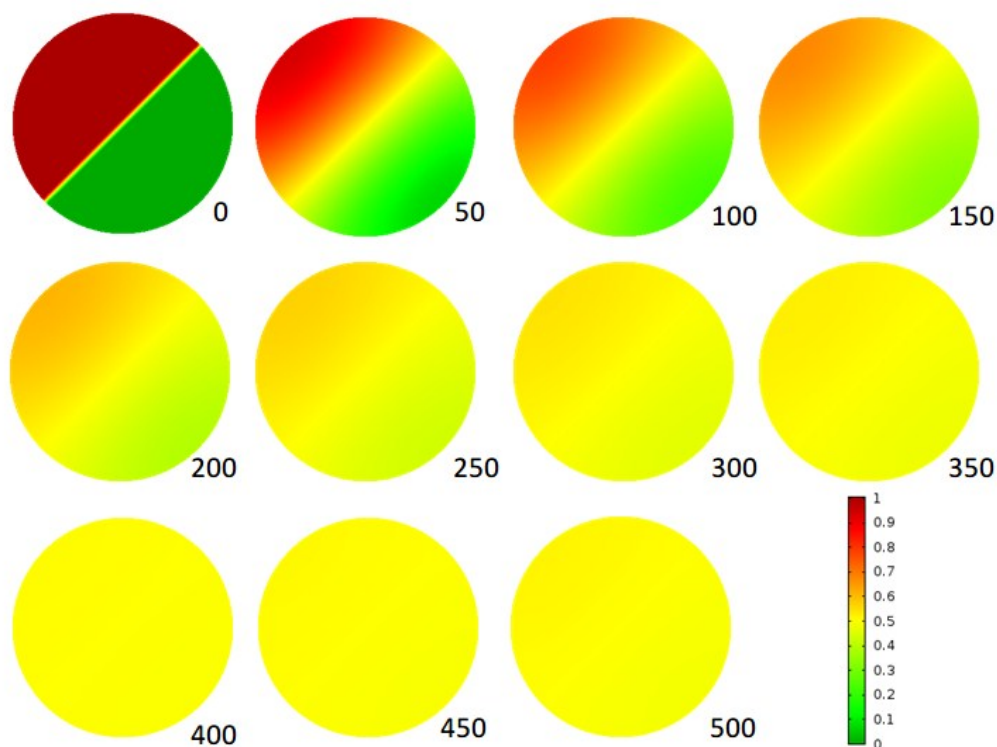
1. The concentration scan along Z direction of the chamber



