

A COMSOL Model of Droplet Formation at a Flow Focusing Device

Presenter:

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PAPER INTRODUCTION

Title: A COMSOL Model of Droplet Formation at a Flow Focusing Device

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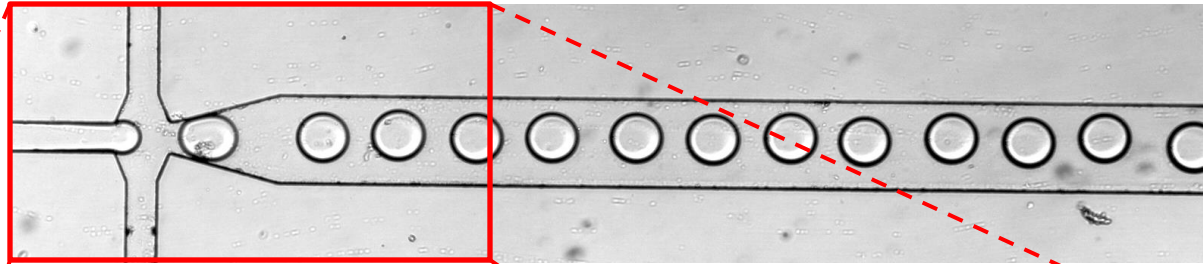
Software used: COMSOL Multiphysics 4.3a[®]

OUTLOOK

Aims:

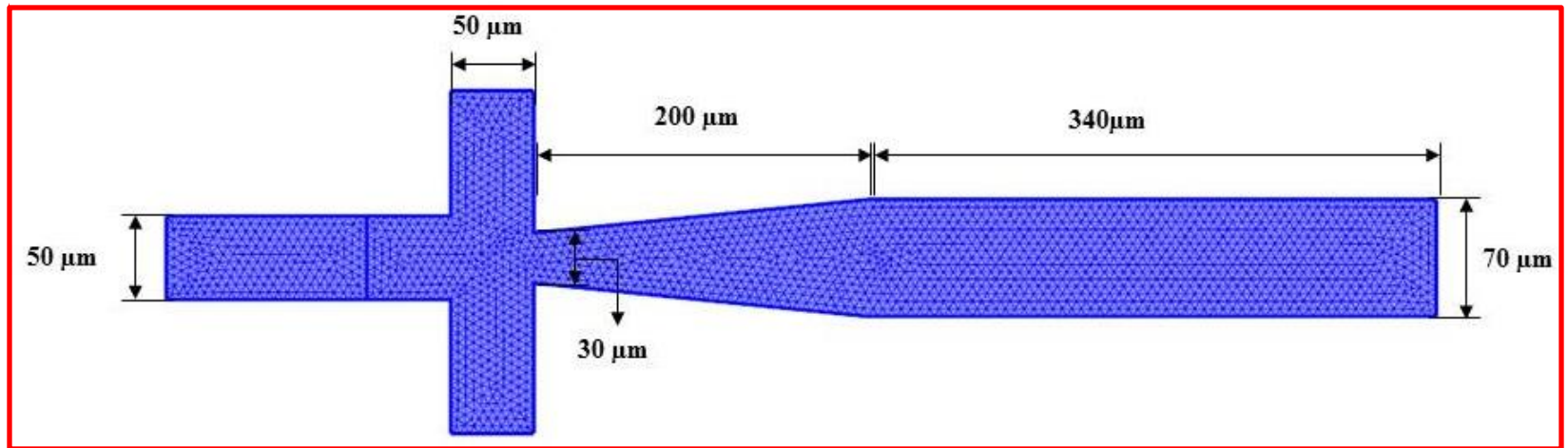
- Simulation of a particular flow-focusing droplet generator
- Investigation on the effect of input velocities ratio on droplet size in a microfluidic device
- Verification of the obtained results

