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Research Article

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Refractometric study of azomethine drugs in different composition

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ABSTRACT

Molecular interaction such as solute-solute, solute-solvent and solvent-solvent interactions in the substituted azomethine drug in the different percentage of organic solvent has been pointed out. In the present work refractive index and the densities of the substituted azomethine in different percent of various organic solvents were reported. The data thus helps to determines Molar refraction (Rm) and polarizability constant (α) of some different substituted azomethine in binary mixture. Observations showed that the molar refraction and polarizability constant of substituted azomethine drugs increases with increase in percent composition of organic solvents.

Keywords: substituted azomethine, molar refraction(rm), polarizability constant(α), refractive index, refractometry.

INTRODUCTION

Refractive index of a liquid is very important property, which gives idea about geometry and structure of molecule. The refractive index (n) of the medium is the ratio of the velocity of light in vacuum to that in the medium. Its value depends upon the temperature and the wavelength of light used. Generally, the D-line of sodium is used for standard measurements. The refractive index is the ratio of angle of incident to the angle of refraction. Measurement of refractive index shows very interesting applications in pharmaceutical, chemical, agriculture, food, oil and beverage industries.

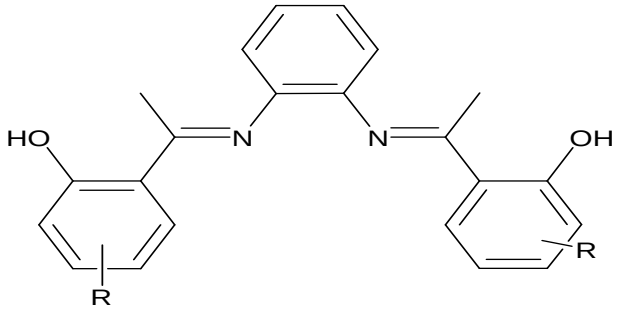
Many researcher have reported the refractive indices in mixed solvents[1-4]. The properties of liquid such as viscosity, refractive index and ultrasonic velocity of binary mixtures are studied by many workers[5-8]. Refractrometric study of S-trizinothiocarbamides in dioxane-water was also reported[9]. The refractometric measurements has very important role in medicinal and drug chemistry[10-12]. Oswal[13] have studied dielectric constants and refractive indices of binary mixtures. Dadhichi[14] have investigated the measurement of viscosity, refractivity index and metal ligand stability constant of substituted benzofurones in different solvents. Refractive indices of binary, ternary liquid solutions and solutions of biologically important compounds have been studied [15–21].

EXPERIMENTAL SECTION

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 liquid by direct reading. The ligands of which physical parameters is to be explore are synthesized by using reported protocol[22]. The solutions of ligand in different percent composition of binary mixtures were prepared by weight. All the weighing 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 precalibrated bicapillary pyknometer (± 0.1%). The constant temperature of the prism box is maintained by circulating water from thermostat at (27± 0.1)^{0}C. Following drugs used for the present work.

L_1 *=2,2'-(benzene-1,2diylbis[nitrilo(1E)eth-1-yl-1-ylidene]-dibenzene-1,4-diol*
L_2 *= 2,2'-(benzene-1,2diylbis[nitrilo(1E)eth-1-ylidene)bis(4-nitrophenol)*
L_3=*4'4-(benzene-1,2diylbis[nitrilo(1E)eth-1-yl-1-ylidene]bis(2,-chloro phenol)*
L_4=*4'4-(benzene-1,2diylbis[nitrilo(1E)eth-1-yl-1-ylidene]bis(2,6dichloro phenol)*



Calculation

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

RESULTS AND DISCUSSION

Table 1: Values of Molar Refraction of different composition of solvents

Solvent Mixture	Molar polarization (Rm)		
	DMSO	Dioxane	Ethanol
20%	15.0946	14.2357	19.1123
40%	14.2355	13.1155	18.5736
60%	12.7632	10.0759	15.0522
80%	10.8125	08.2301	12.7245
100%	5.7311	4.5711	7.0932
70%	10.2257	9.0325	14.0327

