

Surfactant-free Microemulsions in Surface Cleaning

Ann-Christin Seidl¹, Eva Mueller¹, Werner Kunz¹

¹ Institute of Physical and Theoretical Chemistry, University of Regensburg, Germany

Ann-Christin.Seidl@ur.de

Classical microemulsions are transparent, thermodynamically stable liquid systems consisting of two immiscible components stabilized by an amphiphilic substance known as surfactant. Surfactants adsorb at the oil–water interface, reducing the interfacial tension and facilitating the formation of oil-in-water, bicontinuous, or water-in-oil phases [1].

However, nanostructured monophasic solutions can also form in the absence of classical surfactants by using hydrotropes. Unlike surfactants, hydrotropes are smaller molecules with lower amphiphilicity that do not form micelles in aqueous solutions or ordered films at the water-oil interface [2, 3]. In ternary systems, surfactant-free microemulsions (SFMEs) can emerge above the phase boundary within the monophasic region. Depending on the composition, different structural regimes may occur, with oil-in-water-like structures commonly referred to as the pre-Ouzo region [4].

The nanostructuring in SFMEs is characterized by highly dynamic processes and reduced interfacial stabilization. These features result in pronounced mesoscopic fluctuations and increased structural flexibility. This combination of properties makes SFMEs an interesting, eco-friendly alternative for various applications. In particular, in the field of surface cleaning, understanding the role of dynamic structuring is essential to elucidate its potential effects on cleaning performance and mechanisms.

Keywords:

Microemulsion, surfactant-free microemulsion, SFME, nanostructuring, surface cleaning

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