GEOMETRY & DESCRIPTIONS



FC-40 Oil

Water



COMSOL CONSIDERATIONS

Geometry: Two-dimensional Domain

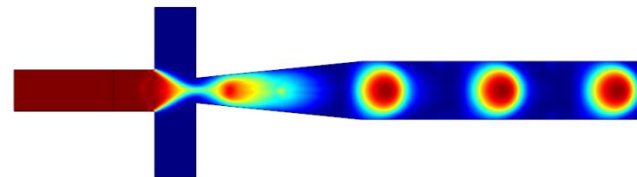
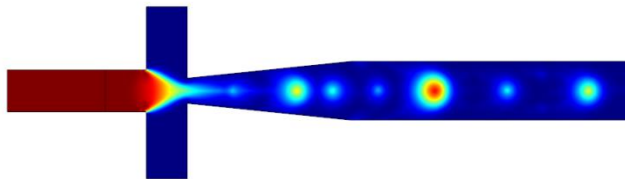
Module: Microfluidics

Library: Droplet_Breakup

Physics: Laminar two-phase flow, Level set

Study: Time Dependent (0,0.0005,0.01 S)

Materials: FC-40 oil defined manually, Water from Materials Library



INITIAL DATA SETS

Channels walls: Wetted walls



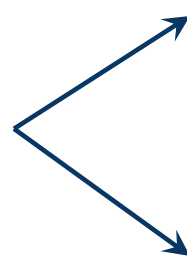
Contact angle ?

