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Study of Molar Refraction and Polarizability Constant of Substituted Thiazolyl Schiff's Bases from Refractive Index Measurement in Different Media

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ABSTRACT

Refractive indices of 2-[3-phenyl-1-(4-phenyl-thiazol-2-ylimino)-allyl] -methyl-phenol(L_1), 2-[-3-(4-methoxy-phenyl)-1-(4-phenyl-thiazol-2-ylimino)-allyl]-methyl -phenol(L_2) and 2-[3-(4-methoxy-phenyl)-1-(4-phenyl-thiazol-2-ylimino)-allyl]-4-methyl-phenol(L_3) have been studied in 1,4-dioxane, Ethanol and Acetone media at 30±0.1°c. temperature. The data obtained is utilized to determine the molar refraction and polarizability constant.

Key words: Refractive indices, Molar refraction, Polarizability constant.

INTRODUCTION

Refractive index is one of the most important properties of liquid. The measurement of the refractive index of liquids is an important work in engineering and science. Transmission and reflection detections near critical angles related to total internal reflections are common methods in refractive index measurement.

When a ray of light passes from one medium to another, it suffers refraction, that is change in direction. If it passes from a less dense to a more dense medium, it is refracted towards the normal so that the angle of refraction (r) is less than the angle of incidence (i) The refractive index (n) of the medium is the ratio of velocity of light in vacuum to the velocity of light in the medium. Refractive index is an important additive property of the structural arrangement of atom in molecule

Refractive index can be measured easily with high degree of accuracy. The values of refractive index depend on the temperature as well as on wavelength of light used.

Oswal et.al[1] have been studied refractivity properties of some homologues series such as n-ethanoate, methyl alkanoats, ethyl alkanoates ete. A.N. Sonar[2] and N.S. Pawar have studied the molar refraction and polarizability constant of substituted heterocyclic compounds in different media from refractive indices. Burghate et.al[3] have studied the molar refraction and polarizabitity constant of substituted chalcones in different percentage of acetone-water mixture.

J.D. Pandey et.al[4] have studied the refractometric and dielectric studies of binary liquid mixtures at different temperature.

J. Padova[5] have studied the ion-solvent interaction in mixed solvent using ethanol and acetone medium.

R.A. Synowicki et.al[6] implemented two different fluid measurement techniques to determined the refractive index of fluids on a commercial spectroscopic ellipsometer system. In first technique they uses roughened glass to which liquid is applied. And in second they uses the prism minimum deviation technique in a hollow prism cell. The advantages and disadvantages of both the techniques discussed.

The present work deals with the study of molar refraction and polarizability constant of substituted thiazolyl Schiff's bases such as 2-[3-phenyl-1-(4-phenyl-thiazol-2-ylimino)-allyl] -methyl-phenol(L_1), 2-[-3-(4-methoxy-phenyl)-1-(4-phenyl-thiazol-2-ylimino)-allyl]-methyl -phenol(L_2) and 2-[3-(4-methoxy-phenyl)-1-(4-phenyl-thiazol-2-ylimino)-allyl]-4-methyl-phenol(L_3) in non aqueous solvent such as 1,4-dioxane, acetone and ethanol (with different percentage)

EXPERIMENTAL

Above solution of the various compositions i.e. of ethanol, acetone and dioxane were prepared by dissolving an appropriate amount by weight. For density measurement, all the weighings were made on contech balance having accuracy (0.001gm). The refractive index of solvent mixtures/solutions were measured using different percentages by Abbe's refractometer ranging reading from 1.3000 to 1.70. The temperature of prism box was maintained constant by circulating water from thermostat at 30°c. (± 0.1°c). The refractometer was caliberated using glass test pieces of known refractive index supplied with the instrument.

The molar refraction of binary by used mixtures such as dioxane-water, acetone-water and ethanol-water mixture were determined from

$$R_{a\text{-}w} = X_1R_1 + X_2R_2$$

Where R_1 and R_2 are molar refractions of medium and water respectively.

The molar refraction of solvent and solution were determined using Lorentz-Lorentz[7] equation.

$$R_m = \frac{(n^2-1)}{(n^2+2)}\left\{\frac{[x_1 m_1 + x_2 m_2 + x_3 m_3]}{d}\right\}$$

Where
R_m → molar refraction
ç → refractive index of solution
x_1 → mole fraction of medium
x_2 →mole fraction of water
x_3 → mole fraction weights of solute
M_1, M_2 & M_3 → molecular weights of medium water and solute respectively
d → density of solution

The polorizability constant (α) of ligand is calculated from the following equation.

$$R_{lig} = \frac{4}{3}\pi No\,\alpha$$

Where No is the Avagadro's number.

The calculated values of molar refraction and polarizbility constant are shown in table.

