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Physicochemical characterization of water-in-oil microemulsions formed by a binary 1,3-dioxolane alkyl ethoxylate/Aerosol-OT surfactant system

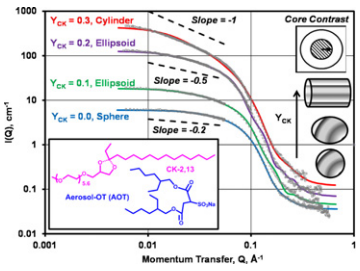
Douglas G. Hayes[a,b,*], Mayson H. Alkhatib[c,1], Javier Gomez del Rio[b,2], Volker S. Urban[d,**]

[a] Department of Biosystems Engineering and Soil Science, University of Tennessee, Knoxville, TN 37996, USA
[b] Department of Chemical and Biomolecular Engineering, University of Tennessee, Knoxville, TN 37996, USA
[c] Biotechnology Science and Engineering Program, University of Alabama in Huntsville, Huntsville, AL 35899, USA
[d] Biology & Soft Matter Division, Oak Ridge National Laboratory, P.O. Box 2008, Oak Ridge, TN 37831-6475, USA

HIGHLIGHTS

- Ellipsoids and cylinders form as cyclic ketal ethoxylate (CK-2,13) is added to AOT.
- Attractive interactions occur for cyclic ketal ethoxylate/AOT microemulsions.
- Water bound to AOTs counterion increased by 0.7 mol mol^{-1} as CK-2,13 is added.
- These changes occur when CK-2,13 is increased from 0.1 to 0.2 mol mol^{-1} CK-2,13 + AOT.

GRAPHICAL ABSTRACT



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ABSTRACT

The physicochemical behavior of the binary surfactant system consisting of the ionic surfactant sodium bis (2-ethylhexyl) sulfosuccinate, or Aerosol-OT (AOT), and the two-tailed cyclic ketal alkyl ethoxylate (2-tridecyl, 2-ethyl-1,3-dioxolan-4-yl) methoxy]-*O*′-methoxy poly(ethylene glycol)], or CK-2,13, in water/isooctane water-in-oil (w/o-) microemulsion systems enriched in AOT was performed to understand the arrangement of the two surfactants at the interface and the behavior and properties of the microemulsion systems to enable applications. Many of the properties observed were similar to microemulsions formed by AOT/$C_{12}E_4$ or $C_{12}E_5$, the latter two being linear alkyl ethoxylates of comparable tail length and average ethoxylate size, including a decrease of water solubilization and increase of attractive interactions with an increase of ethoxylate surfactant concentration, the latter determined via small-angle neutron scattering (SANS). SANS also demonstrated that the increase of the CK-2,13 fraction among the surfactants from 0.1 to 0.2 to 0.3 induced a change in shape from spheres to ellipsoids to cylinders, a trend not reported for AOT/C_iE_j binary mixtures, and that the surface area per CK-2,13 molecule was approximately 35 Å^2, nearly identical to the value reported for $C_{12}E_5$. Profiles of electrical conductivity versus the water-surfactant mole ratio (W_0) for microemulsions prepared at low surfactant concentrations (far below the percolation threshold) were bell-shaped, consistent with the charge-fluctuation

* Corresponding author at: Department of Biosystems Engineering and Soil Science, University of Tennessee, Knoxville, TN 37996, USA. Tel.: +1 865 974 7991; fax: +1 865 974 4514.
** Corresponding author. Tel.: +1 865 576 7221; fax: +1 865 574 8363.
E-mail addresses: dhayes1@utk.edu (D.G. Hayes), urbanvs@ornl.gov (V.S. Urban).
[1] Current address: Department of Biochemistry, College of Science, King Abdulaziz University, P.O. Box 42801, Jeddah 21551, Saudi Arabia.
[2] Current address: Comisión Nacional de Energía Atómica, Centro Atómico Constituyentes, Avda. Gral. Paz 1499, 1650 San Martín, Buenos Aires, Argentina.

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