Available online at www.pelagiaresearchlibrary.com

Pelagia Research Library

Der Chemica Sinica, 2014, 5(5):12-18

Pelagia Research Library
ISSN: 0976-8505
CODEN (USA) CSHIA5

Refractometric study of some substituted oxoimidazoline drugs, in different concentration of solute and solvent at 298K

R. R. Tayade, M. M. Kalaskar and M. P. Wadekar*

Applied Chemistry Division, Govt. Vidarbha Institute of Science and Humanities, Amravati, Maharashtra, India

---

ABSTRACT

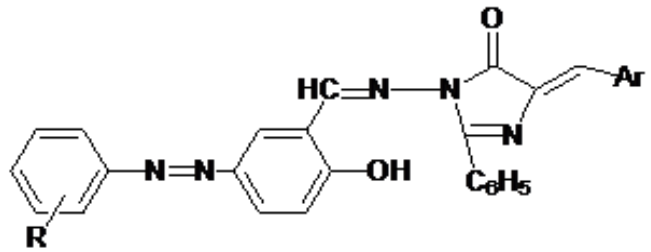
Molar refraction (Rm) and polarizability constant (α) of some different substituted oxoimidazoline drugs have been investigated by measuring the densities and refractive index of different molar solution in same 70% (DMF+water) binery solvent. Also extension with this all above parameter are investigated at same concentration of substituted oxoimidazoline drugs in different percent solution of (DMF+water) binery mixture. Mesurement of refractive index has studied by Abbe's refractometer. It could be seen that molar refraction and polarizability constant of substituted oxoimidazoline drugs increases with increase in percentage of organic solvents. This data have been used to determine molecular solute-solvent, solute-solute interactions in the system.

Key word: substituted oxoimidazoline, 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 oxoimidazoline drugs of different concentration in 70% (DMF+water) solvent and in same concentration of ligand in different percentages of solven tconcentration.Substituted oxoimidazoline used for present work as-



L_A: R = -3-Chloro
L_B: R = -H
L_C: R = -4-Bromo
L_D: R = -2-Bromo
L_E: R = -4-

L_1 =1-[2-hydroxy-5-(phenyl azo) benzylidene amino]-2-phenyl-4-benzylidene- 5- oxoimidazoline
L_2 =1-[2-hydroxy-5-(4-bromo phenyl azo) benzylidene amino]-2-phenyl-4- benzylidene- 5-oxoimidazoline
L_3 =1-[2-hydroxy-5-(4-methoxy phenyl azo) benzylidene amino]-2-phenyl-4-benzylidene- 5-oxoimidazoline
L_4 =1-[2-hydroxy-5-(2- bromo phenyl azo) benzylidene amino]-2-phenyl-4-benzylidene- 5-oxoimidazoline
L_5 =1-[2-hydroxy-5-(3-chloro phenyl azo) benzylidene amino]-2-phenyl-4-benzylidene- 5-oxoimidazoline

MATERIALS AND METHODS

The ligands of which physical parameters is to be explore are synthesized by using reported protocol[22]. 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 (DMF-water) mixtures as well as in different concentration (0.625x10-3to 10x10-3) in 70% (DMF+water) mixture were prepared by weight. All weighings were made on 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^{0}C ± 0.1^{0}C.

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-

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

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-

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

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 –

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

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

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

where, No is Avogadro's number.

RESULTS AND DISCUSSION

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

Percentage of DMF	[R]
20	17.0959
40	16.4094
60	14.8254
80	11.6959
100	4.4501
70	13.6404

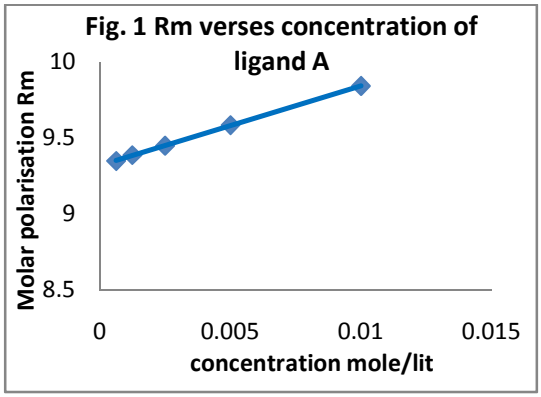
Table 2: The values of refractive index (n) and density(d), molar refraction (Rm), polarizability constant (α) of different molar solution of ligand in 70% (DMF -Water) solvent at 298K

