Research Article **CODEN: AJPAD7** **ISSN: 2321 - 0923**

Asian Journal of Pharmaceutical Analysis and Medicinal Chemistry

Journal home page: www.ajpamc.com

https://doi.org/10.36673/AJPAMC.2020.v08.i04.A21

MOLAR PROPERTIES OF N-PHENYL-2-BROMOBENZOHYDROXAMIC ACIDS IN DMSO AT VARIOUS TEMPERATURES

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ABSTRACT

Densities (□) for solutions of (0.01, 0.02, 0.03, 0.04, 0.05, 0.06, 0.07, 0.08, 0.09 and 0.1M) N- Phenyl-2-bromobenzohydroxamic acid (PNBHA) in dimethylsulphoxide (DMSO) have been measured at temperatures (298.15, 303.15, 308.15 and 313.15K) under atmospheric pressure. Apparent molar volume (ϕ_v) and partial molar volume (ϕ_v^0) and Excess Molar Volumes have been calculated from experimental values of densities. These parameters have been used to discuss the solute-solvent interactions.

KEYWORDS

Density, Refractive index and Hydroxamic acid.

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INTRODUCTION

Molar properties are great possibility for the investigation of sub-atomic cooperation and augmentation of arrangement hypothesis since they rely upon solute and solute-dissolvable collaborations and the underlying impacts emerging from interstitial convenience[1-5]. Properties, for example, densities and their variety with temperatures and creation of the arrangement are helpful to configuration designing cycles and in synthetic and organic enterprises[6-10]. The boundaries, evident molar volumes and restricting obvious molar volumes of weaken arrangements can be utilized for the improvement of atomic models for depicting the thermodynamic way of behaving of solutions. The ϕv values V depend

upon sub-atomic size, shape, associations and underlying impacts among the dissolvable[11]. Overabundance properties of arrangements, for example, deviation in molar volume called abundance molar volume, are valuable for the plan of partition procedures and to test speculations of arrangements[12]. Dimethylsulfoxide (DMSO) a run of the mill aprotic dissolvable having both polar and nonpolar gatherings, is a significant dissolvable in science, biotechnology and medication for the disintegration of different substance and as an antidepressing specialist of living cell. The hydroxamic corrosive usefulness, - C(= O).N.OH, is a vital underlying constituent of numerous biomolecules, some of which, are normally happening and others, for example, peroxidase, grid metalloproteinase and urease inhibitors[13,14] are of manufactured beginning. Hydroxamic corrosive subsidiaries stand out because of their organic action particularly as protein inhibitors[15] and metal chelators[16]. Hydroxamic acids are adaptable reagents in scientific science[17,18] and are broadly utilized in medication as analgetics, hostile to inflamatories[19], anti-microbials[20], anticancer specialist[21], antifungal and hypotentive specialist[22]. Throughout the last ten years, our exploration bunch has put forth a few noteworthy attempts to study the steric and overabundance properties of twofold and unadulterated frameworks of various subsidiaries of hydroxamic acids. The information are deficient in the writing on the densities and Volumetric properties of N-Phenyl-2-bromobenzohydroxamic acids unadulterated DMSO at various temperatures Therefore, in the present paper, we report density, Molar properties of solution over entire range of concentration and at temperatures, *T* = (298.15, 303.15, 308.15 and 313.15) K. These data are further used to calculate Molar Volume (V), apparent molar volume ϕv, Excess molar volume (V^E) in order to understand molecular behavior and the nature of solute-solvent interactions[23-25].

EXPERIMENTAL SECTION

MATERIAL AND METHODS

N-phenyl-2-bromohydroxamic acids was ready in this lab following the system announced in writing[26]. The solute was decontaminated by recrystalling threefold with benzene and dried over phosphorus pentaoxide in vaccum dessicator for a few hours. The liquefying still up in the air on a Rhythm device and is uncorrected. IR spectra were recorded with a FTIR 8400 Series Shimazdu (Japan) utilizing KBr pellets. Natural still up in the air with a Vario-EL examination contraption are displayed in Table No.1. These were purged by crystallization threefold with benzene and dried over phosphorus pentaoxide in vacuum desiccators for a few hours. DMSO of scientific grade was utilized for planning hydroxamic acids arrangement of differing fixation from (0.01 to 0.1M) by mass weakening strategy. Vulnerability in arrangement focus was assessed to be ±0.001 units. Properties of DMSO are displayed in Table No.2.

