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Highly viscous fluids in pressure actuated flow focusing devices

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Résumé / Abstract
Microfluidic flow focusing devices (mFFD) are currently used to produce microdroplets and emulsions. Recently, it has been demonstrated that they are well adapted to the encapsulation of biologic objects like proteins and cells. Liquids used for encapsulation are most of the time dilute polymeric solutions with relatively low viscosity. However, investigations have started to assess the possibility of encapsulation with more concentrated solutions, like semi-dilute solutions of alginates. In this work, we analyze the behavior of highly viscous alginate solutions in pressure actuated FFDs. Experiments have been performed using alginate solutions with a viscosity up to 2600 times that of water. In parallel, an analytical model of the flow in the different branches of the FFD has been derived that explains the limits of the droplet regime. This model can be used to produce scaling rules for FFDs, facilitating the dimensioning of FFDs according to the desired size of the capsules. Finally, an example of encapsulation of Jurkat cells in a high viscosity Keltone alginate capsule is given.

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