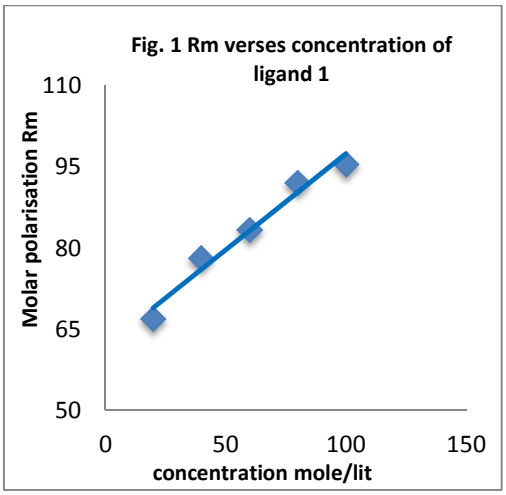
Table 2: The values of refractive index (n) and density(d) of 0.01M solution of ligand in different composition of DMSO, Dioxane and Ethanol solvent at 300K

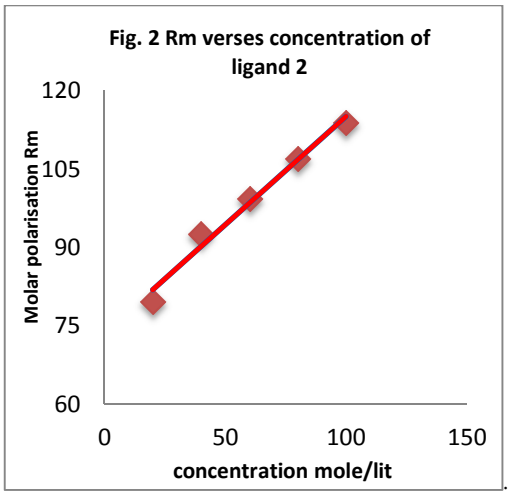
% composition of solvent	Refractive index(n)			Density(d) gm/cm^3		
	DMSO	Dioxane	Ethanol	DMSO	Doixane	Ethanol
L1						
20	1.355	1.301	1.385	1.0051	1.0051	1.0241
40	1.376	1.311	1.405	1.0150	1.0150	1.0277
60	1.387	1.323	1.432	1.0166	1.0166	1.0310
80	1.423	1.335	1.455	1.0176	1.0176	1.0339
100	1.37	1.355	1.486	1.0213	1.0213	1.0362
L2						
20	1.367	1.312	1.411	1.0027	1.0027	1.0072
40	1.387	1.323	1.432	1.0131	1.0131	1.0176
60	1.401	1.341	1.455	1.0150	1.0150	1.0237
80	1.432	1.351	1.486	1.0284	1.0284	1.0278
100	1.451	1.367	1.511	1.0155	1.0306	1.0313
L3						
20	1.384	1.325	1.432	1.0042	1.0042	1.0093
40	1.405	1.335	1.459	1.0087	1.0087	1.0130
60	1.423	1.359	1.486	1.0090	1.0090	1.0231
80	1.446	1.372	1.509	1.0197	1.0197	1.0267
100	1.465	1.387	1.532	1.0089	1.0209	1.0310
L4						
20	1.396	1.339	1.443	0.9987	0.9987	1.0119
40	1.425	1.351	1.473	1.0150	1.0150	1.0195
60	1.441	1.372	1.495	1.0199	1.0199	1.0232
80	1.463	1.385	1.523	1.0256	1.0256	1.0276
100	1.485	1.401	1.555	1.0257	1.0257	1.0357

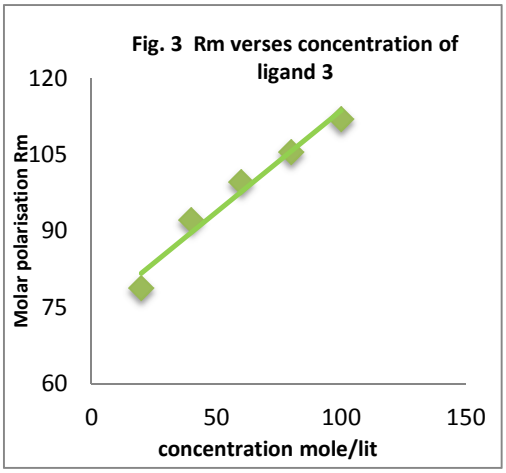
Table 3: The values of Molar refraction (Rm), polarizability constant (α) of 0.01M solution of ligand in different composition of DMSO, Methanol and Acetone solvent at 300K

