Micellar solubilization of tributyl phosphate in aqueous solutions of L64 Pluronic triblock copolymers: structural change evidenced by Small-Angle Neutron Scattering

Serge Lagerge 1,*, Jérémy Causse 1, Julian Oberdisse 2, Jacques Jestin 3

1Institut Européen des Membranes, UMR 5635 CNRS-ENSCM-UMII, Université Montpellier II, Case Courrier 047, Place E. Bataillon, 34095 Montpellier Cedex 05, France
2Laboratoire des Colloïdes, Verres et Nanomatériaux (LCVN), CNRS UMR-5587, Université Montpellier II, Case 015, Place E. Bataillon, 34095 Montpellier Cedex 05, France
3Laboratoire Léon Brillouin (LLB, CEA-CNRS), CEA Saclay, 91191 Gif-sur-Yvette Cedex, France

*e-mail: slagerge@univ-montp2.fr

We have studied the solubilization behaviour of TriButylPhosphate (TBP) in aqueous solutions of L64-Pluronics, using light and small angle neutron scattering (SANS). TBP is a complexing agent which is widely used in the selective extraction of U and Pu from organic solutions. It is a polar oil which is soluble in deionised water to a very small extent. Varying the temperature and the oil-content, the system presents a non trivial phase behaviour [1, 2]. In particular, at 308K, a first solubilization followed subsequently by an emulsification failure and a strong resolubilization is found (see Figure below).

Cut through the phase diagram of the three-component system (L64 at 10 wt% - TBP – water). This diagram shows the evolution of both the cloud point temperature (CPT, black symbols) and the solubilization minimal temperature (SMT, open symbols) against the normalized TBP concentration c/c_{sat}.

We have measured the microstructure by SANS and characterized the microemulsion droplet core-size, corona-thickness, polydispersity, and interactions. It is shown that at low oil content, the system is made of small swollen micelles. After the phase separation, the strong resolubilization is carried by larger oil droplets decorated by copolymer. From specific surface measurements at large angles, a surprising change in surfactant conformation was found to accompany this morphological evolution. In independent measurements, our structural modelling was confirmed using contrast-variation SANS.