Ion Conductance, Walden Product Pressure Coefficient And Hydrodynamic Radii Of Sodium Salt Of Methane Sulphonic Acid In Water-Methanol And Water-Dmf Compositions

V.Radhika¹,²* and J. Sunil Kumar¹,² and N Srivani³

¹Department of Chemistry, S R University, Warangal-506371, Telangana, India  
²Department of Humanities and Sciences, S R Engineering College, Warangal-506371, Telangana, India.  
³Sumathi Reddy Institute of Technology for Women, Warangal, India.

¹hod_hsc@srecwarangal.ac.in

Abstract. Ion-conductance, preferential solvation by Walden product pressure coefficient pressure coefficient and Hydrodynamic Radii correlated with different electrolytes with in solvents is formed by diverse aspects like cohesive energy density, relative viscosity, solvent dielectric constant values of intermediate, with in dual mixture associations of its solvent adhesive solvent measures. Sodium saltion solvent interactions of solute ion with solvent core. Conductance data and physical properties of ion viscosity electrolytes are used by change of the sodium salt ion conductance values, Walden product pressure coefficient and Hydrodynamic radii behavior of the ions and these are measured for derived Sodium salt of Methane Sulphonic acid electrolytein water-MeOH and water-DMF of dissimilar composition in the heat choice of 283K to 313K. \( \Lambda^0 \) values K \( \Lambda \) of electrolyte sodium saltion pair, Association constant values figured out with Shedlovsky Extrapolation method. \( \Lambda^0 \) rise with composition of pure water solvent in organic aqueous dual mixture composition in binary sheath. K \( \Lambda \) value is more in 80% water-MeOH composition signifying sodium saltion of sodium solvation interactions are more at this binary composition of solvation and thermodynamic properties for the function of specified sodium saltion solvent interaction in composition for structural effects.

1. Introduction

“Sodium saltion-conductance and its solvation behavior of electrolytes in binary solvent core is reported by influence of various factors like solvent density, relative viscosity, dielectric constant(\( \varepsilon \)) of the medium, sodium saltion duel mixture solvent interaction of solvent-solvent interaction associations. Sodium saltion solvent interaction relations are reported by previous papers of Manikyamba et al”. In electroltic solutions, sodium saltions are always solvated. The solvated sodium salts dissociated ions finds many properties of sodium salt electrolytesolutions. Conductance measurement is one of the most convenient methods for study of ion association that measures conductance of sodium salt electrolyteat different concentrations and comparing equivalent conductance with concentrations using different model like Shedlovsky Extrapolation method, Fuoss-Kraus etc. structural effect by binarysolvent and extent of aqueous – organic mixture conductance values of sodium salts electrolytes studied by compare \( \Lambda^0 \eta^0 \). A stable Walden product pressure coefficient is anticipated for a given sodium salt electrolyte at unlike composition mixture of dual
aqueous organic mixture provided steady sodium salt ion solvent composition interaction are at every one composition.

Sodium salts are deriving from the methane sulphonic acid, sodium salt obtained by hydrolysis process second most plentiful naturally taking place. Derived Sodium salt of Methane Sulphonic acid electrolyte easily soluble in aqueous binary mixture. The better solubility and low relative viscosity of derived $\text{CH}_3\text{SO}_3\text{Na}$ electrolyte at neutral pH make derived $\text{CH}_3\text{SO}_3\text{Na}$ electrolyte. Moreover, derived $\text{CH}_3\text{SO}_3\text{Na}$ electrolyte are promising as a drug candidate, and as a food composition composition ingredient, additive, and stabilizer that improve quality and human health, because they are inherently biocompatible, non-toxic, and non-allergenic to existing tissues.

In potential applicant in practical request in drug composition and food composition, oral management of derived $\text{CH}_3\text{SO}_3\text{Na}$ electrolyte is inevitable. It have been claimed that derived $\text{CH}_3\text{SO}_3\text{Na}$ electrolyte arrive at systemic circulation after oral administration. Therefore, for the sake of human health, impurities in $\text{CH}_3\text{SO}_3\text{Na}$, especially inorganic ions and its ion in solution, of clearly elucidate and precisely determined. Derived $\text{CH}_3\text{SO}_3\text{Na}$ electrolytes are formed by the enzymatic composition heating methane sulphonate hydrolysis.

It is clear that saturated carbohydrates, such methane and ethane, are required nutrients to function the directive of important cardiac to tangential thick confrontation to determinants of BP level to balanced attentiveness level for all these saturated carbohydrates in order to maintain the required functions of the human being body. Deficiency or excess of these elements over the compulsory level can have implication for human being health. As Derived $\text{CH}_3\text{SO}_3\text{Na}$ electrolyte are a talented candidate to use food composition in drug composition electrolytic fields by aqueous organic binary solvent interaction, their organic solvents to improve effects and avoid harmful effects. Consequently, the expansion of an efficient method for the fortitude of sodium salts for solvation properties of different sodium salt electrolytes[1-5].