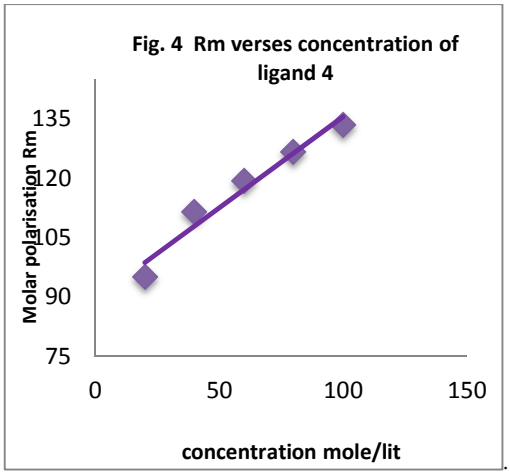
% composition of solvent	Molar refraction (Rm) x10^3 cm^3/mole			polarizability constant (α) x10^{-23} cm^3		
	DMSO	Dioxane	Ethanol	DMSO	Dioxane	Ethanol
L1						
20	66.8917	57.6362	70.0866	3.4796	2.2856	2.7794
40	78.0626	65.8380	81.6871	4.0625	2.6109	3.2394
60	83.3022	70.8890	89.7373	4.5844	2.8112	3.5587
80	91.9491	74.7821	95.5928	5.1449	2.9657	3.7909
100	95.4783	79.5399	102.2347	5.6868	3.1543	4.0543
L2						
20	79.5989	68.7954	86.9939	3.1331	2.7282	3.4499
40	92.5314	78.7384	100.6731	3.6445	3.1225	3.9923
60	99.3297	86.0426	109.0522	4.0136	3.4121	4.3246
80	106.918	89.0521	117.4013	4.2866	3.5315	4.6557
100	113.875	95.1013	123.6669	4.6205	3.7714	4.9042
L3						
20	78.7969	67.8873	86.3531	3.8283	2.6922	3.4245
40	92.1047	77.8228	101.4648	4.0812	3.0861	4.0237
60	99.6751	86.2908	109.8987	4.8935	3.4220	4.3582
80	105.5152	90.0569	116.3226	5.2259	3.5713	4.6129
100	111.9973	95.5152	121.7805	5.5646	3.7878	4.8294
L4						
20	103.4771	82.6679	102.5996	4.1035	3.2783	4.0687
40	117.3996	94.0953	120.6784	4.6557	3.7315	4.7875
60	125.9359	102.8379	130.2451	4.9942	4.0782	5.1651
80	133.2286	107.7419	138.7619	5.2834	5.2727	5.5028
100	139.9505	113.1568	146.5556	5.5500	4.4874	5.8119

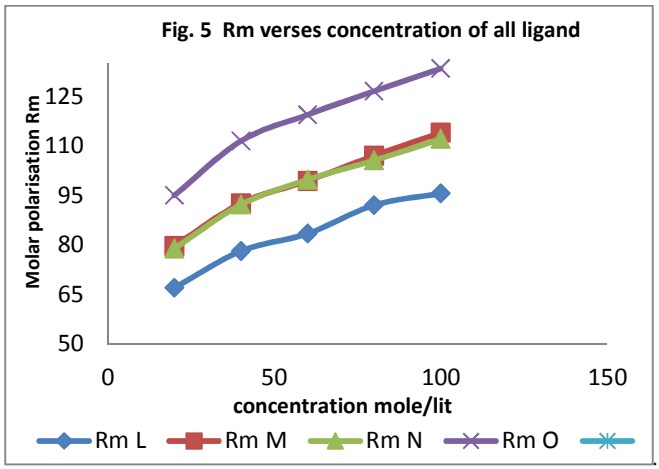
Graphical representation of molar polarization (Rm) of all ligand at 0.01M verses concentration in different percentage of DMSO solvent