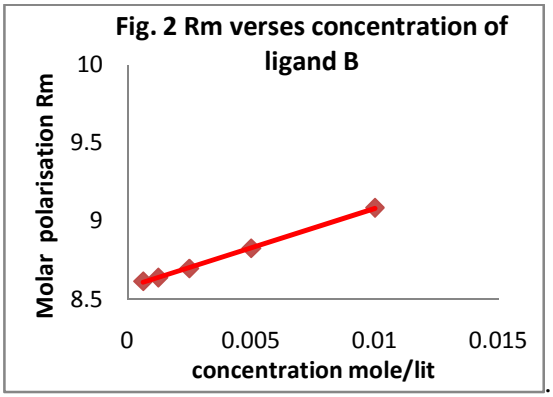
Conc in Mol/Lit	70% (DMF+ Water) system			
	Refractive index (n)	Density(d) gm/cm3	Rmx10^3 cm^3/mole	α x10^{-24} cm^3
L_1				
0.01	1.4157	1.2245	9.8419	3.9030
0.005	1.4134	1.2231	9.5850	3.8011
0.0025	1.4112	1.2220	9.4504	3.7477
0.00125	1.4105	1.2217	9.3888	3.7233
0.000625	1.4085	1.2164	9.3498	3.7078
L_2				
0.01	1.4158	1.2296	9.0851	3.6028
0.005	1.4142	1.2274	8.8280	3.5009
0.0025	1.4127	1.2241	8.6980	3.4493
0.00125	1.4117	1.2235	8.6404	3.4265
0.000625	1.4111	1.2229	8.6170	3.4172
L_3				
0.01	1.4158	1.2260	9.6176	3.8140
0.005	1.4147	1.2231	9.3324	3.7009
0.0025	1.4126	1.2161	9.1838	3.4220
0.00125	1.4115	1.2138	9.1119	3.6135
0.000625	1.4109	1.2125	9.0699	3.5968
L_4				
0.01	1.4162	1.2260	9.8691	3.9137
0.005	1.4148	1.2231	9.5561	3.7896
0.0025	1.4118	1.2161	9.3837	3.7213
0.00125	1.4103	1.2138	9.2892	3.6838
0.000625	1.4091	1.2125	9.2461	3.6667
L_5				
0.01	1.4152	1.2241	9.4390	3.7432
0.005	1.4161	1.2219	9.1557	3.6308
0.0025	1.4139	1.2155	8.9976	3.5681
0.00125	1.4132	1.2120	8.9118	3.5341
0.000625	1.4114	1.2078	8.8712	3.5180

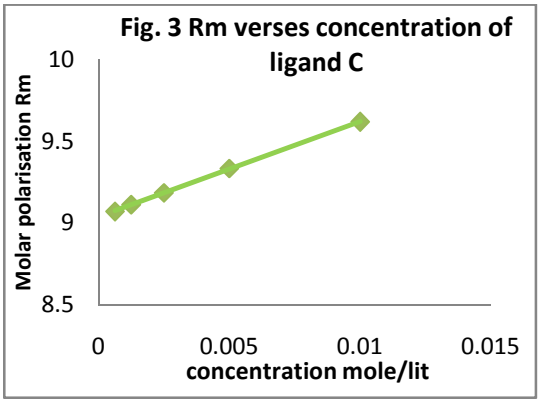
Table 3: The values of refractive index (n) and density(d), molar refraction (Rm), polarizability constant (α) of 0.01M solution of ligand in different percent of (DMF -Water) solvent at 298K

