

Which parameters intrinsically control the self-assembled structures of nonionic bio-surfactants in non-aqueous media? A phase and small-angle scattering study

Lok Kumar Shrestha

International Center for Young Scientists (ICYS), WPI Center for Materials Nanoarchitectonics (MANA), National Institute for Materials Science (NIMS), 1-1 Namiki, Tsukuba Ibaraki, 305-0044, Japan

Formulation and characterization of reverse micelles in non-aqueous media has sparsely been studied in spite of their wide range of practical applications, e.g., in solubilization, extraction, drug delivery, and tailored synthesis of nanomaterials. The term, reverse or inverted micelles, refers to the orientation of amphiphile in the aggregate structure. In reverse micelles, the lipophilic tails are directed outward into the organic solvent while the polar hydrophilic heads point inward. They are opposite to the features of normal micelles in water.¹ Formulation of reverse micelles usually requires polar additives like water. Only a few reports exist in the literature describing reverse micelle formation without water addition.^{2,3} Compared to normal micellar systems, it is generally difficult to play with the control parameter of amphiphile in non-aqueous media and demands more attention. Water addition is the only well known parameter so far, which easily modifies the geometry of reverse micelles (either swells or favors sphere-to-rod transition).² However, the effect of water on the nonionic reverse micellar growth is not significant in comparison with that on the ionic surfactant systems. This emphasizes the need of other intrinsic tunable parameters to formulate the nonionic reverse micelles with the desirable structures. In this talk, I will discuss the self-assembly of biocompatible nonionic surfactants in non-aqueous media without external water addition based on our recent results of small-angle X-ray scattering (SAXS), and will demonstrate a facile route to the flexible structure control of nonionic reverse micelles.⁵⁻¹⁰

References:

1. Evans, D. F.; Wennerstrom, H. *The Colloidal Domain*; Wiley-VCH: New York, 2001.
2. Shrestha, L.K. et al. *Langmuir* **2006**, *22*, 1449;
3. Shrestha, L.K. et al. **2007**, *23*, 6606.
4. Schurtenberger, P.; Scartazzini, R.; Luisi, P. L. *Rheol. Acta* **989**, *28*, 372-381.
5. Shrestha, L.K. et al., *J. Phys. Chem. B* **2010**, *114*, 12008-12017.
6. Shrestha, L.K. et al., *Langmuir* **2010**, *26*, 7015-7024.
7. Shrestha, L.K. et al., *Langmuir* **2010**, *26*, 3115-3120.
8. Shrestha, L.K. et al., *J. Phys. Chem. B* **2009**, *113*, 12669-12679.
9. Shrestha, L.K. et al., *Phys. Chem. Chem. Phys.* **2009**, *11*, 4251-4259.
10. Shrestha, L.K. et al., *J. Phys. Chem. B* **2009**, *113*, 6290-6298.