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A Comparative Study of Conductance of Sodium Dodecyle Sulphate (SDS) in Different Percentage of Ethanol Water Mixed Solvent Media at 298.15 K Temperature

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Abstract

Precise measurement of the conductivity of sodium dodecyl sulphate in different percentage of (0%, 10%, 20%) ethanol-water mixed solvent media containing at 298.15 K temperature were measured. The specific conductivities exhibit a sharp increase with increase in concentration with in the concentration range investigated (0.001 to 0.020) mol per liter. The increase in the conductance with concentration is due to an increase in the number of ion per unit volume of the solution. But decrease in conductance with increase in percentage of ethanol - water mixed solvent media at particular temperature 298.15 K. Ionizing effect is decrease with increase in percentage of ethanol - water mixed solvent media at 298.15K. Due to decrease in dielectric constant with increase in percentage of ethanol - water mixed solvent media at particular temperature 298.15 K. conductivity order is 0% > 10% > 20% at particular temperature 298.15 K.

Key words: Conductivity, sodium dodecyl sulphate, mixed solvent media, ethanol, temperature, dielectric constant and ionizing effects.

Introduction

In low percentage of ethanol-water mixed solvent media have high dielectric constants, having larger ionizing effect on the electrolyte than high percentage of ethanol- water mixed solvent media at 298.15 K. The electrostatic force between oppositely charged ions would be appreciable and conductance value will have small value in higher percentage ethanol-water mixed solvent media than lower percentage ethanol-water mixed solvent media. However, lower percentage ethanol-water mixed solvent media have high dielectric constants yield more conducting solutions compare to higher percentage ethanol-water mixed solvent media. Amount of ethanol work to decrease the dielectric constant of solvent has directly resulted on the ionizing effects. Their change with mixed solvent composition may reflect the change in solvent structure and ion-solvent structure. A binary mixture of water and some organic solvent, with their ratio varying in a wide range, is most frequently investigated medium (sokol et at., 2006).Earlier, the transport properties of have been investigated (Bhattarai et al., 2007) for a poly

electrolyte in methanol-water mixed solvent media. The experimental data was analyzed by manning model and found the lower value than experimental ones. Later on (Bhattarai, 2008) used scaling theory and obtaining good fitting with experimental data.

Methodology

Sodium dodecyl Sulphate employed in these investigations was purchased from Ranbaxy Chemical Company, Inc., India. Sodium dodecyl sulphate (98% pure) were obtained from Loba chemi, India and dried in oven for one hour before use. Solution were prepared of Sodium dodecyl sulphate by weighing approximate amount in an electronic balance (Afcoset-ER120A) with a precision of 0.0001g.Conductivities were measured using digital conductivity meter (306) of Systronics which is the microcontroller based instrument for measuring the specific conductivity of solutions. Conductance measurements were carried out on a Pye-Unicam PW 9509 conductivity meter at a frequency of 2000 Hz using a dip-type cell with a cell constant of 1.15 cm^{-1} and having an uncertainty of 0.01%. The cell was calibrated by the method of Lind and co-workers, 1959 using aqueous potassium chloride solution. The measurements were made in a water bath maintained within ± 0.005 K of the desired temperature. The details of the experimental procedure have been described earlier (Das & Hazra, 1992; 1995). Several independent solutions were prepared and runs were performed to ensure the reproducibility of the results. Correction was made for the specific conductance of the solvent by subtracting the specific conductance of the relevant solvent medium from those of the electrolyte solutions. In order to avoid moisture pickup, all solutions were prepared in a dehumidified room with most care. In all cases, the experiments were performed in three replicates.

Data Analysis

This expermental data was taken in Research Lab of Department of chemistry, Mahendra Morang Aadharsh Multipal Campus, Biratnagar,Nepal (see in figure 1). Three solution were prepared of Sodium Dodedyl Sulphate by weighing appropriate amount in electronic balance with precision of 0.0001 gm. One solution, Sodium Dodecyle Sulphate was put in (100 ml pure distilled water + 0 ml ethanol) that is 0% ethanol water mixed solvent media. Other solution, Sodium Dodecyle Sulphate was put in (90 ml pure distilled water and 10 ml ethanol) that is 10% ethanol water mixed solvent media. Last one solution Sodium Dodecyle Sulphate was put in (80 ml pure water + 20 ml ethanol) that is 20% ethanol water mixed solvent media. Then conductivity were mesured using digital conductivity meter which is the microcontroller based instrument. All three solution were prepared in 298.15 K. The temperature 298.15 K was maintained constant using the thermostat. Following data was noted most careful and accurate in research lab. In data, use to sepatate colum of concentration and conductance of all three types of sodium dodecyl sulphate. This data clearly showed that conductance of 0% ethanol water mixed solvent media ia larger value than 10% ethnol water mixed solvent media at same concentration