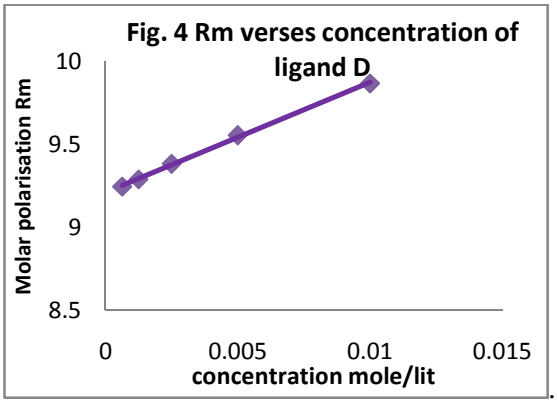
Conc in Mol/Lit	0.01M ligand system			
	Refractive index (n)	Density(d) gm/cm3	Rmx103 cm3/mole	α x10-23 cm3
		L_1		
20	1.347	1.0051	87.7426	3.4796
40	1.367	1.0150	102.4434	4.0625
60	1.402	1.0166	115.6015	4.5844
80	1.448	1.0176	129.7352	5.1449
100	1.498	1.0213	143.3939	5.6868
		L_2		
20	1.333	1.0027	79.0666	3.1331
40	1.351	1.0131	91.9011	3.6445
60	1.374	1.0150	101.2093	4.0136
80	1.399	1.0284	108.0936	4.2866
100	1.422	1.0155	116.5129	4.6205
		L_3		
20	1.352	1.0042	96.5376	3.8283
40	1.371	1.0087	113.0007	4.0812
60	1.391	1.0090	123.3958	4.8935
80	1.416	1.0197	131.7802	5.2259
100	1.435	1.0089	140.3201	5.5646
		L_4		
20	1.378	0.9987	103.4771	4.1035
40	1.39	1.0150	117.3996	4.6557
60	1.405	1.0199	125.9359	4.9942
80	1.424	1.0256	133.2286	5.2834
100	1.442	1.0257	139.9505	5.5500
		L_5		
20	1.364	1.0104	90.3112	3.5814
40	1.376	1.0152	103.7330	4.1137
60	1.392	1.0182	111.8786	4.4367
80	1.414	1.0248	119.1798	4.7263
100	1.432	1.0289	124.8348	4.9505

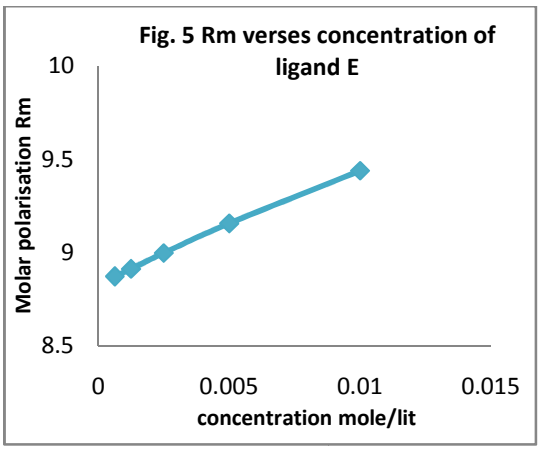
Fig- 1 to 6: Graphical representation of molar refraction (Rm) of all ligand of different concentration verses in 70% (DMF+water) solvent











