Dynamics of multi-particle systems falling gravitationally in a viscous fluid

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We analyzed experimentally and numerically the influence of a vertical hard wall on the dynamics of groups of particles settling under gravity in a viscous fluid at low Reynolds number. The evolution of initially spherical groups of randomly distributed, non-touching particles (suspension drops) and their destabilization rate were investigated. Motion of the particles was analyzed experimentally and using the point-particle model close to a vertical wall [1].

We found that evolution of suspension drops is similar with and without walls. The initially spherical drop occasionally loses individual particles, which are left behind, and it slowly flattens while settling. A torus is formed, which suddenly breaks into two (or sometimes more) smaller droplets. The main conclusion of this paper, both from experiment and the point-particle model, is that the average destabilization time T and distance L traveled by the drop until break-up are smaller if the drop is closer to the wall. The average destabilization length L scales linearly with the inverse distance h between the drop center and the wall, both in experiments (see Fig.1) and for the point-particle model.

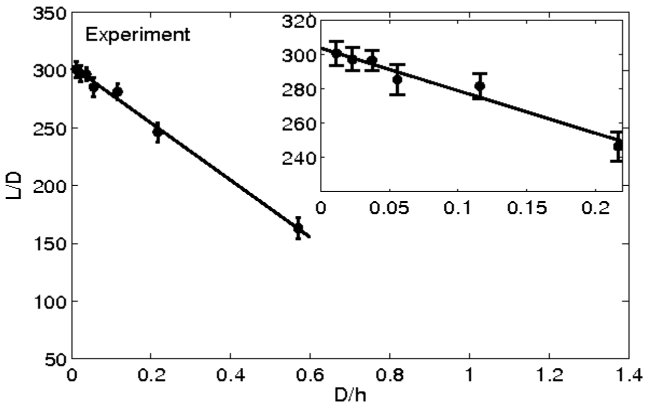

Fig1. The average destabilization length L/D of the suspension drop vs. its inverse distance D/h from the wall. D is the initial diameter of the drop and for each value of h, the average is taken over 21-36 drops..

Destabilization times T and lengths L of individual drops with different random configurations of the particles differ significantly from each other, owing to the chaotic nature of the particle dynamics.

[1] Myłyk A., Meile W., Brenn G. and Ekiel-Jeżewska M. L., "Break-up of suspension drops sedimenting in a viscous fluid close to a wall", *Phys. Fluids (2011),* **23**, 063302

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