S.N.	0 % Ethanol in Water		10% Ethanol in water		20% Ethanol in water	
	Concentration	Conductance	Concentration	Conductance	Concentration	Conductance
1	0.04515	0.950	0.04801	0.858	0.05682	0.790
2	0.03762	0.839	0.04001	0.785	0.04735	0.721
3	0.03135	0.747	0.03334	0.711	0.03945	0.643
4	0.02613	0.668	0.02778	0.594	0.03288	0.560
5	0.02177	0.593	0.02315	0.544	0.02740	0.523
6	0.01815	0.534	0.01929	0.492	0.02283	0.453
7	0.01512	0.487	0.01608	0.440	0.01902	0.404
8	0.01260	0.445	0.01340	0.388	0.01585	0.344
9	0.01050	0.406	0.01116	0.363	0.01321	0.318
10	0.00875	0.369	0.00930	0.321	0.01101	0.276
11	0.00730	0.342	0.00775	0.295	0.00917	0.267
12	0.00608	0.308	0.00646	0.275	0.00764	0.236
13	0.00506	0.280	0.00538	0.246	0.00637	0.219
14	0.00422	0.262	0.00449	0.218	0.00531	0.200
15	0.00352	0.236	0.00374	0.202	0.00442	0.184
16	0.00294	0.223	0.00311	0.180	0.00368	0.153
17	0.00245	0.208	0.00260	0.165	0.00307	0.143
18	0.00204	0.196	0.00216	0.153	0.00256	0.129
19	0.00170	0.187	0.00180	0.136	0.00213	0.120
20	0.00141	0.179	0.00150	0.126	0.00177	0.109
21	0.00118	0.171	0.00125	0.116	0.00148	0.102

Figure 1. **Result of Data Analysis**

and 298.15 K temperature, conductance of 10% ethanol water mixed solvent media is larger than 20% ethanol water mixed solvent media at same concentration and 298.15 K temperature.

Result and Discussion

The experimental specific conductivity of sodium dodecyl Sulphate as a function of surfactant concentration (C_s) at 298.15 K in (0%, 10%, 20%) ethanol - water mixed solvent media are depicted in figures. 2-4. From these figures it is evident that the specific conductivity exhibit a sharp increase with increase concentration within the concentration range investigated here. The increase in the conductance with increase in concentration due to an increase in the number of ions per unit volume of the solution. Figure 2 indicates that variation of specific conductivity of sodium dodecyl sulphate with dilution at 298.15K of double distilled water (0% ethanol-water mixed solvent media). Specific conductivity of double distilled water (0% ethanol water mixed solvent media) solution is the conductance due to all the ions present in one centimeter cube of the solution. As the solution is diluted, the number of ions per centimeter cube decrease. So specific conductivity decrease with dilution. Or specific conductivity increase with increase in concentration at a particular temperature. As increase in concentration number of ions per centimeter cube increases.

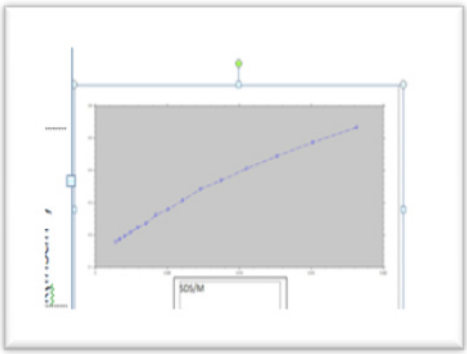

Figure 2. **Functions of surfactant Concerntration**

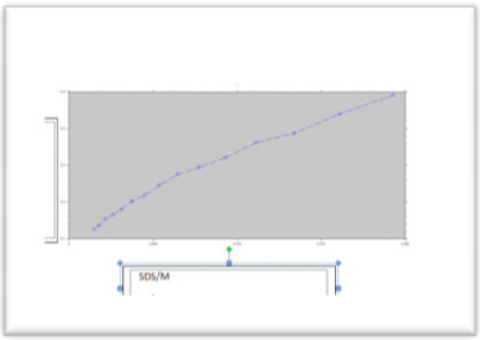

Figure 3. **Functions of surfactant Concerntration**

This figure 4 indicates that variation of specific conductivity of SDS with dilution at 298.1K of 10% ethanol-water mixed solvent media. Specific conductivity of 10% ethanol water mixed solvent media solution is the conductance due to all the ions present in one centimeter cube of the solution. As the solution is diluted, the number of ions per centimeter cube decrease. So specific conductivity decrease with dilution. Or Specific conductivity increase with increase in concentration at a particular temperature. As increase in concentration number of ions per centimeter cube increa

