STUDIES ON REFRACTIVE INDEX OF 1, 3-DIARYL CARBAMIDES IN DIFFERENT PERCENTAGE OF BINARY LIQUID MIXTURE

S.S. Ubarhande1,*, A.S. Burghate1, B.N. Berad2 and J.D. Turak1

1P. G. Department of Chemistry, Shri Shivaji Science College, Amravati-444603(MS)
2Departments of Chemistry, R. T. M. Nagpur University, Nagpur
*E-mail: shri_orgchem@rediffmail.com

ABSTRACT
Refractive indices of binary liquid mixtures and 1, 3 diaryl carbamides in different percentage of binary liquid mixture such as acetone-water, dioxane-water & DMSO-water at 27± 0.1°C were measured by Abbes’ refractrometer. The data obtained was utilized to calculate molar refraction & polarizability constant which explain solute-solvent, solvent-solvent interactions.

Keywords: Refractive index, molar polarization, polarizability constants.

INTRODUCTION
Prediction of refractive indices of binary liquid mixture is essential for determination of composition of binary liquid mixtures. Refractive index measurements in combination with density, boiling, melting point and other analytical data have wide applicability in chemical analysis and industry. Oswal and M.V. Rathanam1 studied dielectric constants and refractive indices of binary mixture of ethyl acetate with toluene, ethyl benzene, o- xylene, p-xylene and p- xylene. Rita Mehta2 studied application of refractive index in binary systems of hexadecane and hepadecane with n-alcohols at different temperatures, Sangeeta Sharma et al3 have studied refractive index on mixing properties of binary liquids mixture of Eucalytol with hydrocarbons at different temperatures. A.N. Sonar, N.S. Pawar4 studied refractive index of substituted heterocyclic compound in different media. The properties of liquids such as viscosity, refractive index and ultrasonic velocity of binary mixture was studied by many workers5-8 Mahajan et9 al have studied molar refraction and polarizability constants of 2-amino-5chloro-benzene sulphonic acid in different % of dioxane-water mixtures.

The present study deals with refractive index measurement of 1,3-diaryl carbamoides in different % of binary liquid systems.

EXPERIMENTAL
Nitrogen-containing heterocyclic compound have maintained the interest of researchers through decades of historical development of organic synthesis.

Some of most common nitrogen containing heterocyclic compounds includes Pyrimidines10, 11 and thiadizoles12, 13 exhibits antimicrobial, anticancer and antiviral activity. For the synthesis of these compounds Urea/Carbamides is used as material. As we well known that the monoaryl, 1, 3-diaryl thiocarbamide, 1, 3-diaryl carbamide14 have role in the synthesis of numerous 5and 6 membered hetrocyclic system. Due to the wide applicability of these compounds their physical parameter study with respect to refractive index measurement is implemented.

Acetone–water, dioxane–water, and DMSO-water mixture of varying compositions as well as solutions of 1, 3-diaryl carbamoides in different percentage of binary mixture were prepared. All weighing were made on contech Electronic balance (± 0.001 g). The accuracy of density measurements was within 0.1 kg m⁻³. The refractive indices of solvent mixture and solutions were measured by Abbes’ refractrometer was within (± 0.001 units). The temperature of prim box was maintained constant by
circulating water from thermostat mentioned at 306 K. Initially refractometer was calibrated with a glass piece (n=1.5220) provided with the instrument.

Table-1: Values of Molar refraction and Polarizability constant at 306K
System – 1, 3 di α- tolyl carbamide

<table>
<thead>
<tr>
<th>% of solvent</th>
<th>Medium</th>
<th>Acetone – water</th>
<th>Dioxane-water</th>
<th>DMSO- water</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>( R_m \times 10^{-3} ) m²/mole</td>
<td>( \alpha \times 10^{-20} ) m⁴/mol</td>
<td>( R_m \times 10^{-3} ) m²/mole</td>
</tr>
<tr>
<td>75</td>
<td></td>
<td>1.04073</td>
<td>0.04127</td>
<td>1.17720</td>
</tr>
<tr>
<td>80</td>
<td></td>
<td>1.15874</td>
<td>0.054952</td>
<td>1.317215</td>
</tr>
<tr>
<td>85</td>
<td></td>
<td>1.292160</td>
<td>0.05124</td>
<td>1.498169</td>
</tr>
<tr>
<td>90</td>
<td></td>
<td>1.43037</td>
<td>0.05672</td>
<td>1.726579</td>
</tr>
<tr>
<td>95</td>
<td></td>
<td>1.58363</td>
<td>0.06280</td>
<td>2.0254014</td>
</tr>
</tbody>
</table>

