Retraction of viscoplastic drops

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In this study, we have numerically investigated the retraction dynamics of viscoplastic drops. The numerical simulations have been performed using the open source solver *Basilisk*. Particular attention is paid to the evolution of the tip velocity and the shape of the drops during their retraction. The problem is primarily governed by two dimensionless parameters: i) the Ohnesorge number, Oh, which is the ratio between viscous and inertia-capillary forces and ii) the plastic number, Pl, which represents the plastic nature of the fluid (related to the yield stress). Furthermore, the initial aspect ratio (ratio of the axial and radial axis length) of the elongated drop in another important parameter which is kept fixed in this study. We perform the simulations for a wide range of Oh (0.01-10), starting from a low Oh where the inertia-capillary force is dominant to a high Oh where the viscous effect is dominant. The effect of plasticity on the retraction dynamics is investigated for every regime. It has been observed that the effect of plasticity is less prominent at lower Oh and the flow is governed by the balance of inertia and capillary forces. However, the yield stress effect is very significant at higher Oh. It has been observed that the retraction dynamics depend on the strain rate distribution within the drop. Furthermore, the retraction occurs when the stress induced by capillary force overcomes the yield stress of viscoplastic fluid. A criterion is derived to separate the retracting and non-retracting regimes as function of Ohnesorge and Plastic numbers.

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