Densities and Refractive Indices of Substituted Hydrazone at Different Binary Mixture of Different Compositions

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Abstract

Molar refraction (Rm) and polarizability constant (α) of some different substituted hydrazone drugs have been investigated by measuring the densities and refractive index of different molar solution in different binary solvent. Also extension with this all above parameter are investigated at same concentration of substituted hydrazone drugs in different percent solution. Mesurement of refractive index has studied by Abbe's refractometer. It could be seen that molar refraction and polarizability constant of substituted hydrazone drugs increases with increase in percentage of organic solvents. This data have been used to determine molecular solute-solvent, solutesolute interactions in the system.

Key word: substituted hydrazone, Density(d), refractive index (n), Molar refraction (Rm) and polarizability constant (α), Refractometry.

Introduction

The refractive index is an important additive property of liquid, it also depends on the structural arrangement of atom in molecule. The value of refractive index depends upon the temperature as well as the wavelength of light used. When a light of beam passes from one substance to another, the beam is bending so that it travels in different direction. If it is passed from less dense to high denser medium it is refracted toward normal to form angle of refraction which is less than angle of incident. The refractive index is the ratio of angle of incident to the angle of refraction. The properties of liquid such as viscosity, refractive index and ultrasonic velocity of binary mixtures are studied by many workers [1,2,3,4,5] Sengwa[6] have studied dielectric constants and refractive indices of binary mixtures. Devsarkar[7] , Dhondge[8] and Pethe[9] have studied the refractive indices in mixed solvents. Wagh[10] have studied the refractive indices in mixed solvents. have studied molar refraction and polarizability of 2-amino-5-chloro - benzene sulphonic acid and 2-hydroxy ethyl benzene in dioxane water and DMF-water medium respectively. Sharma[11] has been studied density and refractive index of binary liquid mixture

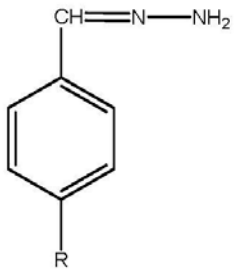
Eucalyptol with hydrocarbons at different temperatures. The properties of liquid such as refractive index of binary mixture were studied by many workers[12,13,14,15,16] Yadava[17] has studied refractive indices of binary mixture of bromoalkane and non polar hydrocarbons. Sonune[18] has been studied additive properties such as molar refractivity and molar polarizability constant of all opurinal, acenocoumarol, warfarin and amoxicillin in different media. Deosarkar et.al[19] , Meshram[20], Anwar Ali[21] have studied the molar refraction and polarizability constant of some substituted sulphonic acid at different concentration and in different percentage of organic solvent-water mixture at 303K. The present work deals with the study of molar refraction and polarizability constants of some different substituted hydrazone drugs in different percentages of solvent concentration. Substituted hydrazone used for present work as –

The different substituted hydrazone ligand used for present work-

Ligand A= (4-Bromo-benzylidene)-hydrazone

Ligand B= (4-Methoxy-benzylidene)-hydrazone

Ligand C= Benzylidene-hydrazone



Where,R= Br, OCH_3, H.

Material and Method

In the present investigation, refractive indices of liquid mixtures were measured with the help of Abbe's refractometer, specially designed to measure the refractive indices of the small quantities of the transparent liquids, solutions ranging from 1.300 to 1.700 rapidly by direct reading. The solutions of ligand in different percentage of different binary mixtures in same concentration. All the weighings were made on one pan digital balance (petit balance AD_50B) with an accuracy of + 0.001 gm.. The densities of solutions were determined by a calibrated bicapillary pyknometer (± 0.2%) having a bulb volume of about $10cm^3$ and capillary having an internal diameter of 1mm. The refractive indices of solvent mixture and solutions were measured by Abbe's refractometer at (25 ± 0.1°C). The accuracy of Abbe's refractometer was within ±0.001 units. The constant temperature of the prism box is maintained by circulating water from thermostat at $25^0C \pm 0.1^0C$.

