Surfactant-driven water-oil droplets in Microfluidics for Water Purification

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Access to clean drinking water is a necessity for every individual. Therefore, it demands a water treatment process to alleviate contaminants in natural water sources globally. For this, understanding the behavior of water droplets on solid surfaces is essential. These droplets exhibit varying shapes due to surface tension, contact angle, and external forces. The collective influence of surface wetting properties is combinedly termed as 'wettability', a key factor in adjusting droplet shape or its behavior over the solid surface. The wettability can be studied at micron-scale using imaging and analysis of water droplets on solid surfaces.

To manipulate the behavior of water droplets on solid surfaces, various surfactants could be useful. Surfactants have a hydrophilic head attracted to water and a hydrophobic tail that repels water. This difference in behavior of the head and tail can enable the removal of impurities from liquid solutions to perform water treatment. While significant literatures is documenting the impact of surfactants on surface wettability, a comprehensive understanding of their influence on different liquid droplets remains yet to be studied. This can be studied by measuring the contact angle and interfacial tension values of the liquid droplets through image analysis by a combination of Axisymmetric drop shape analysis (ADSA) and ImageJ software.

This work proposes to study the solution of PFAS (per- and poly-fluoroalkyl substances) surfactants added to water and study the behavior of oil droplets in the solution. This will enable an understanding of the behavior of oil droplets under the influence of PFAS surfactants. The obtained information would then be used to test liquid droplet behavior inside a microfluidic channel. The manipulation or control of liquid droplets inside a microfluidic channel can help us collect contaminants in the water, which can then be filtered out in further stages. The setup will pave the way for micro-level water treatment experiments, contributing to the development of an efficient and cost-effective water treatment process.

Keywords: Water treatment, surfactants, Axisymmetric drop shape analysis, PFAS, microfluidic.

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[1] Mark L. Brusseau, Sarah Van Glubt, “The influence of surfactant and solution composition on PFAS adsorption at fluid-fluid interfaces.” *Water Research*, Vol. 161, pp. 17-26, 2019.

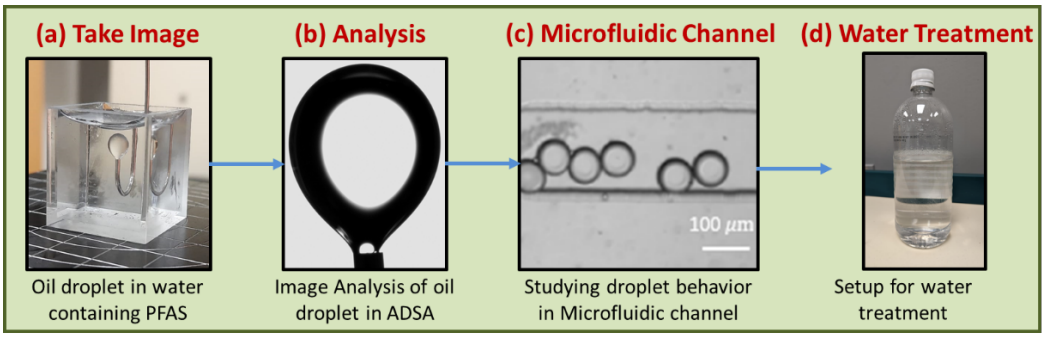

Figure 1: Showing flowchart of research proposed in the abstract with steps as follows: (a) Image is taken for an oil droplet Inside a cuvette filled with water added with PFAS; (b) Image Analysis Implemented on the droplet using ADSA and ImageJ; (c) Studied behavior is used in a microfluidic channel for further analysis; (d) Water treatment process is developed to get clean water.