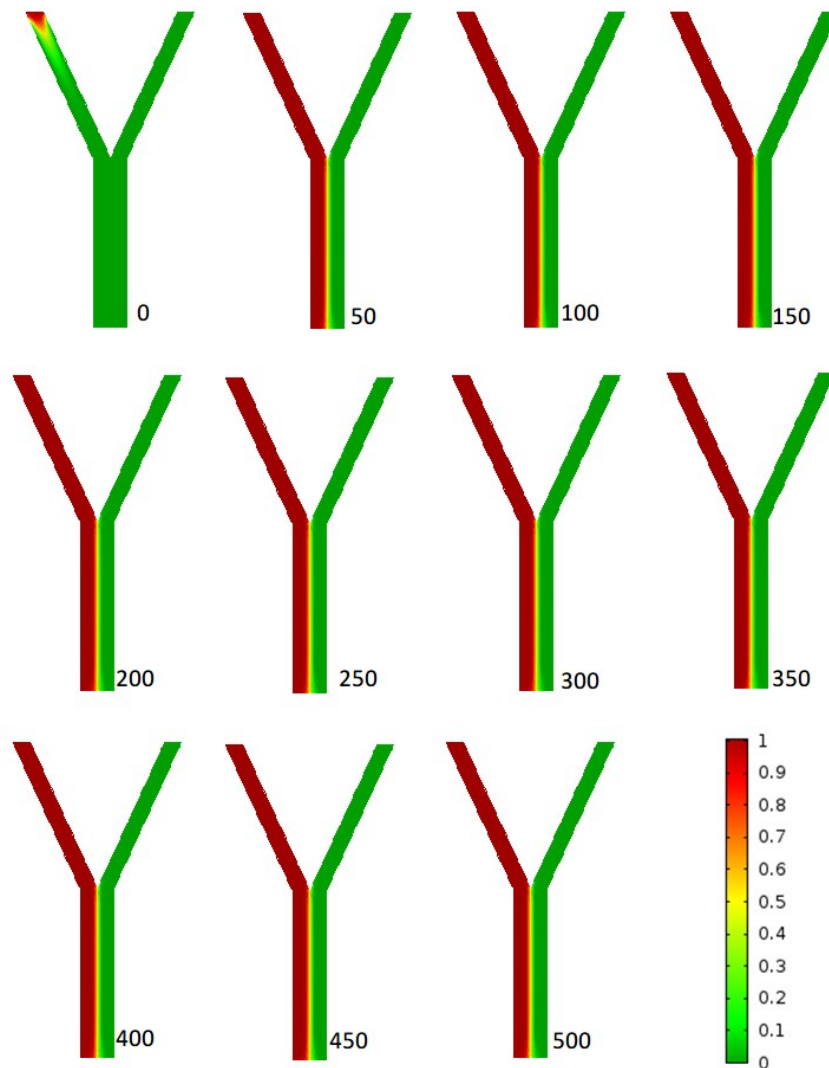
Supplementary Figure. S1: The intensity along depth direction for Rhodamine B and FITC. The section thickness is $11.078 \mu m$. The scan step is $14.9 \mu m$.

2. The mixing efficiency comparison between chamber and channel and discussion about adding a mixer

The main reason we don't include a mixing part is that the mixing happens inside the chamber, which is 1.2 mm in diameter, instead of a micron sized channel, the mixing efficiency is not as low as one would expect in a conventional microfluidic device. We've done a simulation to justify our argument in figure S2, S3. The diffusive coefficient is set as $4.25 \times 10^{-10} \text{ m}^2 \text{ s}^{-1}$ for FITC, $4.27 \times 10^{-10} \text{ m}^2 \text{ s}^{-1}$ for Rhodamine B¹. The chamber size is 1200 μm in diameter, 200 μm depth. It is the size of our chamber in 2D array chip. For the Y-shaped channel, the depth of main channel is 70 μm , the width of channel is 100 μm , the branch 43.3 μm in width. It is the size of main channel in our 2D array chip. The fluid in the circle chamber is in a dead end. The flow rate in Y channel is set as 1 mL/h for each fluid. It roughly takes less than several hundred seconds to complete the mixing in our chamber, and is even faster in experimental observation since the mixing already starts before the fluid fills the chamber. Other than that, our chip is basically an exploration of design of minimization. There're 25 chambers in total, and if a mixing part is to be attached, it must be at the downstream, at the entrance of each chamber, meaning 25 positions. Either we were to rely on some external forces to make an active mixer, like acoustic wave², electrokinetics³, or to design series of curved channels to make a passive mixer⁴, it is doomed to be cumbersome anyway. Overall, the utility a mixing part could bring to our design is marginal, thus we didn't include it.



Supplementary Figure. S2: The simulation of mixing process of circle chamber through diffusion, from 0 to 500 seconds. Frame extract every 50 seconds, time specified at right bottom of each circle. The color bar is the concentration of Rhodamine B, 1 corresponds to 1 mol/L.



Supplementary Figure. S3: The simulation of mixing process of Y-shaped channel through diffusion, from 0 to 500 seconds. Frame extract every 50 seconds, time specified at right bottom of each Y-shaped channel. The color bar is the concentration of Rhodamine B, 1 corresponds to 1 mol/L.

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