RESULTS AND DISCUSSION

The present investigation considers the R.I. measurement of 2-[3-phenyl-1-(4-phenyl-thiazol-2-ylimino)-allyl] -methyl-phenol(L_1), 2-[-3-(4-methoxy-phenyl)-1-(4-phenyl-thiazol-2-ylimino)-allyl]-methyl -phenol(L_2) and 2-[3-(4-methoxy-phenyl)-1-(4-phenyl-thiazol-2-ylimino)-allyl]-4-methyl-phenol(L_3) In binary mixtures dioxane-water, acetone- water and ethanol-water. The results obtained for variation in % of binary mixtures are reported in above tables no. and respective graphical representation is shown in graph.

In the present investigation, there is decrease in polarizability as well as molar refraction with decrease in % of binary mixture with respect to more polar solvent. This may be due to dispersion force. It is the molecular force which arises from temporary dipole moment. The cumulative dipole-dipole interaction may create weak dispersion force resulting in decrease in molar refraction and polarizability.

From the results it may be predicted that for binary liquid mixtures on addition of mentioned compounds L_1, L_2 and L_3, there is decrease in molar refraction as well as polarizability. This may be due to the fact that the solvent-solvent interaction may be more strong than solute-solvent interaction.

Table 1: The values of molar refraction and polarizability constant at 30±0.1 °C temp

System : 2-[3-phenyl-1-(4-phenyl-thiazol-2-ylimino)-allyl-methyl phenol(L_1) Medium						
% of	**Dioxane**		**Acetone**		**Ethanol**	
Solvent	**R_m**	**$\alpha \times 10^{-23}$**	**R_m**	**$\alpha \times 10^{-23}$**	**R_m**	**$\alpha \times 10^{-23}$**
95	1.907778	0.075656	1.77739	0.07670	1.0304312	0.040863
90	1.650705	0.065461	1.056432	0.041891	0.96311	0.038194
85	1.480067	0.058694	1.96181	0.03814	0.90093	0.035728
80	1.344936	0.0533360	1.88206	0.03497	0.849021	0.033669
75	1.215272	0.0481939	1.81476	0.03231	0.795048	0.0315292

Table 2: The values of molar refraction and polarizability constant at 30±0.1 °C temp

System : 2-[-3-(4-methoxy phenyl)-1-(4-phenyl-thiazol-2-ylimino)-allyl] methyl phenol(L_2)						
% of	**Dioxane**		**Acetone**		**Ethanol**	
Solvent	**R_m**	**$\alpha \times 10^{-23}$**	**R_m**	**$\alpha \times 10^{-23}$**	**R_m**	**$\alpha \times 10^{-23}$**
95	1.96219	0.077814	1.13986	0.045203	1.0151732	0.040258
90	1.69145	0.06707	1.03149	0.040906	0.9340412	0.0370412
85	1.48791	0.05900	0.93576	0.037109	0.873614	0.034644
80	1.3150	0.011540	0.85452	0.03588	0.80894	0.032080
75	0.29100	0.052151	0.78816	0.03125	0.759223	0.0301084

Table 3: The values of molar refraction and polarizability constant at 30±0.1 °C temp

2-[3-(4-methoxy-phenyl)-1-(4-phenyl-thiazol-2-ylimino)-allyl]-4-methyl phenol(L_3)						
% of	**Dioxane**		**Acetone**		**Ethanol**	
Solvent	**R_m**	**$\alpha \times 10^{-23}$**	**R_m**	**$\alpha \times 10^{-23}$**	**R_m**	**$\alpha \times 10^{-23}$**
95	2.18308	0.08657	1.171973	0.046476	1.029627	0.040831
90	1.88499	0.08657	1.053047	0.0417606	0.958396	0.03800
85	1.642583	0.065139	0.95001	0.03769	0.88734	0.035189
80	1.466403	0.058153	0.8784	0.0.4653	0.835165	0.035120
75	1.324710	0.052533	0.80538	0.032097	0.787319	0.031222

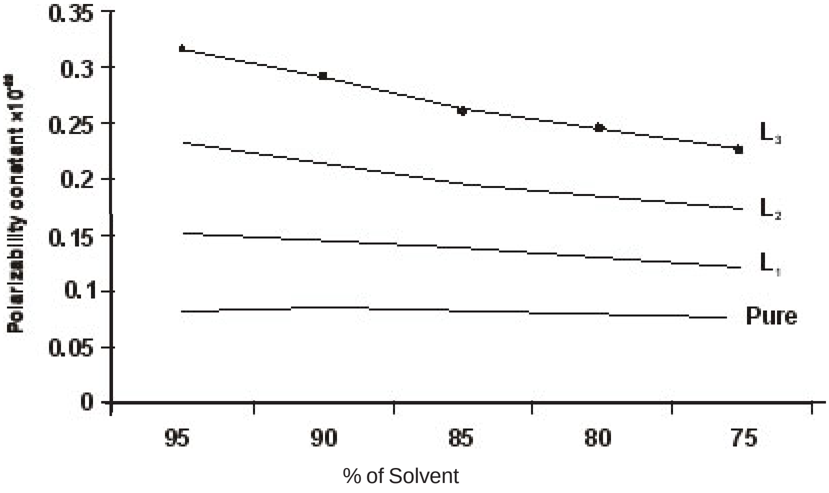

Fig. 1: Variation of polarizability constant with respect to % of dioxane-water mixture

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