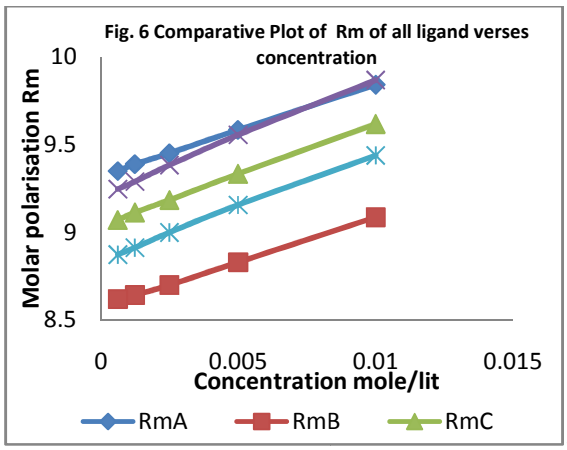
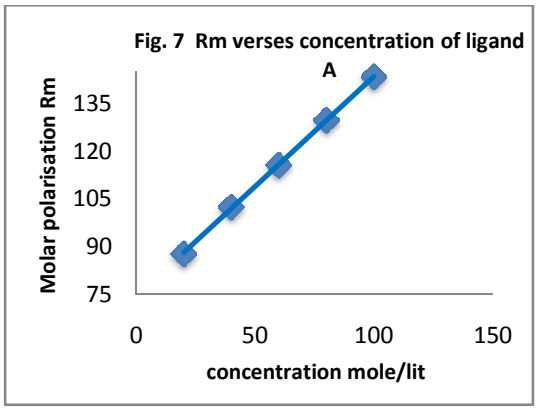
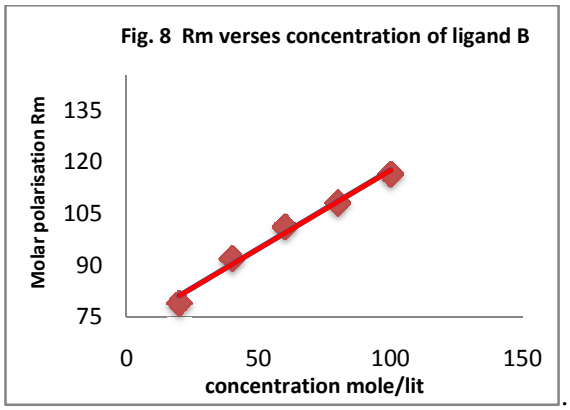
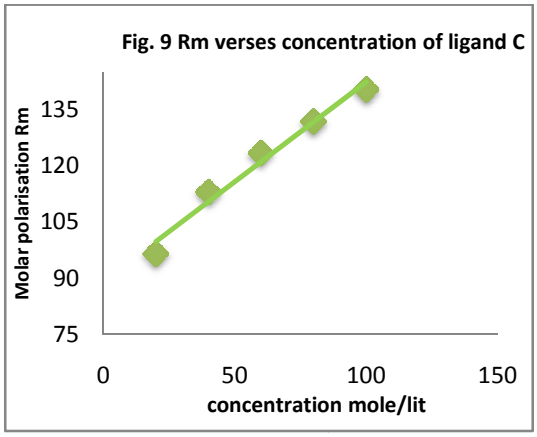
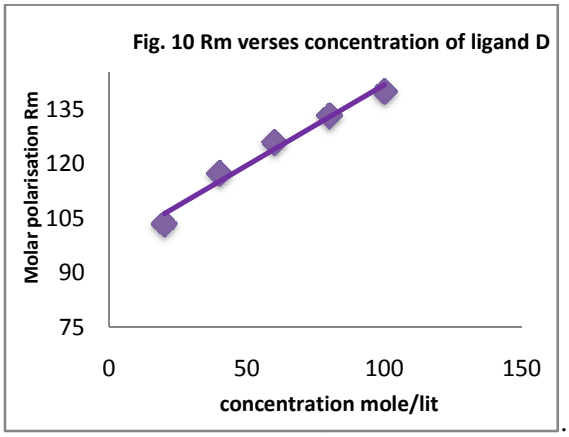


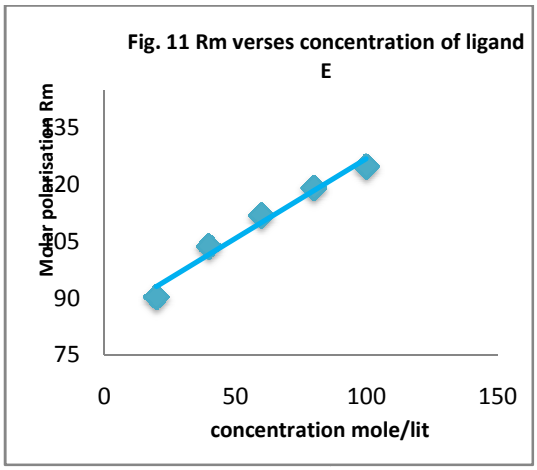
Fig- 7 to 12: Graphical representation of molar refraction (Rm) of all ligand of 0.01M concentration verses in different percentage of (DMF+water) solvent

