

Assessment of Emulsion Stability by Means of Analytical Centrifugation

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Abstract

Understanding the shelf life and the stability of emulsion-based products is a central problem in industrial development. Analytical centrifugation coupled to NIR-light detection has been used to follow-up the sedimentation phenomena in both water-in-oil (W/O) and oil-in-water (O/W) emulsions stabilized with either low-molecular weight surfactants or polymeric emulsifiers.

For surfactant-stabilized O/W systems, the creaming velocity is a linear function of the relative centrifugal force. This is used for the extrapolation of the velocity of creaming at high centrifugal accelerations to 1xg, e.g. to estimate the shelf life of these emulsions with respect to creaming. The utility of this approach is in its speed as, contrary to the widely-used long term ageing, the results become available in a couple of days.

The creaming velocity of diluted, surfactant-stabilized O/W samples obeys the scaling law pertinent for slightly flocculating suspensions of hard spheres. A minor increase of the temperature, as well as prolonged storage results in a higher creaming velocity, due to an increase of the extent of flocculation in both cases. For polymer-stabilized emulsions, the dependence of the sedimentation velocity on the volume fraction obeys a different scaling law. Further, multilayers of adsorbed polymers substantially reduce the compressibility of these emulsions, owing to the osmotic effect of the interfacial polymer layers. This effect is believed to have a positive impact on the emulsion stability.