This figure 4 indicates that variation of specific conductivity of sodium dodecyl sulphate (SDS) with dilution at 298.15K of 20% ethanol-water mixed solvent media. Specific

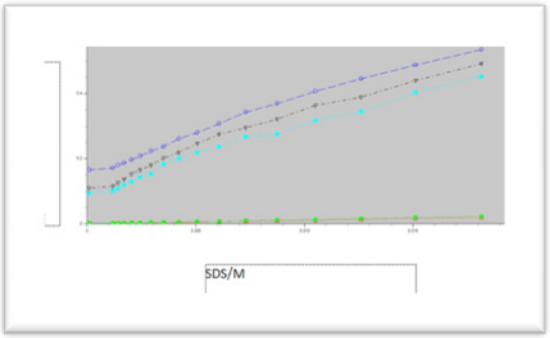

Figure 4. **Functions of Surfactant Concerntration**

conductivity of 20% ethanol water mixed solvent media solution is the conductance due to all the ions present in one centimeter cube of the solution. As the solution is diluted, the numbers of ions per centimeter cube decrease. So specific conductivity decrease with dilution. Or specific conductivity increase with increase in concentration at a particular temperature. As increase in concentration number of ions per centimeter cube increases. This figure 5 indicates that variation of specific conductance with concentration and different percentage of ethanol water mixed solvent media. Upper curve which is denoted by circle is the curve of sodium dodecyl sulphate in double distilled water (0% ethanol-water mixed solvent media middle curve which is denoted by triangle is the curve of sodium dodecyl sulphate in 10% ethanol water mixed solvent media and lower curve which is denoted by square is the curve of sodium dodecyl sulphate in 20% ethanol-water mixed solvent media at 298.15 k.

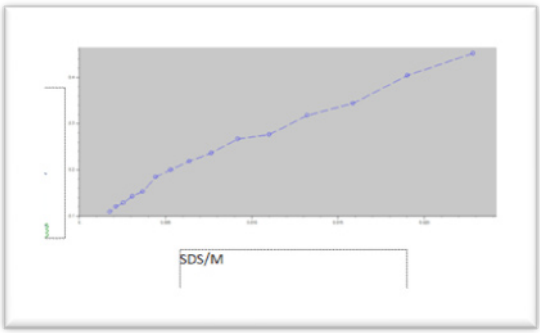

***Figure 5*. Variation of Specific Conductance**

The experimental specific conductivity of sodium dodecyl Sulphate as a function of surfactant concentration (C_s) at 298.15 K in(0%, 10%, 20%) ethanol - water mixed solvent media are depicted in figures 4. From this figure it is evident that the specific conductivity exhibit decrease with increase in percentage of ethanol in solvent within the (0%, 10%, 20%) ethanol - water mixed solvent media range investigated here. The decrease in the conductance with increase in percentage of ethanol in solvent due to decrease in dielectric constant of solvent.

Conclusion

Effect of concentration and different percentage of ethanol - water (solvent composition) on sodium dodecyl sulphate in ethanol - water mixed solvent media have been study by measuring the specific conductance through conductrometric method. The following conclusions have been drawn from above result and discussion. The conduction decrease with increase alcohol content for the studied ethanol water mixed solvent system. Fig. 2, 3 and 4 indicate that Specific conductivity of sodium dodecyl sulphate increases with increasing concentration of double distilled water (0% ethanol water system), 10% ethanol - water mixed solvent media and 20% ethanol - water mixed solvent media respectively. As the solution is diluted, the number of ions per centimeter cube decrease. So specific conductivity decrease with dilution. Or specific conductivity increase with increase in concentration at a particular temperature. As increase in concentration number of ions per centimeter cube increase.

Amount of ethanol work to decrease the dielectric constant of solvent which directly effect on the ionizing effect. Their change with mixed solvent composition may reflect the change in solvent structure and ion-solvent structure. Fig. 5 indicates that Specific conductivity of sodium dodecyl sulphate decreases with increasing percentage of alcohol in solvent. The presence of ethanol reduce the dielectric constant of solvent phase and make the easier the formation of ion pairs in the solution phase. In other word in solvent of low dielectric constant, having small ionizing effect on the electrolytes, the

electrostatics force between oppositely charge ions would be applicable and conductance value will have small value. However, solvent with high dielectric constant yield more conducting solutions.

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