Master 2 internship

Depollution of water by extraction of synthetic microfibers

When washing laundry, fibers are inevitably torn from the washed fabrics and end up in the wastewater. These fibers (diameter 10 µm) can have different compositions (mainly polyester and cotton), and **recovering and separating them remains a major challenge, mainly for recycling synthetic fibers.** Simply **extracting** them **is also a crucial challenge for water decontamination,** as they for instance represent 60% of the microplastics found at the surface of Lake Geneva.

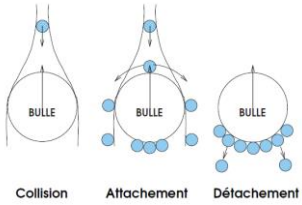

Figure 1 *Three steps of particle capture by a bubble [Ralston et al. Int. J. Miner. Process. 1999]*

Conventional membrane filtration processes are unspecific and expensive (clogging of the membranes, high pressure required to filter the water). Processes based on water evaporation are also not sustainable energetically. **We consider here the flotation process, which consists of creating gas bubbles within the liquid to which the fibers will attach and thus be captured.** Flotation is a common process in industry. However, little is known on how it is affected by the geometry of fibers. Besides, in wastewater, surfactants (laundry detergents) can be present, which may affect the wetting properties of the fibers and their ability to attach to bubbles.

The objective of the internship is thus to **develop a model experiment to study the flotation of polymer fibers in surfactant solutions**. We aim at optimizing the flotation process to develop new applications for **wastewater depollution and plastic recycling**.

The capture process is three-step (fig.1): collision, attachment and possibly detachment. We will focus here on attachment. **We will use videomicroscopy to quantify the probability of adsorption on a single bubble placed in a fiber suspension flow** (fig. 2). These measurements will be coupled with **characterizations of the physicochemical properties of the solution-fiber couples** (surface tension and contact angle), for different types and concentrations of surfactants that are present in laundry formulations.

Figure 2 *Image sequence of a preliminary experiment performed at ILM. We observe the adsorption of a single polymer fibre (time lapse 0.4 s, scale bar 1 mm).*

Key words: bubbles, wetting, microfluidics, surfactants. The internship will be based in Institut Lumière Matière in the Liquids and interfaces team, in close collaboration with IFPEN Solaize. Continuation towards a PhD is possible (funding request currently under evaluation).

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