As for Derived Sodium salt of Methane Sulphonic acid electrolyte physical properties, most of electrolyte salts analytical sodium salts conductance focus on the strength of mind of the average solvation, as well as electrolytes and analysis of the single Derived $\text{CH}_3\text{SO}_3\text{Na}$ electrolyte with different properties. Moreover, this ion solvation method was used to quantify the sodium salts in technical concentrate. The procedure is easy to environmentally responsive of sodium salts are used to turn to liquid these samples.

2. Experimental Section
Double distilled water utilized. Methanol and N, N-dimethyl formamide(DMF) (from sdfine Analar chemicals) are utilized. Derived Sodium salt of Methane Sulphonic acid electrolyte (Spectrochem) sample used by utilize devoid to additional purification by distillation. Conductivity meter (Elicometer. Model - 183) equipped with the help of conductivity glass cell of cell constant(x) which is 0.9891 cm$^{-1}$ of hand-me-down to work out the conductance of within solution. Conductance cell was calibrated by standard soaked 0.1KCl concentration solution. The accuracy of conductivity Elico bridge is 0.01µS. A stockpile solution concentration 0.004M Derived Sodium salt of Methane Sulphonic acid electrolytebe organized in pure water and water binary organic solvents of unequal composition mixtures (v/v) in range of % Zero to 100 MeOH & Dimethyl formamide solvent component. Solution of two different sodium salt concentrations using diluted volumes of binary aqueous organic mixture and conductance measured values were computed in the heat range at 283-313 K. 10-20 µS sample diluted ranges with binary aqueous Solvent / organic Solvent of blend are used in present conductance studies. Conductance of each diluted solvent be deducted to obtained conductance of that stage sodium salt solute at each level concentration. Molar conductance values of sodium salt solution calculated from the conductivity meter those experiential conductance were
obtained using Shedlovsky Extrapolation method [6]. Conductance figures and other physical properties of special electrolytes of sodium salt are helpful to study the electrolyte ion conductance and sodium salt ion solvation obtained. However, text is complete by such a sequential conductance of related to text on Derived Sodium salt of Methane Sulphonic acid electrolyte calculated. In this present paper report, conductance of each concentration observations on solute conductance performance of Derived Sodium salt of Methane Sulphonic acid electrolyte inside water organic mixtures of MeOH and DMF at different heat levels 283 to 313 K study are outlined in Manikyamba. et. al 2019 [7-9].

3. Results and Discussion

Conductance Limiting molar (Λ°) values determined by solvent extract from conductance data for Derived Sodium salt of Methane Sulphonic acid electrolyte in water-MeOH and water-DMF in various (v/v) water – MeOH and water- DMF binary solvent at 283, 293, 303 and 313 K. The values of limiting molar derived by means of Shedlovsky Extrapolation method to assess Λm at infinite dilution[10, 11].

\[ \frac{1}{\Lambda S(Z)} = \frac{1}{\Lambda_0} + \frac{S(Z)y^2K_ACA}{\Lambda^0^2} \]

Λm is the molar conductance next to concentration. C, In this Λm molar limiting conductance, KA is of ion pair Association constant, y± the suggest activity ionic coefficient & S(Z) is a aspect given by

Where \( S(Z) = 1 + Z + ... \) (2)

\[ Z = \frac{S(\Lambda_0)^{1/2}}{\Lambda_0^{3/2}} \quad K \] (3)

\[ \log y_\pm = \left[ \frac{-1.8246 \times 10^6 (C\alpha)^{1/2} I(\varepsilon T)^{3/2}}{1 + 50.24 \times 10^8 R(C\alpha)^{1/2} (\varepsilon T)^{1/2}} \right]^2 \] (4)

\[ \alpha = \frac{S(Z)\Lambda}{\Lambda^0} \] (5)

At this R is parameter of ion size sodium salt identical to Bjerrum’s q critical expanse of equated by

\[ R = q = \frac{e^2}{2\varepsilon kT} \] (6)

Boltzmann’s K is a consistent and T is the heat within 283K to 313K. S is designed via Λ° obtained from Onsager model by proceeds of the contrive of Λm next to \( \sqrt{C} \). The least four-sided figure study of the data (Λm and C) using a equation (1) acceptable with in linear association coefficients from the succession 0.98-0.99.

The morals consequently obtained are exposed in Table-1. In general, conductance data is collected in binary solvent systems of dissimilar compositions in the range of 0-100% (v/v). In case of sodium, salt of methane sulphonic acid, conductance date could not be collected in 100 % MeOH and 100 % DMF, as it was insoluble. Date presented in below Table - I specify limiting molar conductance value gradually decrease with increase in percentage of organic component of solvent mixture. Molar conductance(Λm) values decrease up to 40-60% MeOH and there after it increase slightly at all the four heat used. When organic solvent is added to water, there is steep fall in molar conductance values to the extent of 30 to 40 units of conductance and afterwards only a minor variation is observed which is due to solvent-solvent and ion-solvent interaction interaction interactions. Protophilic solvent addition to water amplified the three dimensional arrangement of H2O which increased solvation shell
in size and captured further number of conducting ions foremost to lessen in conductance. Higher conductance value in 100 % water than in 100 % organic solvent imply that ions were relatively free in water due to high dielectric constant than in organic solvent.

