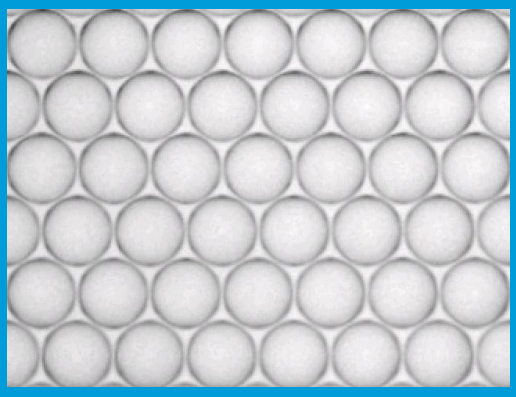
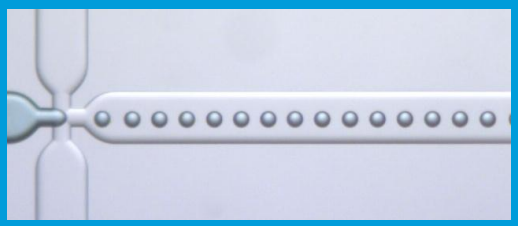
Mitos P-Pump Droplet Monodispersity

A comparison of the size consistency of droplets formed by the Mitos P-Pump and a market leading syringe pump





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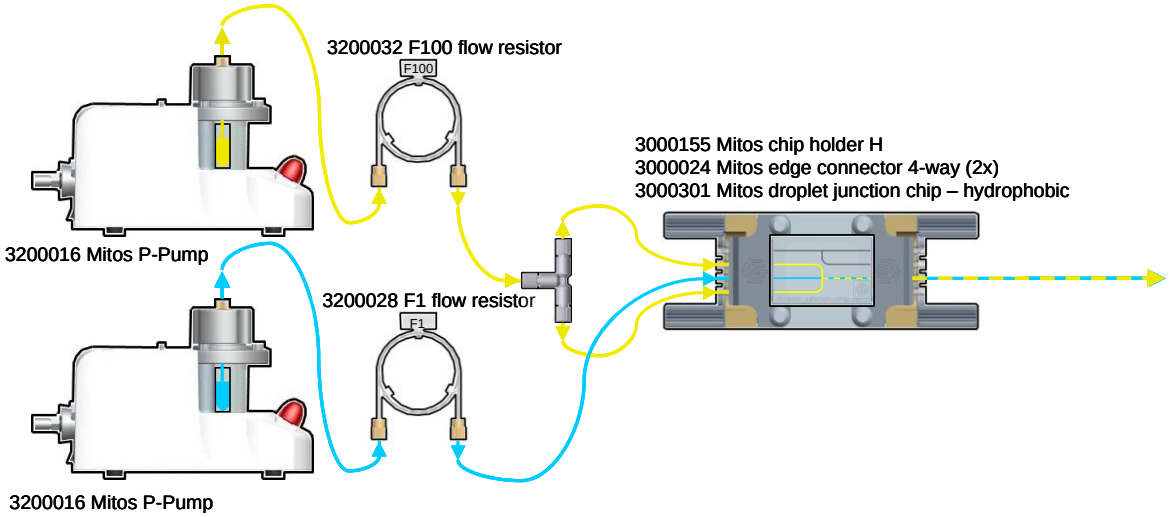
About Monodisperse Droplet Formation

The formation of droplets of oil-in-water or water-in-oil has a range of uses in science and industry. Monodispersity, or size consistency, is the key to making droplet microfluidics a powerful tool for conducting accurate and repeatable experiments.

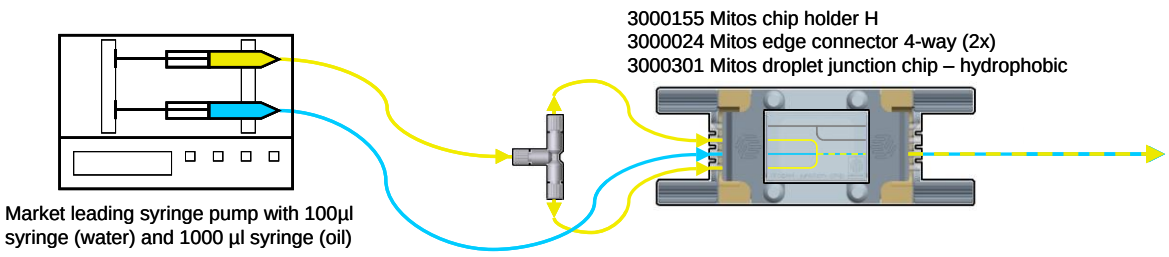
Droplet Application Example	Requirement for Monodispersity
Emulsion production in food or cosmetics	Consistent texture and performance of sample
Droplets as mini chemical reactors	Known chemical make-up of droplets to achieve a reaction
Drug delivery	Controlled dispersion of active ingredients
Performing biochemical assays or screens	Ability to keep conditions inside droplet constant and measure the effect of a single parameter

