

## Efficient mixing with formation of nano-droplet in microfluidic device

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This study presents tiny drop based microfluidic device for performing efficient mixing in millisecond time. The design of microfluidic system is based on different property of two immiscible liquid such as water and oil. The aqueous liquids formed nano-droplets surrounded and transported by the immiscible oil fluid. The formation of nano-droplet size critically depends on difference of two fluids. In this study, we survey the relationship between drop size and flow rate.

In addition, the problem of mixing and dispersion in microfluidic device is key to reducing analytical time and reaction time because of laminar flow. To solve problem of dispersion and mixing, winding channels rapidly mixed the reagents in single droplets, which are attributed from circulation of nanodroplet and formation of turbulent flow.

In here, we show immediate mixing of two reagents and three reagents in microfluidic device at millisecond time scale. We experimentally visualized the effect of mixing and retardation of dispersion and developed optimized operation conditions.

This microfluidic system will be useful for wide range of multistep chemical and biochemical reactions taking on only millisecond time scale.