

Research Paper :

Dissociation/association behaviour of alkaline earth metal laurates at different temperatures

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ABSTRACT

The specific conductance, k (mS cm^{-1}) of alkaline earth metal (Mg/Ca/Sr/Ba) laurates in mixed solvent (50% methanol +50% chloroform) has been measured (30-50°C) in order to look into the dissociation / association behaviour of these surfactant systems. The data for critical micelle concentration (c.m.c) help characterising their micellar behaviour. The significant parameters viz. degree of dissociation (α), dissociation constant (K_D) and limiting equivalent conductance at infinite dilution (μ_0) have been deduced for pre-micellar region (dilute range). Thermodynamic parameters viz., enthalpy, free energy and entropy changes for both dissociation and association processes have also been computed.

Key words : Metal laurates, Conductance, Dissociation, Association, Critical micelle concentration (c.m.c), Thermodynamic parameters

Studies involving both nature and structure of the surfactant compounds have been a great help to their possible uses in industries. Alkaline earth metal soaps have found application to dispersants (Verma and Bahadur, 1974), lubricants (Sokoloova, 1971; Nakonechaya, 1973 and Bouman, 1950), catalysts (Lower, 1947 and Bapyatov and Polstyanoi, 1962), stabilizers (Lehmann, 1951) and corrosion inhibiting agents (Mayne and Rooyen, 1954 and Johnson, 1959). The latest publications (Cook *et al.*, 2001, Leigh t and Li, 2002 and Owens *et al.*, 2003) by W.L. Leigh and co-workers underlined the significance of organometallics to the wide surfactant domain. However, so many national/ international publications (Hepler, 1969; Jalicoeur and Philip, 1975; Franks *et al.*, 1968; Sharma *et al.*, 1986 and Kumar, 1994) have also appeared to signify studies on different physical properties of various surfactants. The present investigation has been initiated with a view to look into the dissociation/association behaviour of alkaline earth metal laurates in mixed solvent (50% methanol+50% chloroform) at different temperatures (30-50°C). Various thermodynamic

parameters have also been evaluated to strengthen the conclusions made.

MATERIALS AND METHODS

Anala R-grade chemicals (lauric acid, methanol, chloroform, carbonates of magnesium/calcium/ strontium and barium) were obtained from Glaxo Labs Mumbai (India). The conductivity water was prepared by twice redistilling good quality distilled water over alkaline KMnO_4 .

Alkaline earth metal laurates were prepared by direct metathesis. The aqueous solution containing stoichiometric amount of respective metal carbonate and potassium laurate were mixed at nearly 80°C under constant stirring. As evolution of CO_2 ceased and metathetic displacement reaction completed (phenolphthalein indicator rendered colourless from pink), the desired compound was separated from mother liquor by vacuum filtration. The product was washed several times with benzene and oven dried. All the four compounds so prepared were further purified by recrystallization from methanol-chloroform

Table 1: Percentage of elements in Alkaline earth metal laurates

Surfactants	Elements							
	% Carbon		% Hydrogen		% Oxygen		% alkaline earth metal	
	Theoretical	Practical	Theoretical	Practical	Theoretical	Practical	Theoretical	Practical
Mg laurate	68.25	67.75	10.90	10.10	15.16	14.85	5.69	5.05
Ca laurate	65.75	65.30	10.50	9.90	14.61	13.90	9.13	8.69
Sr laurate	59.30	57.95	9.47	9.05	13.18	12.75	18.04	17.78
Ba laurate	53.80	53.10	8.59	7.85	11.95	11.20	25.65	25.05