รายงานฉบับสมบูรณ์

โครงการวิจัยเรื่อง “Micellization and gelation of P123, F127 and their mixtures in aqueous and ethanol solutions”

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Pluronics ($E_mP_nE_m$, where E = poly(ethylene oxide), OCH_2CH_2, P = poly(propylene oxide), $OCH_2CH(CH)_3$, and m and n are the repeating unit) copolymers are commercially available and inexpensive. There are several papers published using these copolymers especially P123 ($E_{21}P_{67}E_{21}$) and F127 ($E_{98}P_{67}E_{98}$) in the Pluronic grid. These copolymers are easily dissolved in water at room temperature forming micelles because water is being good solvent for E block and non-solvent for P block. The applications of copolymers are pharmaceuticals e.g. drug solubilization, and templates of nano-materials synthesis, e.g. SBA-15 and SBA-16 etc.

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Abstract

The micellization in dilute aqueous solution of Pluronic copolymers P123 ($E_{21}P_{67}E_{21}$), F127 ($E_{98}P_{67}E_{98}$) and mixtures of the two copolymers was investigated using static and dynamic light scattering. Gelation of concentrated solutions was studied using tube inversion and oscillatory rheometry. P123 and F127 comicellized and gave micelles with narrow size distributions. Clouding temperatures and critical micelle temperatures decreased as the proportion of P123 in the mixture was increased. Micelle association numbers of the mixed micelles lay between the values found for micelles of P123 and F127 alone. Cubic and hexagonal gels were found for concentrated solutions. P123 in 10, 20 and 30 wt% aqueous ethanol was studied using dynamic light scattering, oscillatory rheometry, tube inversion, and small-angle X-ray scattering (SAXS). Clouding was observed at higher temperatures. Isotropic and birefringent gels were defined for concentrated solutions and shown using SAXS to have cubic and hexagonal structures. The cubic gels were clear, whereas the hex gels were either turbid or clear. Temperature scans of dynamic moduli showed a clear distinction between high modulus cubic gels ($G'_{max} \approx$ 20-30 kPa) and lower modulus hex gels ($G'_{max} <$ 10 kPa).