iGEM TU/e 2014
Biomedical Engineering

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Protocol Microfluidics Device Testing

This is a device testing protocol for the production of droplets in a microfluidic device. This method was developed by trial and error.

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1 Preparation

- Cut off approximately 15 cm of tubing (1.02 mm diameter) and a double amount of 3 cm (1.42 mm diameter) of tubing (Figure 1, left) for each of the syringes
- Mount the 1,42 mm tubing on one side on a 90 degree hard tube bender (Figure 1, middle) and the other side on the thinner tubing of 1.02 mm in diameter.
- Mount the ending of the thinner tubing that is still free on a Luer stub (Figure 1, right) using a piece of thicker tubing (1.42 mm diameter) as in the step before.
- Attach needles to 1 mL Scientific Glass Engineering syringes and fill one syringe with 1 mL oil phase and another syringe with 1 ml continuous phase.

Figure 1. From left to right: tubing, 90 degree bended hard tubes, Luer stubs.

2 Set-up

The high speed camera:

- Mount the Phantom V9 high speed camera on the Leica microscope.
- Connect the high speed camera to the computer and start the program for the camera.
- Connect the tubing to the microfluidics device by pressing the bended hard tube into the inlets. NOTE: Do not press too hard to prevent crack in the PDMS which may cause leakage.
- Connect the outlet tubing the microfluidics device. Make sure the end of the outlet tubing is being emptied in an Eppendorf cup. Hold the cup in place with a little piece of tape.
- Put the microfluidics device underneath the microscope under the smallest magnification.
- Adjust the exposure time in the high speed camera program until an image appears. Play with the light until you are satisfied with the image.

Calibrating the system:

- Start the Harvard syringe pump with the syringe filled with continuous phase. Watch the screen until the continuous phase is near the cross junction of the device. Then stop the pump.
- Start the pump containing the oil phase. Watch the screen until the oil phase is near the cross junction of the device. Now stop the pump.
- Set the pumping speed ratio of continuous:oil phase until there is a formation of 15 micron droplets.
- Let the device run for about 2 minutes until there is stable droplet formation.
- Stop the pumps and replace the Eppendorf cup with a new one.

Testing the device (polyacrylamide):

- Start the pumps again.
- Let the set-up run until you get approximately 50 µl of solution in the Eppendorf cup. (**NOTE: this depends on your pumping speed).**
- When finished, stop the pumps. Change the continuous phase (and oil phase if necessary).
- Calibrate the system again and repeat the steps of *testing the device* for the new sample.

Testing the device (cell encapsulation):

- Start the pumps again.
- Let the set-up run until the droplet chamber is full with stable droplets.
- Stop the pumps.
- Cauterize the inlet and outlet tubing to prevent the oil and continuous inside the device from getting out and droplets to flow out of the chamber.
- Take the device and put the droplet chamber underneath a fluorescent microscope.