Chair: Physics of Fluids group

Spontaneous bursting of multicomponent polymeric droplets

Description

A multicomponent droplet containing a highly volatile liquid when deposited onto a bath of another liquid may spontaneously burst into numerous smaller droplets (as shown in Fig. 1a). This occurs primarily due to the difference in surface tension between the drop and the bath created via the selective evaporation of the more-volatile component, resulting in the generation of Marangoni flows. For a Newtonian liquid, this results in the formation of numerous secondary droplets from the initial primary droplet. On the other hand, it is known that even minute concentrations of polymers in aqueous solutions can hinder droplet formation by creating 'beads-on-a-string' structures (seen in Fig. 1b) – a direct consequence of the presence of viscoelasticity in the polymer solutions. In this work, we will experimentally investigate whether viscoelasticity can also suppress the formation of the secondary droplets in a Marangoni bursting scenario. The work is part of an academic-industrial collaboration, and provides the opportunity to study interesting, complex physics that can be directly applied to solve real-world problems.

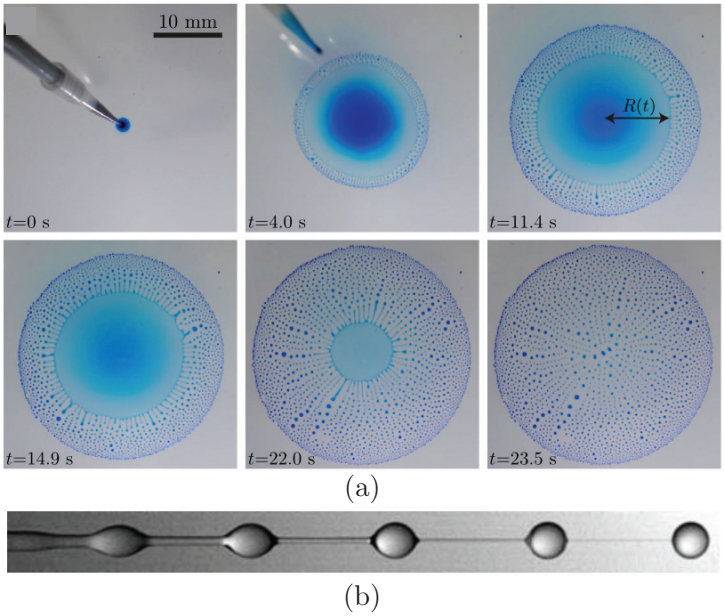

Figure 1: (a) Marangoni bursting observed for Newtonian liquids (adapted from [1]); (b) beads-on-a-string observed for viscoelastic liquids (adapted from [2]).

What you will do and what you will learn?

In the Physics of Fluids group, we are looking for enthusiastic students to join our newly established project on Marangoni bursting of viscoelastic droplets.

1. You will learn about selective evaporation, Marangoni flows, and viscoelasticity.
2. You will work with experimentalists and our industrial collaborators at Canon Production Printing.
3. You will get hands-on experience on experiments involving state-of-the-art high-speed imaging.
4. You will learn how to do basic and advanced scientific data analysis.

For any questions, please feel free to contact Udo, details below:

Supervision	E-mail	Tel.	Office
Dr. Uddalok (Udo) Sen	u.sen@utwente.nl	053 489 9064	Meander 214B
Prof. Dr. Detlef Lohse	d.lohse@utwente.nl	053 489 8076	Meander 261

References

[1] L. Keiser, H. Bense, P. Colinet, J. Bico, and E. Reyssat. Marangoni bursting: evaporation-induced emulsification of binary mixtures on a liquid layer. *Phys. Rev. Lett.*, 118:074504, 2017.

[2] C. Clasen, J. Eggers, M. A. Fontelos, J. Li, and G. H. McKinley. The beads-on-string structure of viscoelastic threads. *J. Fluid Mech.*, 556:283–308, 2006.