Extensive literature review
& Various iterations



Contact angle = 0.349 radian

**Two sets of
simulations**

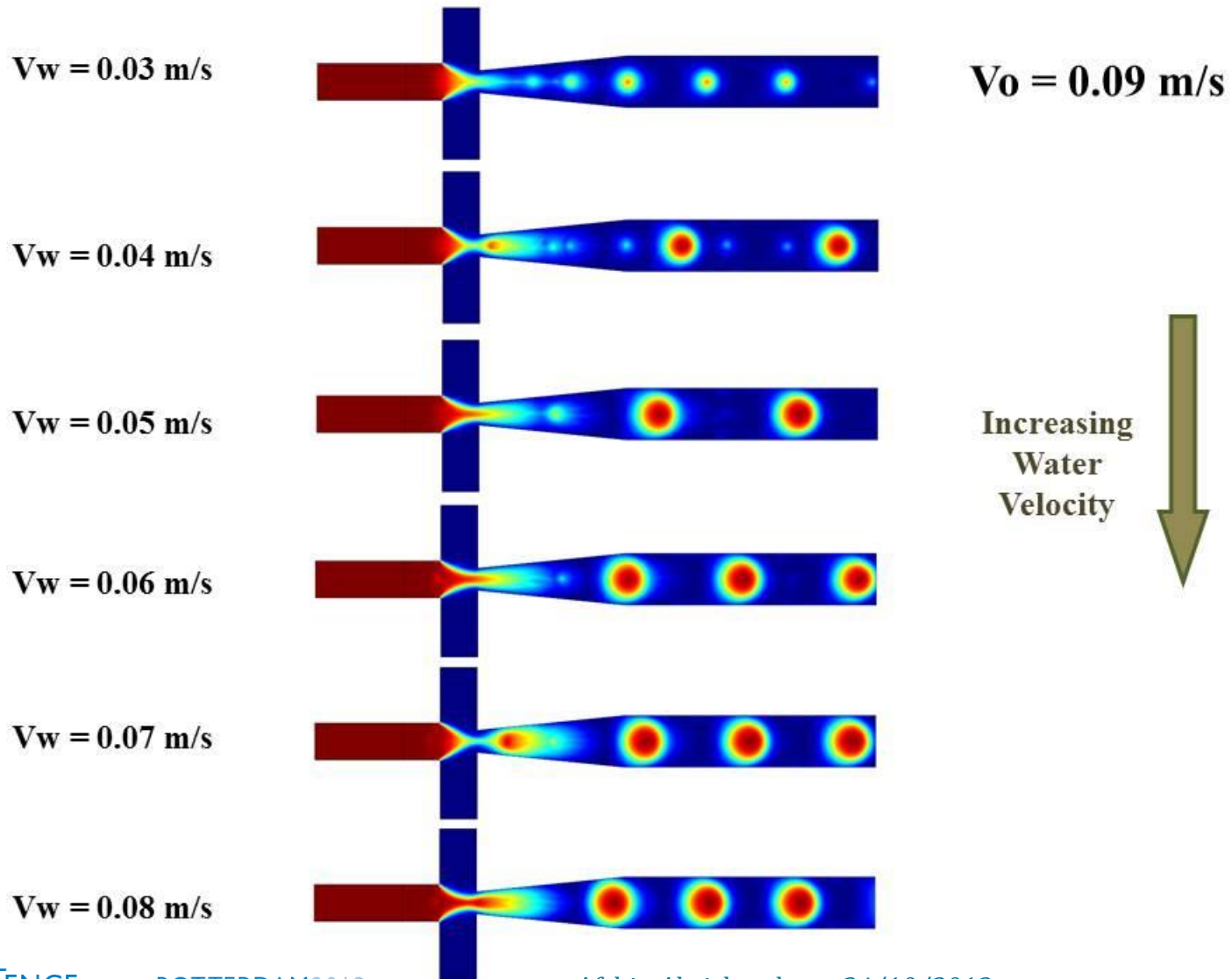


Constant input velocity for FC-40 oil
($V_O = 0.09$ m/s , $0.03 < V_W < 0.08$
m/s)

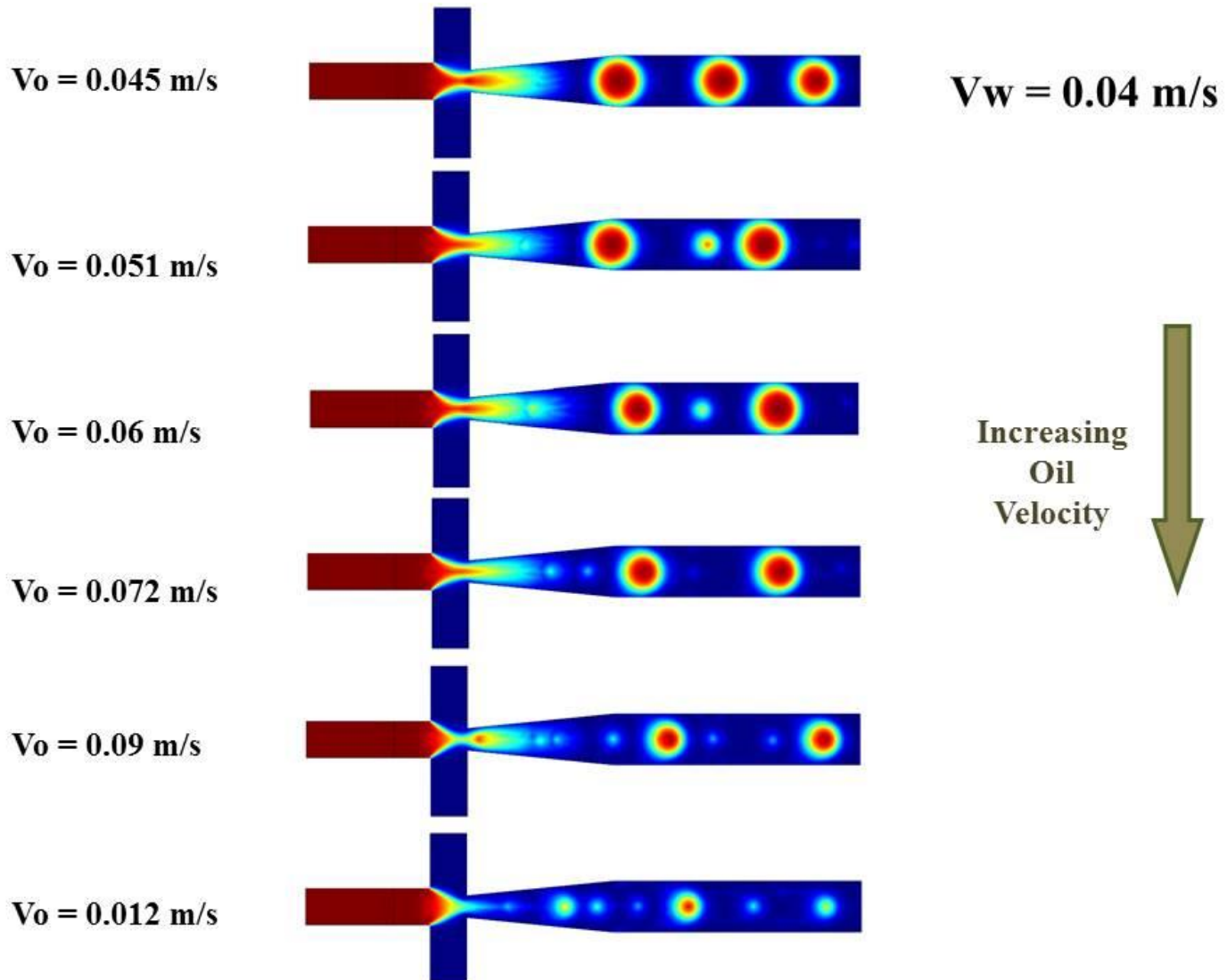
Constant input velocity for water
($V_W = 0.04$ m/s , $0.0449 < V_O < 0.12$ m/s)

