Drainage of suspension: from rice sticking to capillary trapping

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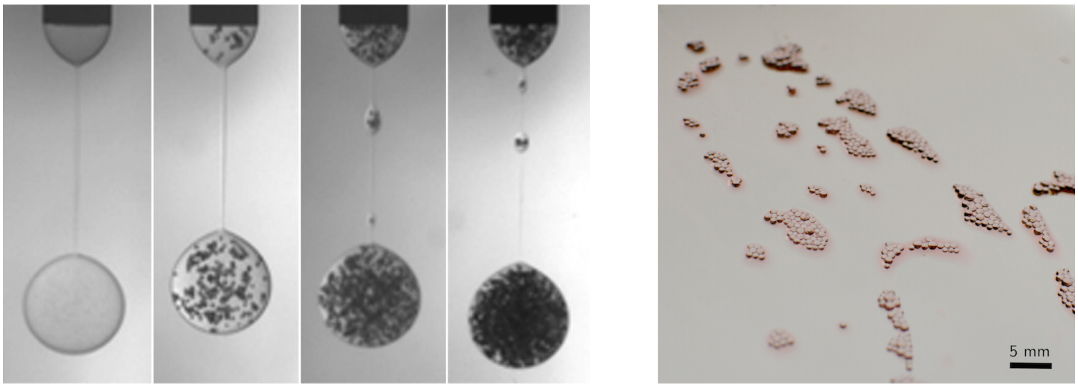
When rice or pasta are cooked in a large amount of water, that is later drained from a pan, rice grains or pasta often remain trapped on the side of the pot. The same situation arises when pouring any suspension from one container to another. The classical model based on the dynamics of particles in bulk flows, cannot explain such trapping of particles on the surface. Indeed, the present situation involves thin liquid films, whose thickness becomes comparable to the particle size. In this flow configuration, the particles deform the liquid film, which modifies the transport of the particles and stability of the film as illustrated in Fig. 1(a) (Furbank & Morris, 2004). Indeed, when a particle is confined in a liquid layer flowing on a solid substrate, its displacement is controlled by the competition between capillary, drag and friction forces. The deposition of particles on the solid substrate, as shown in Fig. 1(b), remains to be understood as it leads to the contamination of the surface and the loss of transported material (Colosqui *et al.*, 2013).



(a) (b)

Figure 1: (a) Pinch-off structures for a pendant drop formation of suspensions for increasing concentration (Furbank & Morris, 2006). (b) Glass particles deposited on a glass substrate by the release of a thin water film of finite volume.

In this project we propose to investigate the situation in which capillary effects contribute to the particle and film dynamics. The drainage by gravity of a particle-laden liquid film flowing down an incline has a thickness that is comparable to diameter of the suspended particles. The density of deposited particles [see Fig. 1(b)] will be characterized as a function of the particle size and relative density, and correlated with the local liquid thickness. The experimental results will be rationalized by taking into account the influence of the liquid, the capillary forces exerted on the particles by the liquid film and the drag force.

The ideal candidate will have a background in physics and fluid dynamics as well as a taste for experimental works and data analysis. This internship, funded by an ANR project, will take place in the joint at FAST Laboraroty in Orsay and/or in the CNRS/Saint-Gobain Research joint laboratory (SVI) at Aubervilliers.