

Dissociation/association behaviour of aqueous alkaline earth metal dodecylsulphates at various temperatures

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ABSTRACT

The specific conductance, k (mS cm^{-1}) of the aqueous solutions of alkaline earth metal (Ba/Sr/Ca/Mg) dodecylsulphates, *i.e.*, $\text{Ba}(\text{DS})_2$, $\text{Sr}(\text{DS})_2$, $\text{Ca}(\text{DS})_2$, $\text{Mg}(\text{DS})_2$ has been measured (25-45°C). The critical micelle concentration (c.m.c.), limiting equivalent conductance at infinite dilution (μ_0), degree of dissociation (α) and dissociation constant (K_D) have been evaluated for these solutions. The significant thermodynamic parameters like enthalpy / free energy and entropy changes have been computed for both dissociation and association processes which are only peculiar to anionic surfactant solutions.

Key words : Alkaline earth metal dodecylsulphates, Conductance, Dissociation, Association, Critical micelle concentration (c.m.c.), Thermodynamic parameters.

Alkali and alkaline earth metal anionic surfactants, especially metal soaps, have already attracted several researchers in the past. Evidently, alkaline earth metal soaps have found their worth as dispersants (Verma and Bahadur, 1974), lubricants (Sokolova, 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 publication (Cook *et al.*, 2001; Leigh 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.

Since studies involving both nature and structure of the surfactant compounds have been a great help to their possible uses in industries, the present investigation is hence an endeavour to look into the dissociation/association behaviour of aqueous alkaline earth metal dodecylsulphate solutions. Various thermodynamic parameters have also been evaluated to strengthen the

conclusions made.

MATERIALS AND METHODS

Anala R-grade sodium dodecylsulphate (NaDS) and carbonates of magnesium/ calcium/ strontium/and barium were obtained from Glaxo Labs Mumbai, (India), and were used after further purification. The conductivity water was prepared by twice redistilling good quality distilled water over alkaline KMnO_4 .

Alkaline earth metal dodecylsulphate compounds were prepared by direct metathesis. The aqueous solution containing stoichiometric amount of respective metal carbonate and NaDS 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 benzene-methanol. The pure and well dried compounds were then stored over calcium chloride. The recrystallized pure compounds are found to decompose between 225 -230°C. The preparation and quality of these compounds were checked by IR and

Table 1 : Percentage of elements in Alkaline earth metal dodecylsulphates

Surfactants	Elements					
	% Carbon		% Hydrogen		% Alkaline earth metal	
	Found	Calculated	Found	Calculated	Found	Calculated
$\text{Mg}(\text{DS})_2$	51.5	52.9	9.0	9.2	4.2	4.5
$\text{Ca}(\text{DS})_2$	49.0	50.5	8.0	8.8	6.8	7.0
$\text{Sr}(\text{DS})_2$	45.0	46.6	7.5	8.1	14.0	14.2
$\text{Ba}(\text{DS})_2$	42.8	43.2	7.0	7.5	19.8	20.6