Choosing the Right Method to Measure Accurately the Optimum Formulation in SOW Systems: Comparison and Specific Applications

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Optimum formulation is defined as the physicochemical condition at which a Surfactant/Oil/Water system at equilibrium presents a minimal interfacial tension, and the surfactant has the same affinity for both oil and water. The search for the optimum formulation of SOW systems is critical for diverse industrial applications, ranging from pharmaceuticals to cosmetics to oil recovery. Indeed, knowing this condition allows to formulate stable emulsions by working at a certain distance. The incorporation into products of new, sustainable, and safer surfactants, such as biobased ones, can pose a significant challenge due to their intricate composition and unique properties, and the precise determination of the optimum formulation is essential to characterize them accurately.

We present a systematic approach to determine the optimum formulation of SOW systems using a variety of techniques, including conventional ones such as phase behavior, minimum interfacial tension, emulsion stability, electrical conductivity and viscosity. We also explore innovative techniques such as minimum dilational modulus (OSDIR), nuclear magnetic resonance (NMR), X-ray microcomputed tomography (Micro CT), small-angle X-ray scattering (SAXS), differential scanning calorimetry (DSC), dynamic light scattering (DLS), light backscattering (LBS), near-infrared spectroscopy (NIR), and differential dielectric sensors (DDS) [1]. We discuss challenges that can arise when determining the optimum formulation, such as hysteresis and liquid crystal formation. By considering these factors and selecting the most suitable technique based on the specific application, formulators can effectively incorporate new surfactants into their formulations to achieve best performance.

References

[1] R. Marquez, J. Ontiveros, N. Barrios, L. Tolosa, G. Palazzo, V. Nardello-Rataj, J.-L. Salager (2023). Advantages and inconveniences of different methods to determine the optimum formulation in surfactant-oil-water systems: A Review. Submitted to the *Journal of Surfactants and Detergents*