UK Fluids Network Short Research Visit

Oblique impingement of liquid jets on vertical and inclined walls

Researcher: Melissa Chee (Department of Chemical Engineering and Biotechnology, University of Cambridge)

Host: Dr Julien Landel (School of Mathematics, University of Manchester)

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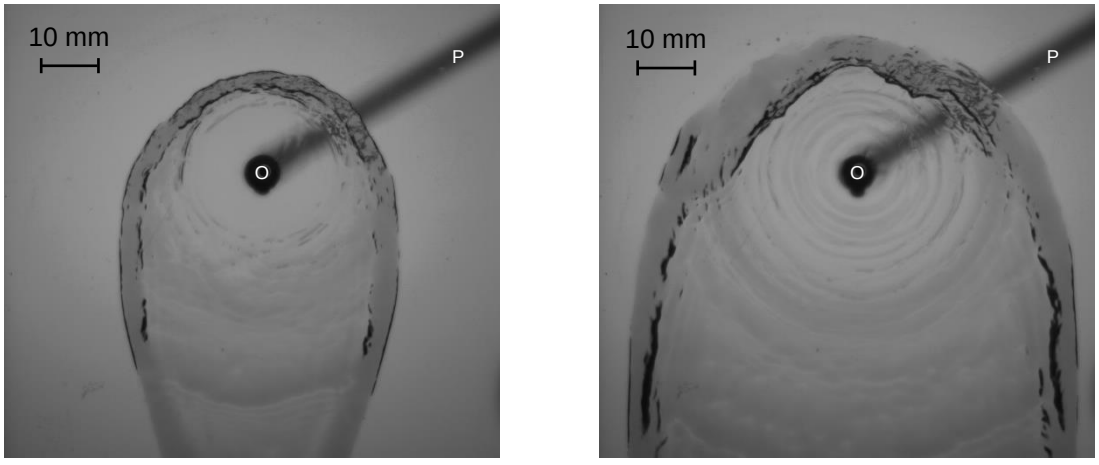
The purpose of the research visit was to carry out an experimental investigation of the hydrodynamics of liquid jet impingement under industrially relevant conditions. Impinging liquid jets generated by rotating spray arms or spray balls are widely used in cleaning-in-place systems to remove soil layers from the internal surfaces of process equipment. The jets generated by the rotating spray arms or spray balls often impinge obliquely on the target surface.

Quantitative models of the hydrodynamics of liquid jet impingement have been developed in the last decade and combined with cleaning models to predict the removal of soil layers. The effect of oblique liquid jets impinging on flat vertical walls was studied and modelled by Bhagat and Wilson (2016)*. The focus of the current work is to refine the model as this would enable the performance of industrial jet cleaning systems to be predicted more accurately.

The experimental set-up at the University of Manchester allowed the jet and wall angles to be manipulated independently, generalising the cases of normal jet impingement studied in earlier experiments at Cambridge. The experimental data collected will be used in verifying refinements to the model. The research visit also included training on the use of dye attenuation to measure film thicknesses of draining flows, as this has not been measured accurately in our experiments at Cambridge to date.



Images from the dye attenuation experiments at two different jet flow rates. The film thickness corresponds to the shade of grey, where a darker grey indicates a thicker film. The edges of the rope appear black due to high curvature. O is the point of jet impingement and P is the pipe supplying the nozzle which is out of focus.

* Bhagat, R.K. and Wilson, D.I. (2016) Flow in the thin film created by a coherent turbulent water jet impinging on a vertical wall, *Chem. Eng. Sci.*, 152, 606-623.