Production of droplets using capillary instead of a microfluidic device

Problematic: How to generate droplets with microfluidic technology without reproducing all the steps for the conception of a microfluidic device?

We describe in details what digital microfluidic is in another elveflow application note (Getting started with digital microfluidics). It is possible to make droplets with commercial tools, especially chromatography tools. Here we focus on how to do it. One can easily make drops using a cross or a T junction (Fig.1).

These tools are respectively the equivalents of flow focusing and cross flowing microfluidic methods. The main difference is the needed setup time. The main drawback is the manufacturing dependence. It means that you cannot choose precisely your channels’ dimensions. You have to choose between sizes, which are put forward (from 25 µm to 1 mm).

There is a main setup protocol. This protocol describes how to make fluid-fluid dispersion with:

A- Flow focusing method
B- Cross flowing method

The general protocol is the same; you bring two phases in a junction. One phase will be the continuous phase and the other one the dispersed phase (droplets) (Fig.2).
There are some details however, which differentiate the two methods.

A- Flow focusing with a cross junction (Fig.3)

1. The main channel is the channel where the droplets will flow
2. It is very important to connect the continuous phase **perpendicularly to the main channel**
3. The dispersed phase has to be connected to the channel in the **continuity of the main channel**
4. Control droplets’ sizes with input pressure driven flow

![Fig.3: Schema of droplets formation at a cross junction (flow focusing)](https://www.elveflow.com)

B- Cross flowing method (Fig.4)

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![Fig.4: Schema of droplets’ formation at a T junction (cross flowing)](https://www.elveflow.com)
In definitive, by connecting submillimeter tubes to submillimeter T and Cross junctions it is possible to generate droplets as in microfluidics. It is an easy way to manage the production of droplets. There is no simple alternative to the co-flowing method. But the two main methods used in microfluidics are easily done with chromatography tools. As describe in another elveflow application note (Getting started with digital microfluidics), droplets’ sizes are pre-determined by the characteristic dimensions of the tubes and junctions. There are more flexibilities on droplets’ size with flow focusing method (cross junction). Refer to [1,2] where the control of sizes is well described.

References:


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Tools on:

http://www.vici.com/cfit/hp_tees.php
http://www.vici.com/cfit/360um_pk.php
http://www.idex-hs.com/default.aspx - Adapters, High-Pressure Multi-Port & Adapters, Low-Pressure Multi-Port