AGEING OF SUSPENSIONS – CAN WE BETTER UNDERSTAND THEIR STABILITY AND DESIGN FORMULATIONS WITH IMPROVED STABILITY?

Malcolm Faers
Bayer AG, Formulation Technology, Monheim, Germany.
Contact Email: malcolm.faers@bayer.com

Abstract

Suspension formulations are typically weak gels stabilised against gravitational separation by a mechanically rigid network. For many suspensions, this network is formed from particles with attractive interactions that reversibly aggregate. This reversibility is on one hand useful, since it allows the suspensions to flow when applied, for example as in paints, consumer products and crop protection flowables. However, on the other hand it can be detrimental to stability since it allows the network to age through the rearrangement over time of the particles in the network, and to ultimately fail and collapse under gravity.

To understand the ageing and failure processes, bespoke low invasive vane rheology and tracer particle tracking techniques have been used with model refractive index matched silicone oil emulsions, with attractive interactions to form weak reversible gels that show both the ageing and failure processes.

Low invasive rheology reveals how the network strength changes during the ageing process and unexpectedly reveals that the network strength increases with network age. However, at a particular age, the network strength rapidly decreases and the network and sample collapses. This raises an interesting quandary, since if the network is increasing in strength why does it collapse?

Complimentary particle tracking of tracer particles in ageing gel networks reveals the presence of localised intermittent flows within the sample prior to collapse, and at the point of collapse, chaotic flows that spread throughout the whole sample.

When combined this knowledge gives us a valuable understanding both for what information is required to predict the stability of suspensions, and also how to design formulations with improved stability. An example will be shown where added low density particles in combination with a low yield stress provide a solution to gravitational separation without the cost of high viscosities.

Back to Programme