# Droplet-based millifluidics repurposed for plant protein assembly

A regular dietary supply of plant proteins is widely recommended. However, their use as an ingredient is limited by the fact that they have an inherently low water solubility and a heavily aggregated fraction. To better understand and control this aggregation, we developed a medium-throughput screening tool working by droplet-based millifluidics.

## ▸ RESULTS

The experimental setup consists of an assembly of cheap and commercial off-the-shelf tubing and connecting (Fig. 1A) that can serve to map the phase diagram of single proteins or protein mixtures. This device (Fig. 1B), once coupled to an image data acquisition system, can serve to:

- generate a homogeneous proteins/buffer and/or proteins/biopolymers mixture in a flash (~s),
- vary the composition of the mixtures simply by adjusting the flowrates,
- determine droplet turbidity by greyscale analysis,
- control process temperature within a 4°C–40°C range.

The fitness-for-purpose of the device (mixing efficiency, turbidity calibration against greyscale level) was first gauged using colloidal dispersions of titanium dioxide (TiO2) then validated by establishing a known phase diagram of a binary mixture of biopolymers, i.e. β-lactoglobulin–acacia gum. The device was then mobilized to probe a rapeseed napin–pectin assembly.

Using millifluidics made it possible to use ten times less material and run experiments five times faster than with a conventional-scale tubing-system approach, while at the same time being less expensive than microfluidics and requiring less expertise to deploy.

## ▸ FUTURE OUTLOOK

Potential further developments push in a number of directions—we are exploring synergies between plant proteins, animal proteins and other biopolymers to increase protein solubility and to generate smart new assemblies like microgels and capsules.


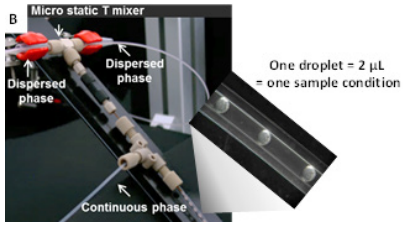


*Figure A. Set of tubing, syringes and connecting used for millifluidics device design. ©Chloe Amine*
*Figure B. Set-up able to mix two solutions and generate droplets in a co-flow configuration. Each droplet represents a condition and can be assimilated to a reactor.*


## Participants

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## Read more

*Millifluidique à gouttes : un outil pour le criblage des interactions entre biopolymères*

(2017) Thèse de doctorat, Unité BIA, Amine C

*Droplets-based millifluidic for the rapid determination of biopolymers phase diagram*

(2017) Food Hydrocolloids

Amine C, Boire A, Davy J, Marquis M, Renard D

*Droplet-based millifluidics tool for screening biopolymer–biopolymer interactions.*


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