Monodispersity Test Set-up

To enable a comparison to be made between the Mitos P-Pump pressure pump technology and syringe pump technology, droplets were generated using each pump type and the droplet size distribution measured. A high speed video was captured to provide a data sample and processed using image analysis software. The droplet liquid was water with 10% v/v blue dye and the carrier liquid was mineral oil with 1% v/v Span 80 (Span 80 is a surfactant used to increase droplet stability).



Experimental set-up for monodispersity test of droplets generated by the Mitos P-Pump



Experimental set-up for monodispersity test of droplets generated by the syringe pump

P-Pump Results

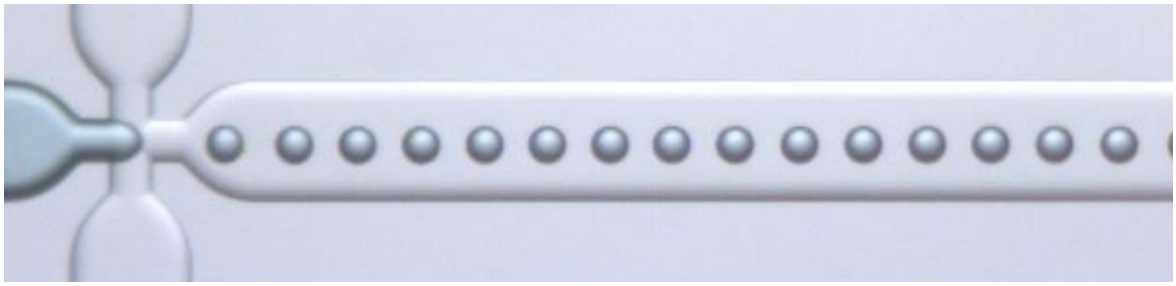
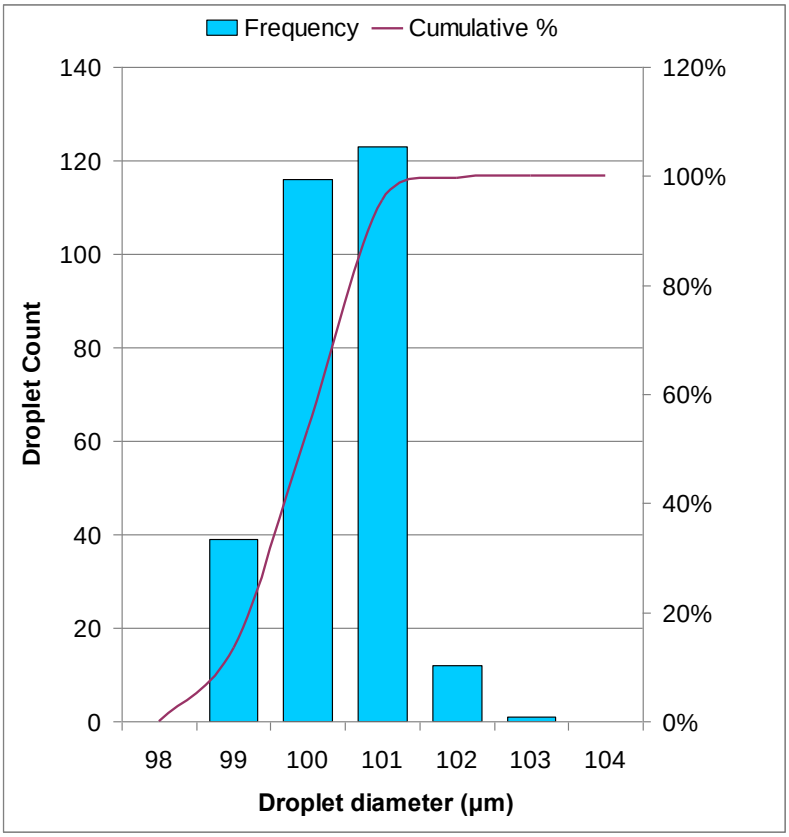