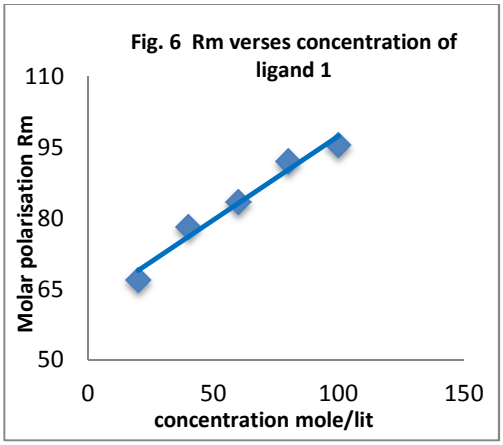


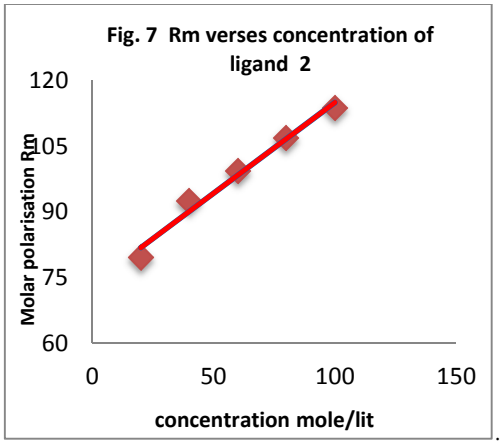


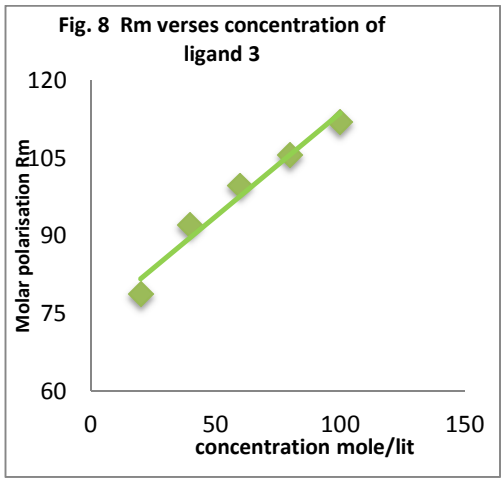


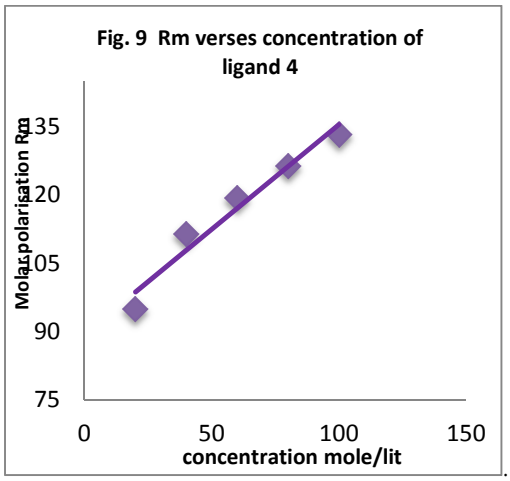


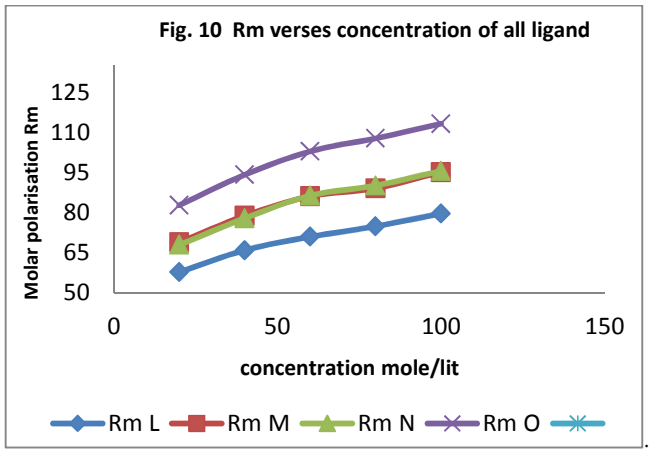
Graphical representation of molar polarization (Rm) of all ligand at 0.01M verses concentration in different percentage of 1,4-Dioxane solvent



