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Title Key: **Molar conductance of sodium benzoate in glycerol …**

Molar conductance of sodium benzoate in glycerol solutions at 303.15K

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Abstract

Molar conductance of sodium benzoate has been measured in water at 303.15 K temperature and atmospheric pressure in the concentration range 0.004948 to 0.009896 mol/dm^3. Experimental data have been used for calculating specific conductance, molar conductance. Experimental results have been explained on the basis of Debye Huckel Onsagar equation.

Key words Molar conductance, limiting molar conductance, Debye-Huckel-Onsagar equation, regression analysis

1. Introduction

Sodium benzoate is sodium salt of benzoic acid, commonly used as good preservative. This colourless solid is miscible with water and certain organic solvents. It is bacteriostatic and fungistatic under acidic conditions. It is most widely used in acidic foods such as salad dressings (vinegar), carbonated drinks (carbonic acid) jams and fruit juices(citric acid) pickles, and condiments. It is also used as a preservative in medicines and cosmetics Concentration as a food preservative is limited by the FDA in the U.S. to 0.1% by weight. Sodium benzoate is also allowed as an animal food additive at up to 0.1%, according to AFCO's official publication Sodium benzoate is used as a treatment for urea cycle disorders due to its ability to bind amino acids. This leads to excretion of these amino acids and a decrease in ammonia levels.

Glycerol also called glycerin is a simple polyhydric alcohol. It is a colorless, odorless, highly viscous liquid, sweet in taste and non-toxic. The glycerol backbone is found in all lipids known as triglycerides. It is widely used in the food industry as a sweetener and in pharmaceutical formulations. Glycerol has three hydroxyl groups that are responsible for its solubility in water and its hygroscopic nature. Glycerol is also used for production of nitroglycerin, which is an essential ingredient of various explosives such as dynamite, gelignite and propellants like cordite.

2. Materials and Methods

Chemicals

Purity of glycerol (s d Fine Chemicals>99 mole percent) was checked measuring boiling point several times using calibrated mercury thermometer before use as per standard procedures1,2 .Glass distilled water was used for preparation of standard solutions of potassium chloride (AR grade) and sodium benzoate (s d Fine Chemicals>99

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mole percent). Purity of solvents was checked before use measuring refractive index, density, viscosity and conductivity.

Experimental values of density, refractive index and specific conductance of water and glycerol were determined by standard procedures1,2,3, using vibrating tube density meter(Anton Paar), and Abbe's refractometer(Focus India) at 298.15K and compared with literature values4.Experimental and literature values4 for water are d/gcm-3 0.9972(lit 0.9970474), n_D 1.3326(lit 1.3325029), κ/Scm-1 6x10-6 (lit 5.89x10-6). Experimental and literature values4,6 for glycerol are d/gcm-3 1.255(lit 1.25512), nD 1.4738(lit 1.4735), κ/Scm-1 0.9x10-6 (lit 0.6 x10-7) .

Conductivity Measurement:

Cell constant of conductivity cell have been measured using standard potassium chloride solutions1,2.Conductance measurements were made at 303.15 K using conductivity meter (Equiptronics EQ-665), dip type conductivity cell (cell constant K 1.03 cm-1), thermostat (Toshniwal Constant Temperature Bath CAT No.GL15), and digital thermometer(1/100) 0C . Standard solutions of potassium chloride, for calibration of conductivity cell, were prepared in Pyrex glass containers. Glycerol solutions v/v% was prepared adding suitable aliquots of conductivity water and from calibrated burette8 in to the Pyrex glass container. Sodium benzoate solutions were prepared *in-si-tu* containing known mass of sodium benzoate and glycerol solution of known concentration in the to the Pyrex glass container, containing calibrated conductivity cell. Statistical mean value of conductivity, calculated from several measurements of conductance, used for further computations.

3. **Results and Discussion:**

Experimental values of molar conductance of sodium benzoate in aqueous glycerol solutions 5%, 10%, 15% and 20% v/v as a function of concentration of solute 'C' at 303.15 K are given inData in above table clearly shows that molar conductance of the solute decrease with increasing concentration of glycerol in the given concentration range in water.

$$\lambda = \lambda^0 - \left\{ \frac{82.4}{(\varepsilon T)^{1/2}\eta} + \frac{8.20 \times 10^5}{(\varepsilon T)^{1/2}} \lambda^0 \right\} \sqrt[2]{c}$$

.Variation of molar conductance of sodium benzoate as a function of concentration of glycerol in the concentration range 0.004948

to 0.009896 mol/dm3 shown in Fig.1 reveals that the molar conductance decreases with increasing concentration of glycerol.
Molar conductance of the sodium benzoate glycerol in water has been explained on the basis in of Debye- Huckel Onsagar equation5:

where ε and η are the relative permittivity and viscosity of medium respectively, at the absolute temperature T and C is the concentration of solute in moles per liter.
Variation of molar condutance of sodium benzoate as a function of square root of concentration in glycerol solutions in water is shown in Fig. 1 and shows that molar conductance is a non-linear function of square root of concentration and clearly shows the invalidity of Debye Huckel Onsagar equation.

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Table 1.