Measurement of Density, ρ

Densities of hydroxamic corrosive in not set in stone by utilizing a 10 cm3 twofold furnished pycnometer at four temperatures (298.15, 303.15, 308.15 and 313.15 K). The pycnometer was adjusted at wanted temperature with newly pre-arranged triple refined water. The gauge accuracy of thickness estimation of arrangement was ± 0.03kg.m^{-3}. The reproducibility of thickness estimation was ± 0.04kg.m^{-3}.

RESULTS AND DISCUSSION

The ρ upsides of all the N-phenyl-2-bromohydroxamic acids in DMSO at T = (298.15, 303.15, 308.15 and 313.15) K are introduced as a component of their focuses in Table No.3. From Table No.3 and diagram 1 show that ρ increments with expansion in the grouping of hydroxamic acids separately.

Molar Properties

Molar properties are thermodynamic amounts which show how any broad property of an answer or combination differs with change in molar structure of the blend at steady temperature and tension. Each broad property of combination has comparing halfway molar property. These properties result from trial estimations or relationship. For fostering the precise connection, exact estimations expect to guarantee that the

condition addresses the right actual way of behaving of estimated property.

Molar volume of hydroxamic acid solutions, v

The molar volumes of hydroxamic acids arrangement are determined following the articulation (12),

$V = (x_1M_1+x_2M_2) /d$ [1]

Where, x_1, Mole fraction of DMSO, x_2, Mole fraction of solute, M_1, Molecular weight of DMSO, M_2, Molecular weight of solute d, Density of solution. The information of molar volume are shown in Table No.4. From the table it is obviously seen that the worth of molar volume increments with expansion in focus and temperature shows solid solute-dissolvable cooperation.

Excess Molar volume, V^E

The excess properties of solution are important to understand and interpret the nature of interactions between the molecules of mixture. Excess molar volume obtained by following the expression,

$V^E = V-(x_1V_1 + x_2V_2)$ [2]

Where, V, Molar volume of hydroxamic acid solution, V_1, Molar volume of DMSO, V_2, Molar volume of solute, x_1, Mole fraction of DMSO, x_2, Mole fraction solute. The data are reported in Table No.5.

Apparent Molar Volume, ϕv

Apparent molar volume has been useful in understanding solute-solvent interactions. The temperature dependence of ϕ_v and some extra thermodynamic assumption can be used to calculate partial molar expansibility at infinite dilution.

These limiting quantities depend on size and solute-solvent interactions. The apparent molar volume, ϕ_v, is obtained by following the equation,

$\phi_v = 1000(d_1-d)/cdd_1 + M/d$ [3]

Where C, Molarity of the solution, M, Molar mass of the solute D, Density of solution. The values of ϕ_v calculated are positive throughout the concentration and temperature range investigated. The data are reported in Table No.6.

Apparent Molar Volume at infinite dilution, ϕ_V^0

Apparent molar volume at infinite dilution is also called partial molar volume at infinite dilution or standard partial molar volume, since ϕ_V^0 provides information concerning solute-solvent interactions. The contribution towards a property of the solution by one mole of a component is known is its partial molar property. Thus partial molar volume of a component in a mixture is defined as, *"Its contribution towards volume of mixture by one mole of it's"* The values of ϕ_v^0 are calculated by the method of least square and fit to plot of ϕ_v versus $c^{1/2}$ in accordance with the Masson empirical relation,

$$\phi_v = \phi_V^0 + S_V^* c^{1/2} \quad [4]$$

Where, S_V^* = Experimental slope. The values of apparent molar volume at infinite dilution are obtained from extrapolation of the plot to zero concentration. The data are reported in Table No.7. The values of experimental slope are displayed in Table No.8. Larger and Positive value of apparent molar volume at infinite dilution suggests strong solute-solvent interactions.

Table No.1: IR spectra and elemental analysis of five hydroxamic acids

S.No	Hydroxamic acids	M. P. (Reported)	M. P. (Observed)	Elementary Analysis						IR KBr_υ cm^{-1}			
				Theoretical			Observed			N-OH	C=O	C-N	N-O
		°C	°C	C	N	H	C	N	H				
1	N- Phenyl-2-bromo	113	113	53.45	4.80	3.43	53.60	4.70	3.60	3100	1610	1320	1018

Table No.2: Properties of DMSO

S.No		ρ_o/gcm^{-3} [a] ρ_o [16] [b], ρ_o [17], [c] ρ_o [18],	
	T/K	This work	Lit
1	298.15	1.0947	1.0955[a] 1.09475[b]
2	303.15	1.0907	1.0896[c] 1.09076[b]
3	308.15	1.0860	1.0855[a] 1.08606[b]
4	313.15	1.0804	1.08045[b] 1.0797[c]

