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Physicochemical Properties of PEO-PPO-PEO Triblock Copolymer (Mol.Wt. 2000) Micelles in Sodium Dodecyl Sulfate (SDS) Micellar Environment

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Abstract — The hydration of the polymer micelles has been directly determined from the measurements of conductance of micellar solutions of the triblock copolymer (PEO-PPO-PEO) in 25 mM SDS (fixed) and in 5 mM NaCl (fixed), using the principle of the obstruction of electrolyte migration by the polymer. The asymmetry of the micellar entities of the polymer and the polymer-SDS mixed micellar systems and their average axial ratios are calculated using the intrinsic viscosity and hydration data obeying Simha-Einstein equation. The hydration of the polymer has also been determined by Einstein and Vand equations, and good agreement with the conductivity results obtained. Hydration number and micellar sizes are found to be variable with temperature. The aggregation number, $\bar{N}$ of the polymer in an aqueous solution of SDS (25 mM, fixed) was determined by fluorescence spectroscopic technique considering the SDS solution as the solvent only in one case, and in the other case, the micellar concentration of SDS had been taken into account to consider the SDS-polymer mixed system. Both $\bar{N}$ and the Stern-Volmer constant (K_{sv}) are variable with temperature. The shape of the polymer micelles has been observed to be ellipsoidal rather than spherical. From the absolute values of the axes, the micellar volume, hydrodynamic radius, radius of gyration, diffusional coefficients as well as translational (τ_D), rotational (τ_r) and effective (τ_a) correlation times have been calculated. The partial molal volume of the polymer micelles has also been determined and its comparison with the molar volume of the pure polymer suggested a volume contraction due to the immobilization of the water phase by the hydrophilic head groups of the polymer. The thermodynamic activation parameters for the viscous flow favour a more ordered water structure around the polymer micelles at higher temperatures.