Scalable microfluidic static droplet arrays for biochemical analysis based on chemical concentration gradient

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We present a microfluidic static droplet array (SDA) device that can generate high-resolution concentration gradient. The system consists of discrete sample dispensing channel, array units, and microvalves for droplet generation and droplet storage. We applied a negative pressure on the storage chamber to increase the capacity of storage chamber. The size of droplet is controlled by valve open time, and the storage chamber can contain the droplets up to 32 with 20 milliseconds valve open time. The gradient was generated by combinatorial storage of binary concentration of droplets. We confirmed that the resolution of concentration gradient is achieved down to 1/32. We also performed enzymatic inhibition assay for IC50 using β-galactosidase and PETG, and we achieved IC50 value of 2.18 μM.