

Autonomous Droplet Microfluidic Sensor for Highly Variable Ocean Alkalinity

(b)



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Ocean alkalinity is the capacity of seawater to resist changes in pH

Application

Fast-changing environments



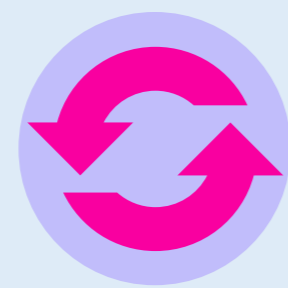
Titration frequency in continuous microfluidics is limited by mixing



This droplet sensor aims to improve on shortcomings of current continuous microfluidic alkalinity sensors



REDUCED WASTE



FASTER MIXING

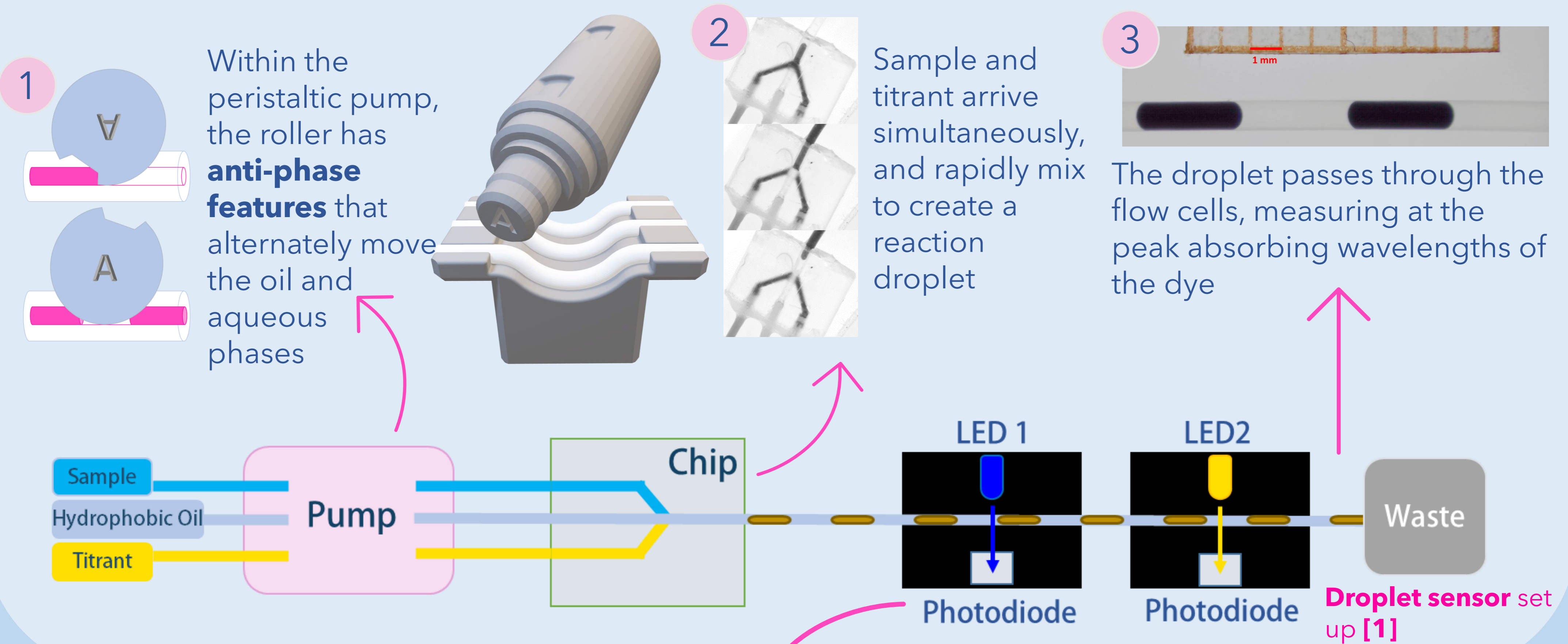


HIGH SAMPLE FREQUENCY



INCREASED RANGE

Single-Point Measurement

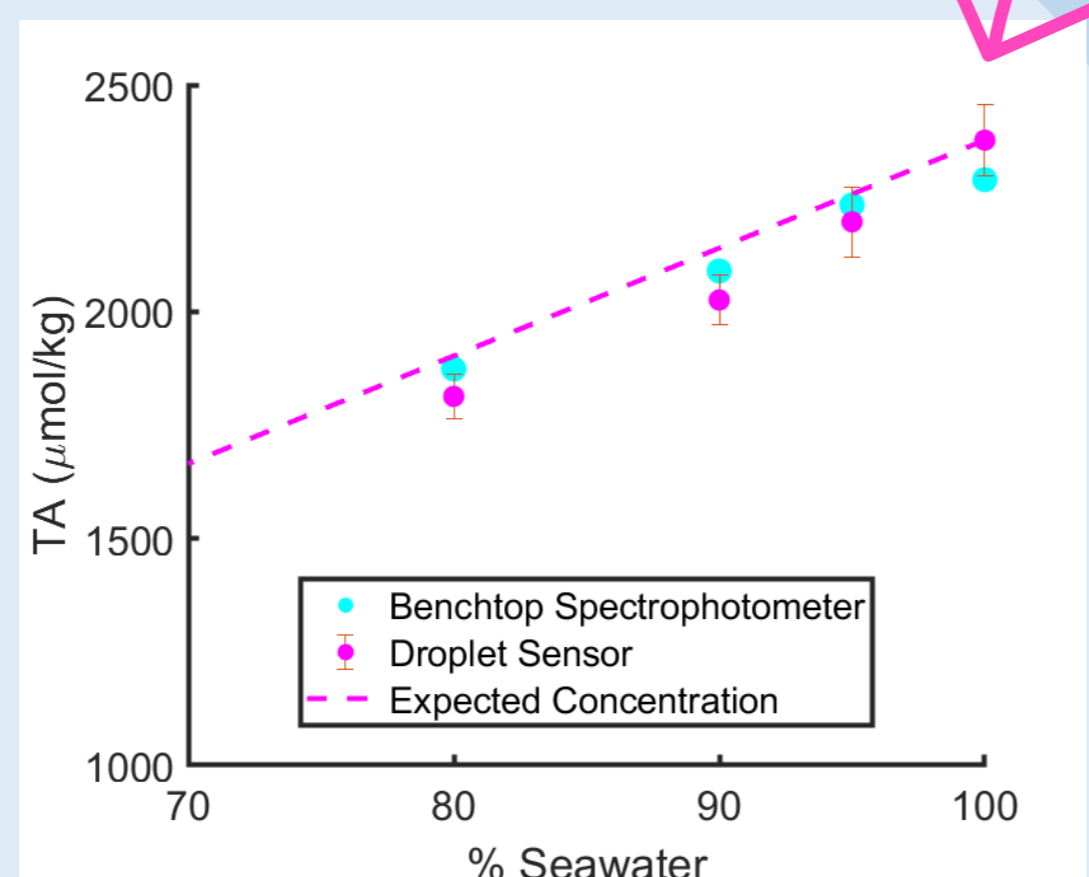


Results

Discrete, single-point **total alkalinity (TA)** titrations are performed in microfluidic droplets.

Seawater is combined with **titrant** (acid and a pH-sensitive, colour-changing dye) and measured **spectrophotometrically**