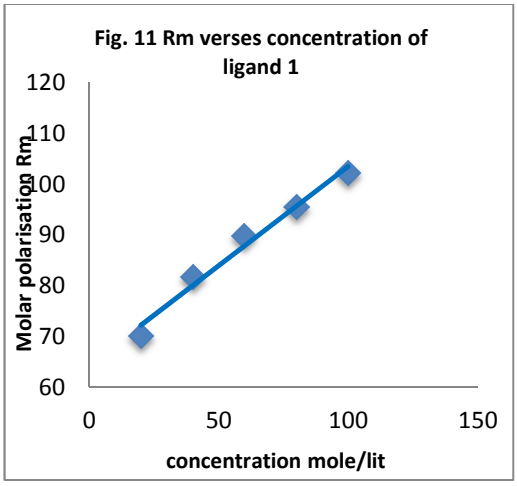


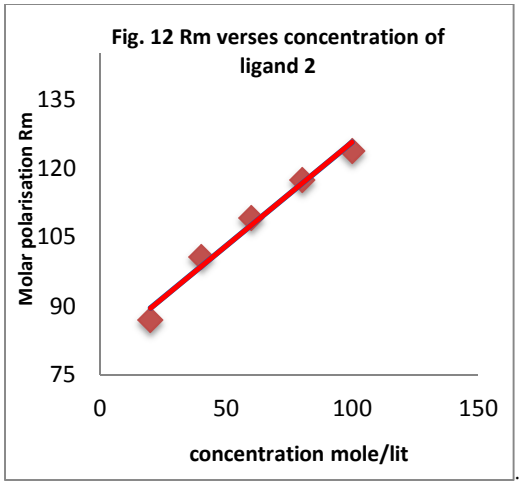


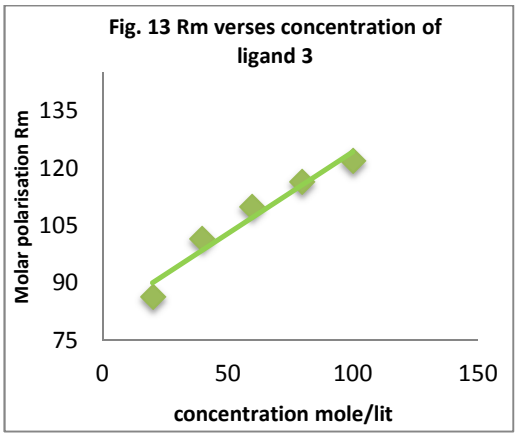


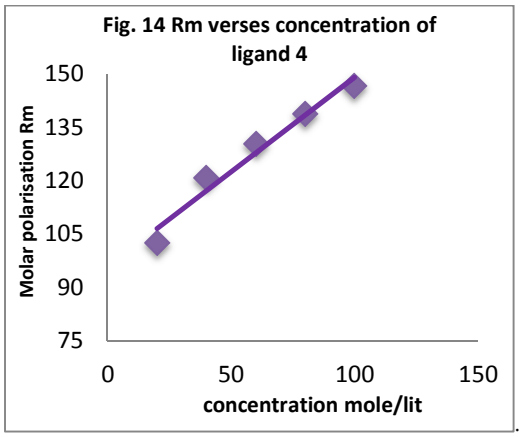


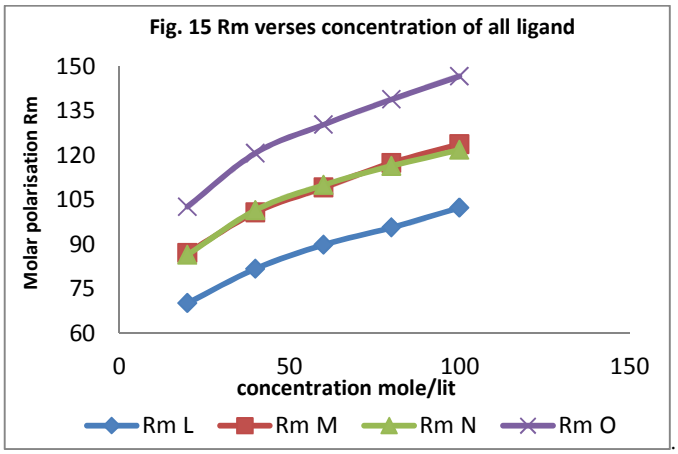
Graphical representation of molar polarization (Rm) of all ligand at 0.01M verses concentration in different percentage of Ethanol solvent











The value of molar refraction of different percent composition in binary mixture are shown in table-1. From the data it is observed that value of molar refraction goes on increasing with the decrease in amount of water in percent composition. Comparatively molar refraction of Ethanol is greater than DMSO and dioxane this is due to more value of dipole moment of DMSO.

Table-2 shows the comparative data of refractive indices and densities of ethanol, dioxane and DMSO, in different percent composition with water. From this, it is observed that, refractive index and density increases with the increase in percent composition of organic solvent. Graphical representation between molar refraction and percent composition of DMSO, dioxane and ethanol shows linear relationship.(Fig.1-5 DMSO, fig.6-10 dioxane, fig.11-15 ethanol) Those solvent having more value of dipole moment shows greater refractive index and density, also there is same trend in case of ligand used. Ligand having more dipole moment shows greater value of refractive index and less value of density.

Table-3 shows the comparative data of molar refraction and polarizability constant. These parameter provide important information about structural orientation of ligand in solution. From this it is observed that, molar refraction and polarizability constant in ethanol is higher than DMSO and 1,4-dioxane. The trend regarding increasing value of molar refraction and polarizability constant is ethanol > DMSO >1,4-dioxane. From this observation it is concluded that, ethanol has strong hydrogen bonding, which make solution more viscous which is responsible for more bending of light towards normal.

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