On the effects of drop size distribution, dispersed phase volume fraction, and dispersed phase viscosity in emulsion rheology

Koay Ze Nian[1], Claudio Pereira da Fonte[1], Adam J. Kowalski[2] and Thomas L. Rodgers[1]

1 University of Manchester
2 Unilever UK

Contact Email: ze.koay@manchester.ac.uk

Rheological properties of emulsions are of considerable importance across different household products. For example, sensory evaluation of food emulsions such as mayonnaise and ice cream are related to their rheological properties. In this research, the rheological behaviour of oil-in-water (O/W) emulsions is studied over a broad range of drop size distributions, dispersed phase volume fraction and dispersed phase viscosity. High volume fraction emulsions were created using an in-line rotor-stator mixer, and then diluted to lower volume fractions. The drop size distribution of the highly concentrated emulsions does not change when subsequently diluted to the lower concentrations.

The yield stress of different high volume emulsions were measured using steady stress sweep and the viscosity could be modelled using Herschel-Bulkley type equation. The consistency index for different volume fractions was found to be predictable by a Krieger-Dougherty style model. The linear viscoelastic (LVE) range of each emulsion was determined with an amplitude sweep, followed by a frequency sweep and creep test to determine its long term stability and viscoelastic properties. Results showed that the emulsion rheology is strongly dependent on its Sauter mean diameter and dispersed phase volume fraction but not the dispersed phase viscosity.

Back to Programme