Calculation

The molar refraction of solvent and solution are determined by using Lorentz-Lorentz equation.

The molar refraction of solvent, DMF-water mixtures are determined from-

$$R_{DMF\text{-}W} = X_1R_1 + X_2R_2 \quad \text{.....(1)}$$

where , R_1 and R_2 are molar refractions of DMF and water respectively.

The molar refraction of solutions of ligand in DMF-water mixtures are determined from-

$$RMix = \frac{(n2-1)}{(n2+2)} + \left\{\frac{[X1M1 + X2M2 + X3M3]}{d}\right\} \quad \text{.... (2)}$$

where,

n is the refractive index of solution, X_1 is mole fraction of DMF,

X_2 is mole fraction of water And X_3 is mole fraction of solute,

M_1, M_2 and M_3 are molecular weights of DMF, water and solute respectively.

'd' is the density of solution.

The molar refraction of ligand is calculated as –

$$R_{lig} = R_{mix} - R_{DMF-w} \quad \text{..... (3)}$$

The polarizability constant (α) of ligand is calculated from following relation-

$$R_{lig} = 4/3\ \pi No\alpha \quad \text{..... (4)}$$

where, No is Avogadro's number.

Result And Discussion

Table 1: Values of Molar Refraction of Different % of DMF- Water Mixture

Percentage of DMF	[R]
20	15.9059
40	13.076
60	11.765
80	10.239
100	6.534

Table 2: The values of refractive index (n) and density (gm/cm-3) at 303K.

Conc in %	DMF+ Water system	
	Refractive index (n)	Density (d) gm/cm^3
Ligand A		
20	1.357	0.996104
40	1.384	0.997067
60	1.405	0.979274
80	1.42	1.0056
100	1.43	1.00987
Ligand B		
20	1.358	0.98499
40	1.377	0.99551
60	1.4	0.99602
80	1.421	1.00669
100	1.431	0.99074
Ligand C		

20	1.357	0.98448
40	1.378	0.994913
60	1.401	0.996021
80	1.422	0.997271
100	1.432	0.989573

Table 3:The values of Molar polarization (Rm) and polarizability constant(α) at 303K.

Conc in Mol/Lit	At different concentration of DMF+ Water system	
	Rm $x10^3$ cm^3/mole	α $x10^{-23}$ cm^3
Ligand A		
20	36.1193	1.4323
40	42.8580	1.6996
60	47.5613	1.8861
80	48.7965	1.9351
100	50.2172	1.9914
Ligand B		
20	25.0739	1.080
40	28.7482	1.14
60	31.4264	1.2462
80	33.1560	1.3148
100	34.7952	1.3798
Ligand C		
20	22.5035	1.0121
40	25.8762	1.0261
60	28.2456	1.1201
80	30.0671	1.1923
100	31.2868	1.2407

Fig- 1 to 4: Graphical representation of molar refraction (Rm) of all ligand of 0.01M concentration verses in different percentage of (DMF+water) solvent.

