

Influence of the phase behaviour on the properties of ionic nano-emulsions prepared by the Phase Inversion Composition method (PIC)

Isabel Solè^{‡†}, Alicia Maestro[†], Carmen González[†], Conxita Solans[‡]
and José M. Gutiérrez[†]

[†] *Departament d'Enginyeria Química, Universitat de Barcelona.*

[‡] *Departament de Tecnologia de Tensioactius, Instituto de Investigaciones Químicas y Ambientales de Barcelona, CSIC*

Abstract

Nano-emulsions are a type of emulsions with droplets of extremely small diameters, typically in the range 20-500 nm. They are nonequilibrium systems and, consequently, an energy input is required for their formation. The low-energy preparation methods make use of the energy stored in the components of the system to be emulsified. The so called Phase Inversion Composition (PIC) method is a type of low-energy emulsification method in which the spontaneous curvature of the surfactant changes during the emulsification process, at a constant temperature through the change of composition. In this work, the formation of nano-emulsions is studied in an ionic system in which an anionic surfactant, potassium oleate, is formed during the emulsification process by neutralization of oleic acid with an alkaline aqueous solution. This results in a change in the spontaneous curvature of the surfactant, and, as a result, a nano-emulsion is formed. The results obtained, in terms of phase behaviour and nano-emulsion formation, are compared with those obtained in the equivalent cationic system using oleylammonium chloride as ionic surfactant, resulting from the neutralization of oleylamine with HCl aqueous solution. A direct cubic liquid crystalline phase was observed along the different emulsification paths in both systems. The coincidence, within the experimental error, between the radius of the nano-emulsion droplets and the radius of the micelles that form the cubic phase, permit to deduce that nano-emulsions are formed by a dilution process of the cubic phase.