- Same V_O to V_W ratio applies for both sets of parameters.
- Only limited numbers of ratio result in droplet formation!

FIRST SET OF SIMULATIONS (Constant Oil velocity)



SECOND SET OF SIMULATIONS (Constant Water velocity)

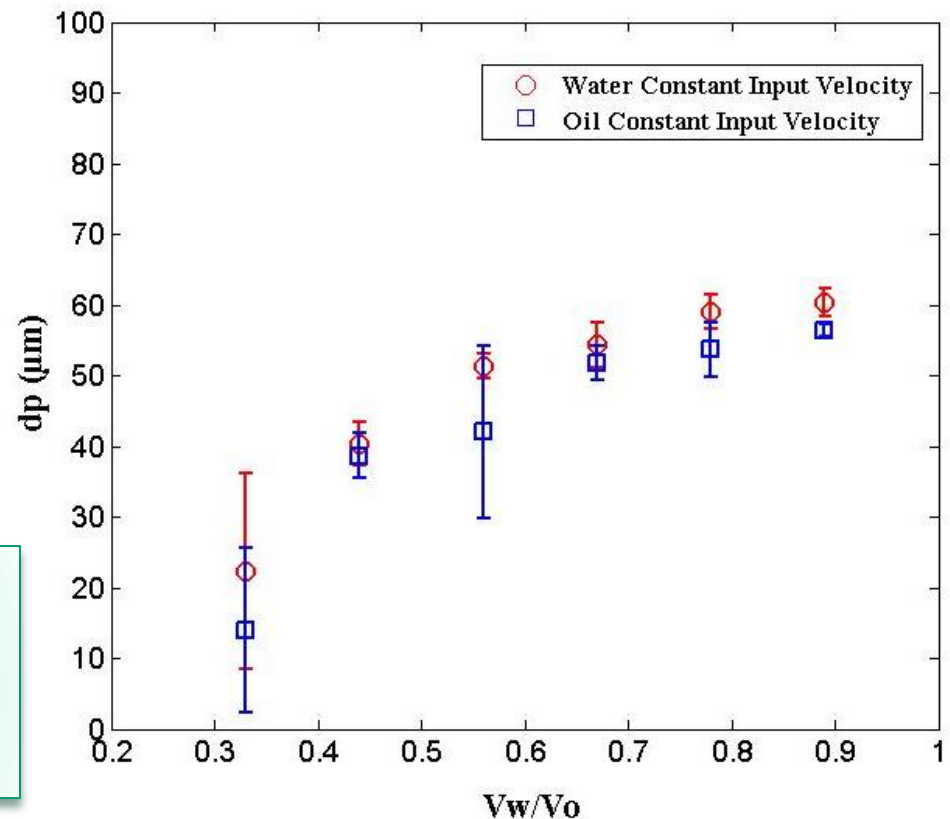


RESULTS AND DISCUSSION

- 3-4 measurements for each simulation
- Plotting mean droplet size with respect to velocity ratio



Velocity ratio of the two phases directly determine the size of the droplets!



FURTHER WORKS

- More numbers of measurements
- Wider ranger of velocity ratio
- Verification of the obtained results by the experimental data
- Investigation of polydispersity of droplets
- Study on the effect of varying the device geometry





Thanks for your kind attention
&
nice patience!

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QUESTIONS?