In water-MeOH a slight different performance is observed where Molar conductance ($\Lambda_m$) increases slightly with increase in proportion of organic component. This variation may be endorsed to the increase in three-dimensional structure of water in association with MeOH or decreased ion-solvent interaction interaction interactions. Walden product pressure coefficient ($\Lambda^0\eta^0$) reflects variation of total solvation with respect to composition of solvent. Walden product pressure coefficient decreases (Table-II) with amplify in proportion of organic component in water solvent. A slight rise in Walden product pressure coefficient is due to the initial addition of organic solvent indicates weak solvation of ions that attain a maximum value for 40% MeOH or DMF. Hydrodynamic radii of the ions are evaluated by Walden product pressure coefficient and presented in Table-I. In water-MeOH and water-DMF, hydrodynamic radii are maximum in 80 % organic solvent and in 100 % water the sodium salt has hydrodynamic radii in the range of 12.8 to 10.7 Å. From this, it is concluded that the length of alkyl group does not have any effect on the hydration of RSO$_3$ group.

### Table 1. Molar conductance (mho cm$^2$ mol$^{-1}$), Walden product pressure coefficient and Hydrodynamic Radii of Sodium salt of Methane Sulphonic acid in Water-Methanol and Water-DMF compositions.

| % of Organic Composition | 283 K Aqueous-MeOH | 283 K Aqueous-DMF | 293 K Aqueous-MeOH | 293 K Aqueous-DMF | 303 K Aqueous-MeOH | 303 K Aqueous-DMF | 313 K Aqueous-MeOH | 313 K Aqueous-DMF |
|--------------------------|-------------------|------------------|-------------------|------------------|-------------------|------------------|-------------------|------------------|
| 0                        | 83.27             | 83.27            | 101.83            | 101.83           | 110.06            | 110.06           | 121.02            | 121.02           |
| 20                       | 57.48             | 55.05            | 67.72             | 66.58            | 78.45             | 77.19            | 86.23             | 87.13            |
| 40                       | 45.08             | 43.08            | 53.36             | 53.52            | 65.88             | 60.07            | 71.32             | 63.35            |
| 60                       | 46.43             | 32.11            | 54.83             | 40.21            | 67.78             | 45.58            | 74.32             | 51.05            |
| 80                       | 48.94             | 29.03            | 55.01             | 35.89            | 69.04             | 37.96            | -                 | 42.24            |
| 100                      | -                 | -                | -                 | -                | -                 | -                | -                 | -                |

$\Lambda^0$ = Shedlovsky Extrapolation method.

### Table 2. Walden product pressure coefficient and Hydrodynamic Radii [(1/r$_s^+$) + [(1/r$_s$)] of Derived Sodium salt of Methane Sulphonic acid electrolyte at 293 K

| % of Organic Component | Hydrodynamic Radii [(1/r$_s^+$) + [(1/r$_s$)] in Å$^0$ & Walden product($\Lambda^0\eta^0$, s cm$^2$ mol$^{-1}$ cp ) |
|------------------------|--------------------------------------------------------|
|                        | Water-MeOH    | Water-DMF    | Water-MeOH    | Water-DMF    |
| 0                      | 11.52 x 10$^{-1}$ | 11.32 x 10$^{-1}$ | 2.08         | 1.98         |
| 20                     | 11.49 x 10$^{-1}$ | 13.18 x 10$^{-1}$ | 2.01         | 2.09         |
| 40                     | 12.41 x 10$^{-1}$ | 11.60 x 10$^{-1}$ | 1.88         | 1.99         |
| 60                     | 12.81 x 10$^{-1}$ | 13.37 x 10$^{-1}$ | 2.04         | 2.73         |
| 80                     | 16.81 x 10$^{-1}$ | 16.14 x 10$^{-1}$ | 1.99         | 2.34         |
| 100                    | 16.26 x 10$^{-1}$ | -             | 1.97         | 2.78         |
Estimated Derived Sodium salt of Methane Sulphonic acid electrolyte values amplify with organic solvent by rising heat at all belongings payable to magnify during thermal power with the mobility of sodium saltsions. Limiting $\Lambda_n$ standards are experiential to subsist dependent on symphony of the organic aqueous duel mixture solvent additionally. At every one heat, these principles were highest in 100% water. By the addition of organic solvent MeOH to pure water, they progressively Derived Sodium salt of Methane Sulphonic acid electrolyte decrease to 60% organic MeOH. The composition of organic liquid MeOH and DMF 80 % (v/v) to derived Sodium salt of Methane Sulphonic acid electrolyte again increase up to pure 100% can say it as more stabilized in organic composition than in 100% water.

4. Conclusion
The paper concludes from these results that ion-conductance and Walden product pressure coefficient and Hydrodynamic Radii parameters are physically powerful in superior percentage of 80% water-MeOH and water-DMF.

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