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A probe into the dissociation and association behaviour of alkali metal dodecylsulphates in water throgh conductometric investiation (25 – 45^{0}C)

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ABSTRACT

The present paper deals with the conductometic measurements on aqueous solutions of alkali metal dodecylsulphates represented as LiDS, NaDS, KDS at different temperatures (25-45^{0}C). The specific conductance, K (Scm^{-1}) as a function of surfactant concentration, C (mol dm^{-3}) is found to increase at different temperatures, whereas K-C plot intersects to give critical micelle concentration, c.m.c. The cmc for different alkali metals varies as : NaDS > LiDS > KDS and decrease with increasing temperatures. The equivalent conductance at infinite dilution λ_∞ (Scm^2/g-eq.) for these solutions is found to increase with increasing temperature and varies as : KDS > LiDS > NaDS. The degree of dissociation (α) for NaDS (0.94 – 0.99), LiDS (0.56– 0.96) and KDS (0.49 – 0.99) have also been evaluated. The dissociation constant, K_D as (163.0 - 1220) x 10^{-2}, (14.2 – 19.1) x 10^{-3} and (19.5 – 111.0) x 10^{-4} for NaDS, LiDS, KDS, respectively, have been computed. Thermodynamic parameters for dissociation ($\Delta H^0_D < 0$, $\Delta G^0_D > 0$, $T\Delta S^0_D < 0$) and for association ($\Delta H^0_A > 0$, $\Delta G^0_A < 0$, $T\Delta S^0_A > 0$) clearly suggest that the process of micellisation *i.e.* association predominates over dissociation process for these surfactant systems.

Key words : Alkali metals, Dodecylsulphates, Conductance, Dissociation, Association, cmc, Thermodynamic parameters.

The determination of critical micelle concentration, cmc is an age old significant ploy used to hint at a better quality product. Researchers and academicians alike (Aicart *et al.*, 2006; Atwood and Flovenie,1983; Avakawa and Brain, 1980; Barry and Russel, 1972 and Bufe andWolff, 2006) have already shown a keen interest for various surface active agents, also termed as surfactants. They have been enthusiastic about their various facets *viz*. the physicochemical characterization, shape / size determination of micellar aggregates. W.J. Leigh and co-workers (Bunajdad and Eastore,2004; Cook *et al.*, 2001 and Hartl *et al.*, 2007) have, of late, shown how significant organometallics are to the wide domain of surfactants. Several national / international publications (Jacobs *et al.*, 2006; Jaliceour and Philip, 1975; Kim *et al.*, ; Kumar, 1994 and Leigh and Li, 2002) have appeared in literature just to prove the merit of various physical properties of surfactants. Techniques such a viscometry and electrical conductivity have proved handy to study neutral polymer micelle interactions (Lelong *et al.*, 1951). Bumajdad and Eastoe (Malik *et al.*, 1984) employed conductivity to study water in oil microemulsions stabilized by mixed surfactants. Tania *et al.* (Mc. Brain, 1939) have resorted to spectrocopy and conductometry to probe interaction between water soluble poly {1, 4- phenylene –[9, 9- bis (4- phenoxy butyl-sulfonate)] fluorene – 2, 7 - diyl} copolymer and ionic surfactants. Aicart and co-workers (Mehta *et al.*, 1979) examined electrochemical, microscopic and spectroscopic characterization of vesicles and prevesicle nanostructures of mixed cationic surfactant systems.

Very recently researchers (Mehrota *et al.*, 1970) have undertaken a study on electrically conductive bacterial cellulose by incorporation of carbon nanotubes. Kim and co-workers (Modaressi *et al.*, 2007) have, however, carried out a similar looking study using dielectrophoresis of surface conductance modulated single-walled carbon nanotubes with cationic sufactants. Hartl *et al.* (Niisson *et al.*, 2006) have investigated into ion sensitivity of surface conductive single crystalline diamond. Jacobs *et al.* (Niisson *et al.*, 2006) have dealt with aspects on dynamics of alkyl ammonium intercalants with in organically modified montmorillonite : Dielectrical relaxation and ionic conductivity. Rajamani *et al.* (Robins *et al.*, 2003) have performed a study on carbon nanotube based transparent conductive thin films. NMR diffusometry and electric conductometric techniques have been employed to study interactions between gemine surfactants, 12-s-12, and beta cyclodextrin (Sarah *et al.*, 2006)). Bufe and Wolf (Sibel and Osman, 2007) have recently undertaken a study on switching electrical conductivity in an AOT- isooctane – water microemulsion through photodimerization of solubilized N-methyl – 2 - quinoline. conductometirc measurements have been found extremely handy to look into CTAB aggregation in aqueous solutions of ammonium based ionic liquids (Sharma *et al.*, 1986). Conductometric method (Shun-Cheng *et al.*, 2004) has also been a worthy tool to investigate interaction