Image of water-in-oil droplets formed with the Mitos P-Pump and Mitos Droplet Junction Chip - Hydrophobic



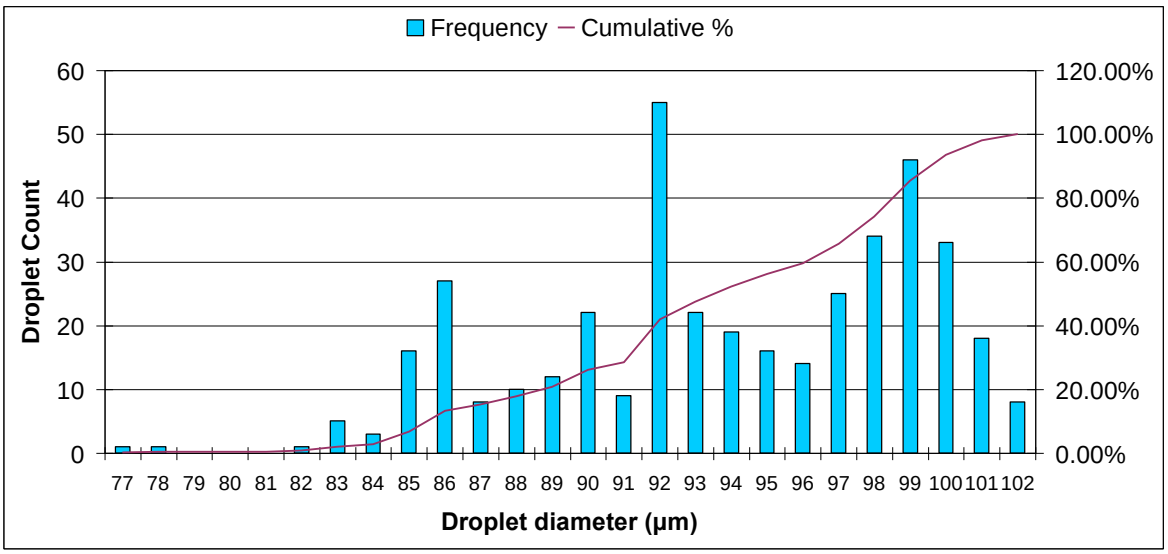
Histogram of water droplet size distribution with water flow rate of 1 µl/min and oil flow rate of 8.4 µl/min. Sample data obtained with Mitos P-Pump and Mitos Droplet Junction Chip – Hydrophobic and processed using image analysis software

Measure of Distribution	Value
Mean Droplet Diameter	99.7 µm
Standard Deviation	0.6 µm
Minimum Droplet Diameter	98.5 µm
Maximum Droplet Diameter	102.2 µm
Coefficient of Variation	0.6 %

Table showing variation in droplet size – Mitos P-Pump

Syringe Pump Results

Image of water-in-oil droplets formed with a market leading syringe pump and Mitos Droplet Junction Chip - Hydrophobic



Histogram of water droplet size distribution with water flow rate of 1 µl/min and oil flow rate of 10 µl/min. Sample data obtained with market leading syringe pump and Mitos Droplet Junction Chip – Hydrophobic and processed using image analysis software

Measure of Distribution	Value
Mean Droplet Diameter	93.4 µm
Standard Deviation	5.1 µm
Minimum Droplet Diameter	76.8 µm
Maximum Droplet Diameter	101.2 µm
Coefficient of Variation	5.5 %

Table showing variation in droplet size – market leading syringe pump

Conclusions

For generating highly monodispersed droplets, the Mitos P-Pump presents a better solution than a market leading syringe pump. In this test, the Mitos P-Pump provides a coefficient of variation in the droplet diameter of 0.6% compared with 5.5% for the syringe pump. This illustrates that there is clear difference in flow smoothness with these two pump technologies. The precise pressure-driven pumping mechanism of the Mitos P-Pump delivers liquid with a smooth and even flow, whereas even the best motor drives and mechanics of a syringe pump have slight nonlinearities, which cause unwanted pulsation. As a result, the Mitos P-Pump technology offers optimum flow smoothness for microfluidic applications.

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