Table No.3: Density (g cm^{-3}) of N-phenyl-2-bromobenzohydroxamic acid in DMSO at various temperatures

S.No	Conc	298.15	303.15	308.15	313.15
1	0.01	1.085106	1.084445	1.08345	1.08173
2	0.02	1.087185	1.085477	1.08447	1.08275
3	0.03	1.088224	1.087538	1.0855	1.08376
4	0.04	1.090303	1.08857	1.08652	1.08579
5	0.05	1.09078	1.08867	1.0869	1.08598
6	0.06	1.091342	1.0896	1.08756	1.08681
7	0.07	1.092381	1.09063	1.08957	1.08783
8	0.08	1.09345	1.09172	1.09064	1.08986
9	0.09	1.0945	1.09263	1.09246	1.09084
10	0.10	1.09653	1.09456	1.09369	1.091888

Table No.4: Molar volume (V) cm^{3}mol^{-1} of n-phenyl-2-bromobenzohydroxamic acid in DMSO

S.No	Conc	298.15	303.15	308.15	313.15
1	0.01	70.6833	70.9432	71.2434	71.7211
2	0.02	70.6857	71.0101	71.3174	71.7895
3	0.03	70.7585	71.0190	71.3915	71.8646
4	0.04	70.7609	71.0860	71.4658	71.8737
5	0.05	70.8660	71.2181	71.5796	72.0021
6	0.06	70.9715	71.2985	71.6740	72.0910
7	0.07	71.0384	71.3726	71.6830	72.1667
8	0.08	71.1055	71.4403	71.7579	72.1692
9	0.09	71.1792	71.5213	71.7736	72.2518
10	0.10	71.1882	71.5303	71.8355	72.3212

Table No.5: Excess molar volume (V^E) cm^3mol^{-1} of n-phenyl-2-bromobenzohydroxamic acid in DMSO

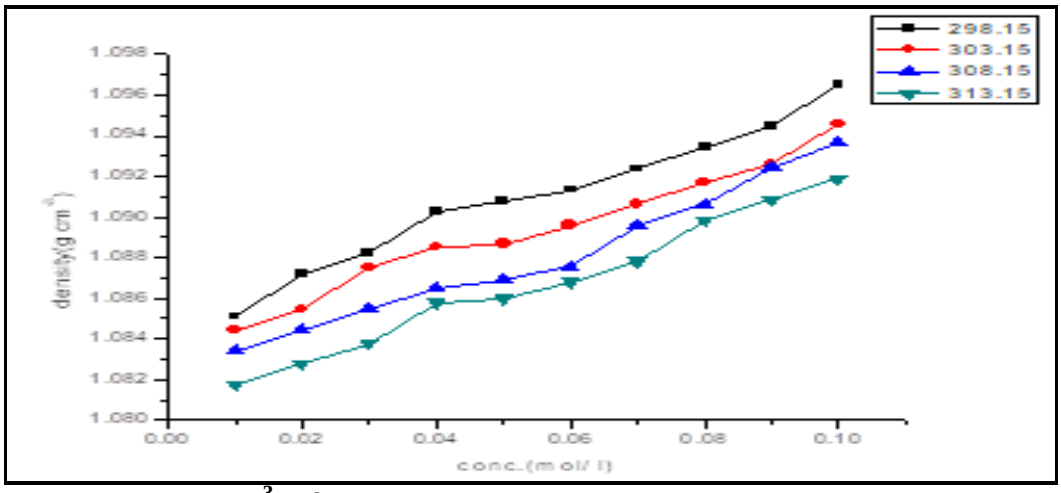
S.No	Conc	298.15	303.15	308.15	313.15
1	0.01	-0.7717	-0.8990	-0.8709	-0.8286
2	0.02	-0.9052	-0.9692	-0.9355	-0.9005
3	0.03	-0.9688	-1.0974	-1.0001	-0.9661
4	0.04	-1.1025	-1.1679	-1.0649	-1.0974
5	0.05	-1.1345	-1.1744	-1.0910	-1.1107
6	0.06	-1.1666	-1.2323	-1.1365	-1.1634
7	0.07	-1.2370	-1.2968	-1.2667	-1.2295
8	0.08	-1.3076	-1.3679	-1.3320	-1.3680
9	0.09	-1.3719	-1.4262	-1.4559	-1.4278
10	0.10	-1.5001	-1.5554	-1.5345	-1.5008

Table No.6: Apparent Molar volume (ϕv) cm^3mol^{-1} of n-phenyl-2-bromobenzohydroxamic acid in DMSO

