

16th International Conference on

Emerging Materials and Nanotechnology

March 22-23, 2018 | London, UK

Active demulsification of stable emulsions using light

Yukishige Kondo

Tokyo University of Science, Japan

Emulsions are metastable systems where one liquid (dispersoid) is dispersed as particles in another liquid (dispersion medium), and have been used in many fields, including cosmetics and paints. Many research has focused on the enhancement of emulsion stability. On the other hand, Demulsification, which is a phase separation phenomenon of stable emulsions, also plays an important role in industry. For example, aqueous waste fluids containing hazardous substances can be mixed with an oil to obtain an emulsion, and then the emulsion is demulsified to extract hazardous substances into the oil phase. This process is called “emulsion liquid membrane extraction”. Demulsification has been so far performed by adding chemicals or by physical techniques such as the application of high electrical fields, or mechanical external forces and the variation of temperature. In this work, we will focus on the control over the stability of emulsions by an external stimulus, which is light. As a photo-responsive surfactant, a cationic gemini surfactant having an azobenzene group (C7-azo-C7) has been synthesized. C7-azo-C7 exhibits photo-isomerization between *trans* and *cis* isomers. When mixtures of *trans*-C7-azo-C7 aqueous solution and n-octane were homogenized, stable emulsions were obtained in a specific region of weight fraction and surfactant concentration. Fluorescence microscopy observations using a small amount of fluorescent probes showed that the stable emulsions were oil-in-water (O/W)-type. As can be seen in Figure 1, UV irradiation of stable O/W emulsions promoted the *cis* isomerization of *trans*-C7-azo-C7 and led to the demulsification. Dynamic interfacial tension between aqueous C7-azo-C7 solution and octane temporarily increased with UV light irradiation. From these results, the *cis* isomerization of *trans*-C7-azo-C7 molecules at the O/W interface on UV irradiation leads to direct contact between the water and octane phases, because of the reduction of molecular area at the interface, and subsequently makes the emulsions demulsified.

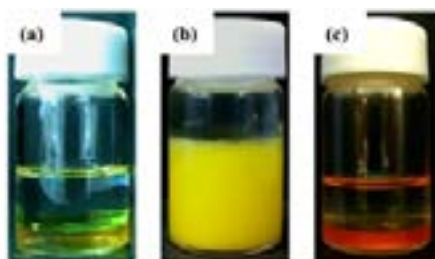


Figure 1 Photographs illustrating the demulsification of a stable emulsion consisting of octane/aqueous C7-azo-C7 solution at 10 mM (=70/30, w/w): (a) binary mixture of octane and aqueous C7-azo-C7 solution before homogenization, (b) after homogenization, and (c) demulsification caused by UV light irradiation to the emulsion shown in (b)

Biography

Yukishige Kondo received his B. Eng. in Chemical Engineering from the Tokyo University of Science (TUS) and earned his Dr. Eng. for his doctoral thesis concerning “Solubilization of organic compounds using surfactant vesicles”. His professional career started by joining the faculty at the Department of Industrial Chemistry, TUS. After he worked as a visiting assistant professor at University of Wisconsin–Madison from 2004 to 2005, he was promoted to Professor in 2015. He is working on “the synthesis of novel surfactants and their solution properties” and “preparation of metal-lustrous crystals using organic compounds” along with 24 students. He has a fascination for aircraft; he enjoys watching airplanes at airports and traveling by air.

ykondo@rs.tus.ac.jp