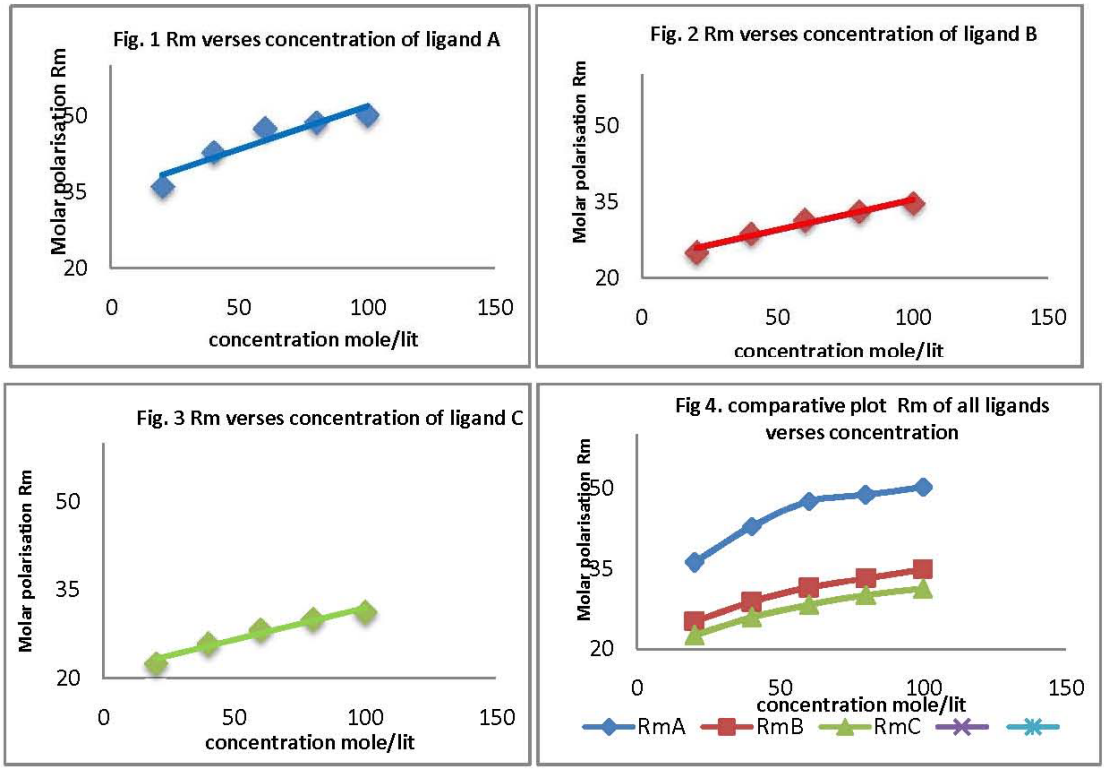


Table 4: Values of Molar Refraction of Different % of Ethanol- Water Mixture

Percentage of Ethanol	[R]
20	19.6019
40	17.026
60	15.465
80	12.139
100	8.434

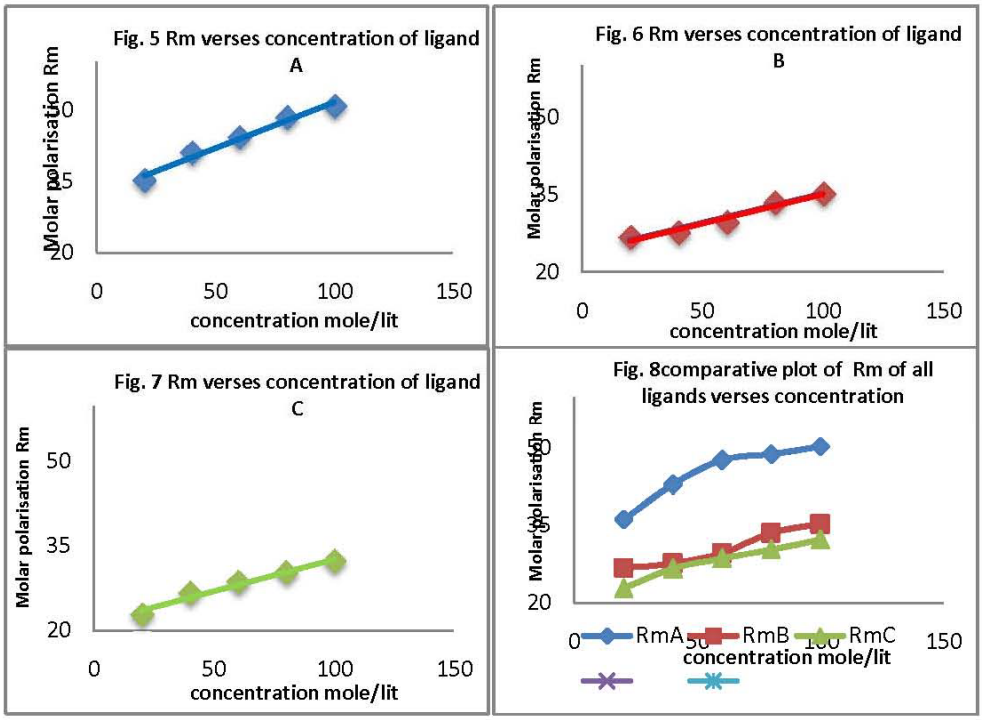
Table 5: The values of refractive index (n) and density (gm/cm-3) at 303K.