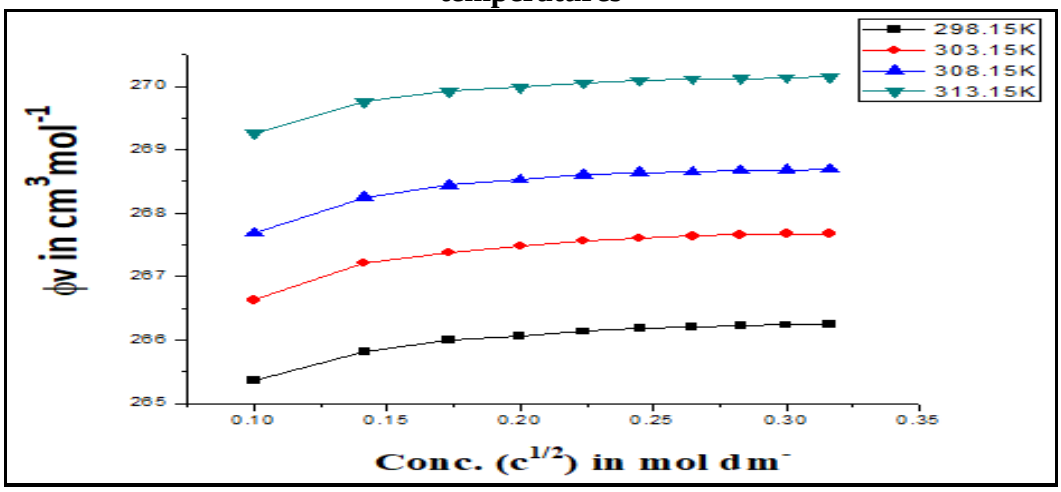
S.No	Conc	298.15	303.15	308.15	313.15
1	0.01	265.3591	266.6261	267.6830	269.2604
2	0.02	265.8105	267.2108	268.2496	269.7557
3	0.03	265.9945	267.3782	268.4385	269.9239
4	0.04	266.0614	267.4825	268.5329	269.9848
5	0.05	266.1307	267.5635	268.6006	270.0547
6	0.06	266.1769	267.6052	268.6412	270.0921
7	0.07	266.2021	267.6337	268.6530	270.1161
8	0.08	266.2210	267.6539	268.6734	270.1214
9	0.09	266.2367	267.6717	268.6801	270.1378
10	0.10	266.2402	267.6758	268.6918	270.1492

Table No.7: Apparent Molar volume (ϕ_V^0) cm^3mol^{-1} at infinite dilution and Experimental slope (S_V^*) cm^3mol^{-1} of n-phenyl-2-bromobenzohydroxamic acid in DMSO

S.No	Hydroxamic acids	Apparent molar volume at infinite dilution, ϕ_V^0				Experimental slope, s_V^*			
		298.15K	303.15K	308.15	313.15	298.15K	303.15K	308.15K	313.1K
1	N-phenyl-2-bromobenzo-	265.2544	266.5296	267.6135	269.1918	3.5111	4.0973	3.8764	3.4173



Graph No.1: Density (g cm^{-3}) of N-phenyl-2-bromobenzohydroxamic acid in DMSO at various temperatures



Graph No.2: Experimental slope (S_v^*) cm^3mol^{-1} of n-phenyl-2-bromobenzohydroxamic acid in DMSO

CONCLUSION

The hydroxamic corrosive practical gathering − NOH •C = O shows an extensive variety of natural action. Utilizing thickness information, fractional molar volumes, evident molar expansibilities at boundless weakening. The way of behaving of the boundaries recommends solid solute-dissolvable collaboration. Bigger and Positive worth of clear molar volume at limitless weakening areas of strength for proposes dissolvable connections. It goes about as design creator in DMSO however hydrogen bond development. As hydroxamic acids are bioactive atoms these boundaries will be of additional utilization in Quantitative Design Action Relationship studies.

ACKNOWLEDGEMENT

The authors wish to express their sincere gratitude to Department of Science and Humanities, Government Polytechnic, Mahasamund, Chhattisgarh, India for providing the necessary facilities to carry out this research work.

CONFLICT OF INTEREST

We declare that we have no conflict of interest.

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Please cite this article in press as: Veenu Verma. Molar properties of n-phenyl-2-bromobenzohydroxamic acids in DMSO at various temperatures, *Asian Journal of Pharmaceutical Analysis and Medicinal Chemistry*, 8(4), 2020, 195-202.