

# STRUCTURE, SYNERGISTIC ENHANCEMENT OF VISCOELASTIC PROPERTIES AND RESPONSIVENESS TO HYDROCARBONS OF A NEW MIXED VISCOELASTIC SURFACTANT SYSTEM

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Surfactant molecules can self-assemble into long cylindrical or wormlike micelles (WLMs). WLMs can entangle and form a transient network with viscoelastic properties even at moderate surfactant concentrations. Also, micellar chains are highly responsive to external stimuli, e.g. to the addition of hydrocarbons, which can break the micelles. Viscoelasticity and responsiveness of the micellar networks is widely exploited in practical applications. For instance, these are the key properties for the application of surfactant solutions as hydraulic fracturing fluids in oil recovery. Therefore, a search for new surfactant systems with high viscoelasticity and responsiveness is of high demand. In the present work, we investigate a new viscoelastic surfactant system comprised by a mixture of an anionic (potassium oleate) and a cationic (1-dodecylpyridinium chloride) surfactants [1].

First, we investigated the influence of the molar ratio of cationic to anionic surfactant on the structure and rheological properties of the mixed system. A transition from spherical to cylindrical micelles was observed upon increasing content of cationic surfactant. By SANS it was discovered that the cylindrical micelles have an elliptical cross-section with a major radius close to the length of longer anionic surfactant tail and minor radius close to the length of shorter cationic surfactant tail. 1H NMR NOESY and SANS data suggest that both surfactants are segregated on the surface of the micelles. The viscosity goes through a maximum with increasing content of cationic surfactant, and at an optimal ratio of surfactants, the system shows high viscoelasticity. SANS data show that mixed surfactant system is responsive to hydrocarbons, which is a result of transformation of long cylindrical micelles into ellipsoidal microemulsion droplets.

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[1] A.V. Shibaev, A.S. Ospennikov, A.I. Kuklin, N.A. Arkharova, A.S. Orekhov, O.E. Philippova. Structure, rheological and responsive properties of a new mixed viscoelastic surfactant system. *Coll. Surf. A. Phys.-Chem. Eng. Asp.* 2020, 586, 124284