Conc in %	Ethanol+ Water system	
	Refractive index (n)	Density (d) gm/cm^3
Ligand A		
20	1.345	0.991978
40	1.356	0.967403
60	1.361	0.94599
80	1.365	0.890732
100	1.368	0.861685
Ligand B		
20	1.344	0.999753
40	1.354	0.975504
60	1.355	0.956409
80	1.366	0.927334
100	1.367	0.8956
Ligand C		
20	1.354	0.999489
40	1.36	0.980421
60	1.361	0.979523

Table 6: The values of Molar polarization (Rm) and polarizability constant(α) at 303K.

Conc in Mol/Lit	At different concentration of Ethanol+ Water system	
	Rm $x10^3$ cm^3/mole	α $x10^{-23}$ cm^3
Ligand A		
20	35.1238	1.09
40	40.9782	1.15
60	44.2154	1.28
80	48.3822	1.35
100	50.7533	1.39
Ligand B		
20	26.7390	1.502
40	27.6662	1.704
60	29.6419	1.941
80	33.4681	1.992
100	35.2076	1.995
Ligand C		
20	22.77	2.74
40	26.5792	3.13
60	28.5676	3.36
80	30.2855	3.55
100	32.2776	3.7

Fig 5 to 8 Graphical representation of molar refraction (Rm) of all ligand of 0.01M concentration verses in different percentage of (Ethanol+water) solvent.



The value of molar refraction of different percent of (DMF+water) solvent shown in table-1 and(Ethanol+water) shown in table 4. From the data it is observed that the values of molar refraction decreases with decrease in concentration of water. The values of molar refraction and polarizability constant of substituted hydrazone drugs increases with increase in percentage of organic solvents(Table 3 and table 6). Molar refraction is greater in polar protic solvent than polar aprotic solvent.This is due to the ability of formation hydrogen bonding of protic solvent(water).

The values of molar refraction and polarizability constant of substituted hydrazone drugs having same concentration in different percentage of different binary mixture presented in table3 and table 6. It shows that the values of molar refraction and polarizability constant of substituted benzylidene hydrazone increases with increase in percentage of organic solvents. This is due to fact that the dipole in substituted benzylidene hydrazone drugs lies perpendicular to the longer axis of molecule and with increase in percentage of solvents causing decrease in dielectric constant of medium, considerable dipole association take place. The graph Rm verses concentration are plotted and shown in fig. 1 to 4 for DMF+water and in fig 5 to 8 for

ethanol+water. It could be seen that there is linear relationship between molar refraction and concentration. It is also observed that the refractive index is linearly related to the percentage of dissolved solid in a solution in different solvent. By comparing the values of refractive index of solution to that of standard curves, the concentration of solute can be determined with good accuracy. In this case we get a same trends of molar refraction and polarizability constant which depends upon polar and ring activating substituent's. It is observed that the substance containing more polar groups normally have higher refractive index than substance containing less polar groups. From the data it is concluded that, the substituent which increase the electron density on a ring by resonace effect and also polar in nature have greater value of molar refraction and polarizability than other substituent.

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