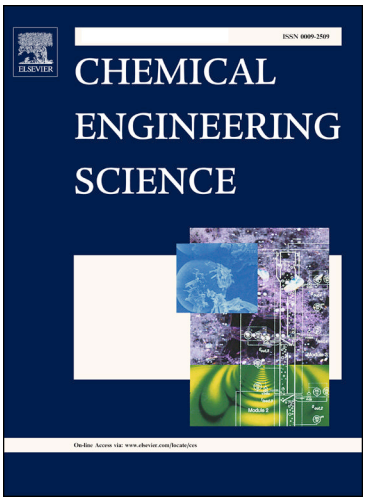

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Sumit Tripathi, Amitabh Bhattacharya, Ramesh Singh, Rico F. Tabor

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Rheological behavior of high internal phase water-in-oil emulsions: Effects of droplet size, phase mass fractions, salt concentration and aging

Sumit Tripathi[a], Amitabh Bhattacharya[b], Ramesh Singh[b], Rico F. Tabor[c,*]

[a] *IITB-Monash Research Academy, Mumbai-400076, India*
[b] *Mechanical Engineering Department, IIT Bombay, Mumbai-400076, India*
[c] *School of Chemistry, Monash University, Clayton 3800, Australia*

Abstract

The rheological properties of high internal phase emulsions (HIPEs), comprising polydisperse aqueous droplets in oil, have been characterized as a function of emulsification time, salt concentration, phase mass fractions and aging. The droplet size distribution and structural details of the emulsion samples were obtained using cryogenic-scanning electron microscopy (cryo-SEM) and optical microscopy. For rheological characterisation, amplitude sweep tests performed on HIPE samples with a high mass fraction of dispersed phase (93.5 wt%) show that the strain behavior, especially the yield strain (ε_y) and crossover strain (ε_c), are almost independent of the droplet size and polydispersity. However, emulsions with smaller droplets have higher yield stress (τ_y) and storage moduli (G') values; explanations for these observations, based on the physical properties of the systems are suggested. Furthermore, it is observed that, for constant mass fractions of oil and aqueous phases, the strain behavior is also independent of the salt concentration in the dispersed phase. Our findings indicate that, independently of the salt concentration, the energy requirement for the emulsion to start flowing is greater when smaller droplets are present. Aging studies, performed over a period of 6 months, show no significant change in the

*Corresponding author, T: +61 3 9905 4558
Email addresses: sumit.tripathi@monash.edu (Sumit Tripathi), bhattach@iitb.ac.in (Amitabh Bhattacharya), ramesh@me.iitb.ac.in (Ramesh Singh), rico.tabor@monash.edu (Rico F. Tabor)