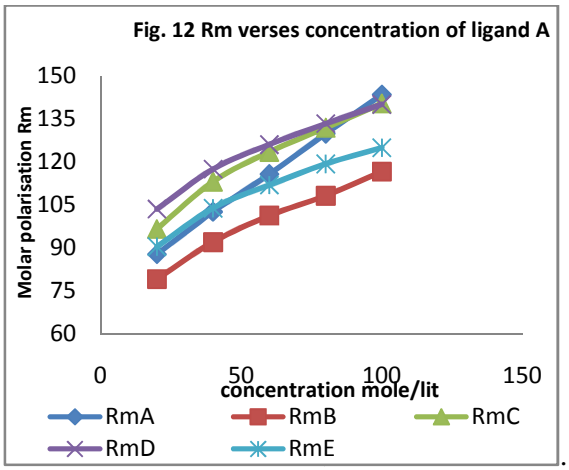












The value of molar refraction of different percent of (DMF+water) solvent shown in table-1. From the data it is observed that value of molar refraction goes on decreasing with the decrease in amount of water in percent mixture. Molar refraction is greater in polar protic solvent(water) than polar aprotic solvent (DMF). This is due to the ability of formation hydrogen bonding of protic solvent(water).

It is observe that the values of molar refractivity and polarizability constant decreases with decreasing concentration of substituted imidazolinone drugs in 70% (DMF+ Water) solvent. The calculated value of molar refraction and molar polarizability constant for different concentration of substituted imidazolinone drugs and ligand in 70% (DMF+ Water) solvent shown in table-2. It could be seen that from table-2, the values of refractive index decreases with decrease in concentration of solution (fig. 1 to 6). As the concentration of solute decreases, distance between the molecules of solute increases. Hence refractive index, molar refraction and polarizability constant of ligand dercreses. 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(L_1,L_4) have greater value of molar repraction and polarizability than other substituent(L_2, L_3, L_5).

The values of molar refraction and polarizability constant of substituted imidazolinone drugs having same concentration in different percentage of (DMF+ Water) solvent presented in table-2. It shows that the values of molar refraction and polarizability constant of substituted imidazolinone drugs increases with increase in percentage of organic solvents. This is due to fact that the dipole in substituted imidazolinone 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. 7 to 12. 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.

Acknowledgment
The Authors is thankful to Alice S. Chandami, GVISH College, Amravti for kindly cooperation.

REFERENCES

[1] Tayade D, Kshirsagar A, *The open phys.chem..J* ,**2014**,6,1.
[2] Satyamaiah G, Prasad M, *Ind.J.Adv.chem..sci*, **2014**,2(2),116.
[3] Tayade D, Kshirsagar A, *Derchemicasinica*,**2013**,4(4),25.
[4] Aralaguppi M, Aminabhavi T, *J.Phys.Chem*, **1991**,95,5299.
[5] Burghate A, Agrawal P, Narwade M, *Asian J.Chem*,**2001**,13(4),1652.
[6] Sengwa R, Sankhla S, Sharma S, *Ind.J.Chem*, **2007**,46A,1419.
[7] Devsarkar S, Pandhare V, Kattekar P, *J.Engg*, **2012**,2013,1.
[8] Dhondge S, *J.Chem.Engg.Data*, **2010**,55,3962.
[9] Pethe G, Ramteke A, *J.Chem.Pharm.*,**2010**,2(4),68.
[10] Wagh S, Ph.D Thesis in Chemistry, Amravati University, Amravati, (**2004**).
[11] Sharma S, Patel P, *E- J.Chem.*, **2007**,4(3),343.
[12] Postigo M, Canzonieri S, Mariano A, *J.Mole.Liq*, **2008**,143,115.
[13] Arbad B, Patil C, Shankarwar A, *AsianJ.Chem*. **2001**,13,787.
[14] Ubale S, Palaskar N, *Asian J.Chem*, **2001**,13,1682.
[15] Penzkofer A, Glasand H J.*Schemaizl.Chem.Phys*, **1982**,70,47.
[16] Ali A, Sabir S, Shahajan , *ActaPhy.Chim.Sinica*, **2007**,23(7),1007.
[17] Yadava S, Yadava A, *Ind. J.Chem.*, **2009**,48A,650.
[18] Sonune K, Meshram Y, *ActaCien.Ind.*, **2007**,23C(2),131.
[19] Deosarkar S, Narwade M, *Orin.J.Chem.*,**2008**,24(3),1135.
[20] Meshram U, Khobragade B, Narwade M, *J.Chem.Pharm*, **2011**,3(3),77.
[21] Ali A, Patel R, *J.Ind.chem.soc*, **2012**,89,1335.
[22] Wadekar M, Raut A, *DerPharmaChemica* **2010**,2(1),76.