Table 1: Molar conductance of sodium benzoate in glycerol at 303.15 K

Concentration 'C' mol/dm3	√C	Molar Cond λ in 5% glycerol	Molar Cond λ in 10% glycerol	Molar Cond λ in 15% glycerol	Molar Cond λ in 20% glycerol
0.004948	0.002474	167.8045	141.0053	124.5134	104.7232
0.005075	0.002537	163.4386	137.1787	120.7172	101.9041
0.005208	0.002604	158.5134	133.5829	116.4664	99.34997
0.005349	0.002675	153.8081	130.5252	112.1811	96.65922
0.005498	0.002749	149.2801	126.9047	108.8709	93.50876
0.005655	0.002827	144.2585	122.7934	105.4318	91.22696
0.005821	0.002911	139.4097	119.1536	101.8763	88.17365
0.005997	0.002999	135.2584	115.615	98.49729	85.30819
0.006185	0.003092	132.4625	110.8252	95.52077	82.59116
0.006384	0.003192	128.5228	106.9785	92.12035	79.73859
0.006597	0.003299	124.5392	103.6667	88.82405	77.22822
0.006825	0.003412	120.0591	100.1215	85.38498	74.33261
0.007068	0.003534	115.5584	96.97205	81.41612	71.71891
0.00733	0.003665	111.0208	93.1748	79.08587	69.12969
0.007612	0.003806	106.6074	89.88468	75.94907	66.36834
0.007917	0.003958	101.7856	86.16345	72.63498	63.93811
0.008247	0.004123	97.66471	82.97047	69.61208	61.15176
0.008605	0.004303	93.37605	79.19925	66.65823	58.75194
0.008996	0.004498	88.80034	75.58006	63.48227	56.99685
0.009425	0.004712	84.66114	72.16084	60.45601	53.41039
0.009896	0.004948	80.29467	69.26575	59.67986	49.99091

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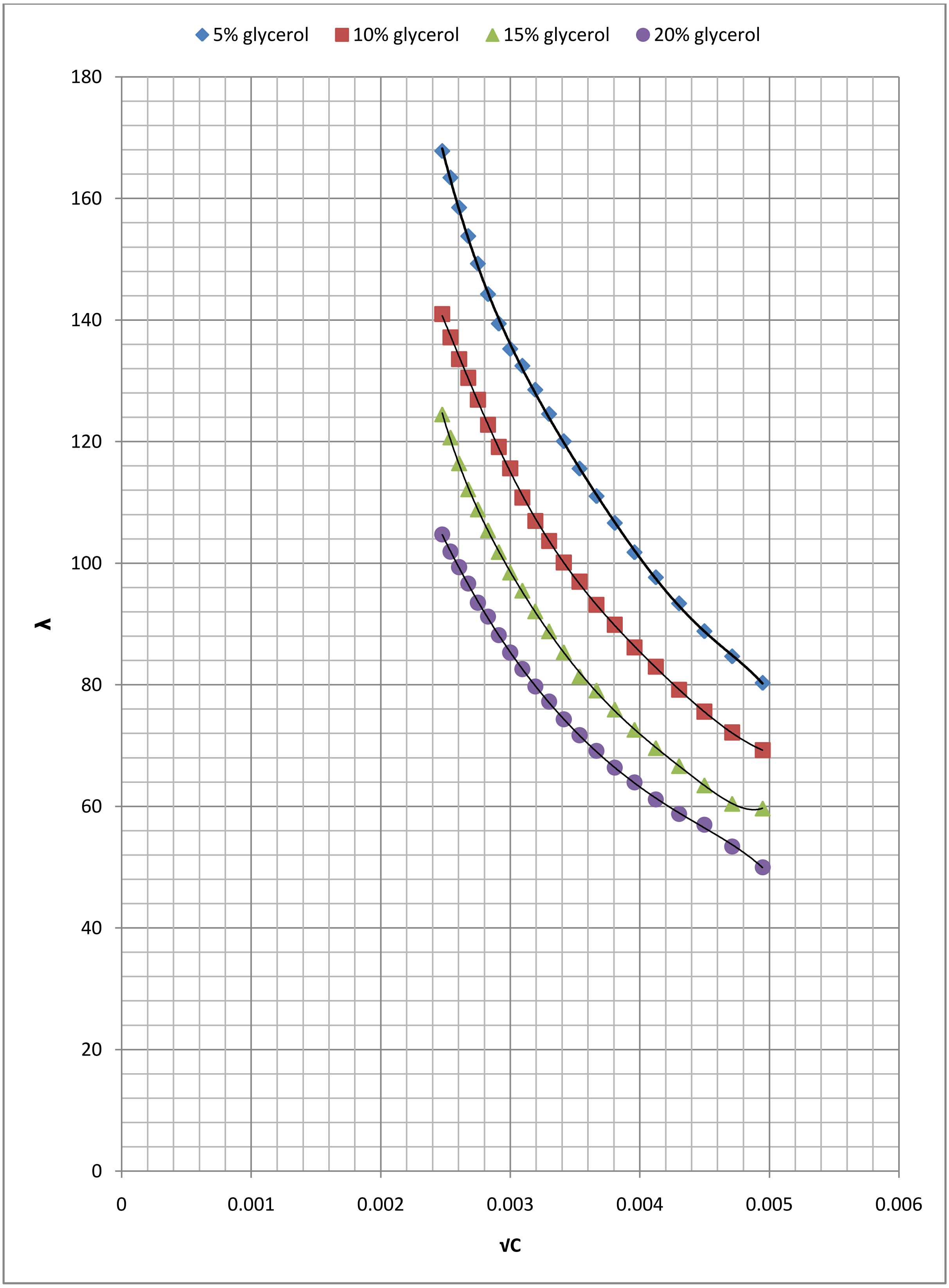

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