Droplet sensor gives equivalent TA measurements to benchtop spectrophotometer

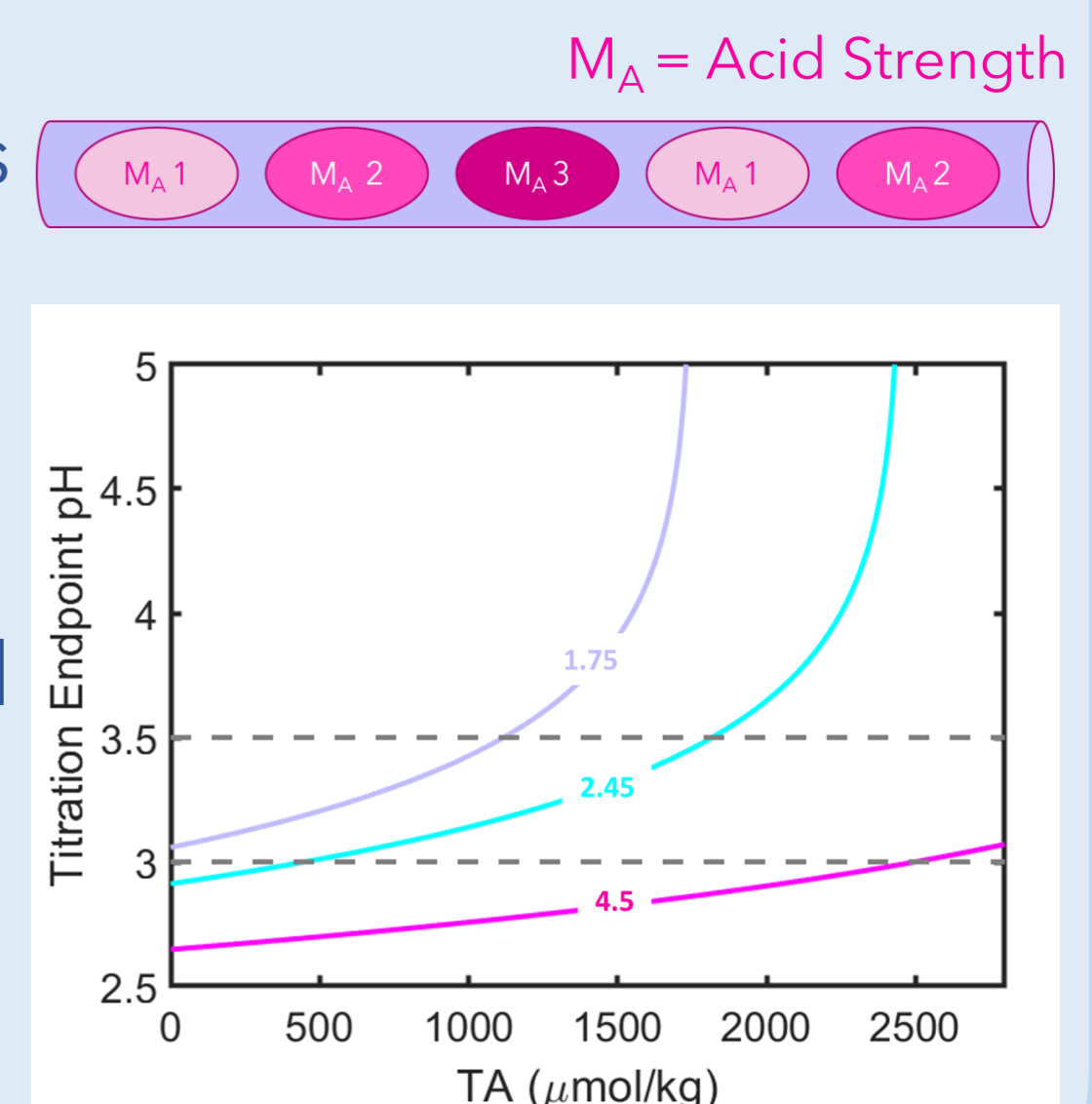


Error bars on benchtop are too small to visualise

Future Work: Multi-Point Measurement

Current continuous microfluidic TA sensors measure a **limited range**, using one acid strength.

The droplet system will measure over the **entire TA range** by increasing acid strength in consecutive droplets



Each line represents an acid concentration in mmol/kg

References

[1] Nightingale, A.M., Hassan, S.U., Warren, B.M., Makris, K., Evans, G.W., Papadopoulou, E., Coleman, S. and Niu, X., 2019. A droplet microfluidic-based sensor for simultaneous in situ monitoring of nitrate and nitrite in natural waters. *Environmental science & technology*, 53(16), pp.9677-9685.
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