The molar refraction of solvent, acetone–water, dioxane–water, DMSO-water were calculated from determined from:

\[
R_{S-W} = x_1 \cdot R_1 + x_2 \cdot R_2
\]

Where; \( R_1 \), \( R_2 \) are the molar refractions of solvent and water respectively.

The molar refraction of solutes of 1, 3- diaryl carbamide in binary liquid mixture were determined from

\[
R_{mixture} = \frac{(n^2 - 1)}{((n^2 + 2)\left(\frac{x_1 M_1 + x_2 M_2 + x_3 M_3}{d}\right))}
\]

Where, \( n \) = Refractive index of solution
\( x_1 \) = Mole fraction of solvent (acetone and 1,4-dioxane and DMSO)
\( x_2 \) = Mole refraction of water
\( x_3 \) = Mole fraction of solute
\( M_1, M_2, M_3 \) = molecular weight of solvent, water and solute respectively.
\( d \) = density of solution.

The polarizability constant (\( \alpha \)) of compound is determined from:

\[
R_{lig} = \frac{\alpha}{\pi N_A}
\]

Where, \( N_A \) = Avogadro’s number.

RESULTS AND DISCUSSION

Refractive index is an important physical parameter of liquids. The potential of refractometry depends on sensitivity and time of measuring. The value of refractive index of blood\(^{12} \) can serve as objective
parameter for estimating the level of inflammatory process both at the stage of identification and studying dynamics of liquid.

Table-3: Values of Molar refraction and Polarizability constant at 306K
System – 1, 3 di p-tolyl carbamide

<table>
<thead>
<tr>
<th>% of solvent</th>
<th>Acetone – water</th>
<th>Dioxane-water</th>
<th>DMSO- water</th>
</tr>
</thead>
</table>
|              | $R_m \times 10^{18} \text{m}^3/\text{mole}$ | $\alpha \times 10^{-26} \text{m}^3$ | $R_m \times 10^{18} \text{m}^3/\text{mole}$ | $\alpha \times 10^{-26} \text{m}^3$ | $R_m \times 10^{18} \text{m}^3/\text{mole}$ | $\alpha \times 10^{-26} \text{m}^3$
| 75           | 1.03794         | 0.041161      | 1.159650    | 0.0459881 | 1.176813    | 0.04666 |
| 80           | 1.186795        | 0.047064      | 1.305573    | 0.051775038 | 1.30773     | 0.051865 |
| 85           | 1.28915         | 0.0511240     | 1.480022    | 0.058693  | 1.46773     | 0.076455 |
| 90           | 1.40494         | 0.055715      | 1.69997508  | 0.067415  | 1.67009     | 0.076455 |
| 95           | 1.54804         | 0.061390      | 1.98966     | 0.0789039 | 1.927913    | 0.076455 |

Molar refractivity is a measure of total polarizability of a mole of substance. It depends on refractive index of substance, temperature & pressure.

In the present study refractive index of solvent water mixture and 1, 3 diaryl carbamides in solvent-water mixture were determined. Molar refraction and polarizability was determined for variation in percentage of solvent-water mixture for fixed amount of compound.

For acetone –water, dioxane-water and DMSO-water mixtures, increase in % of solvent, molar refraction as well as polarizability constant increases. The variation in molar refraction & polarizability constant observed for different solvents (Table 1-3) follows following trend:

Acetone water < DMSO-water < dioxane water

Though DMSO is having high dipole moment as compound to acetone and dioxane, the above mentioned result are observed due to solute solvent interaction and change in dielectric constant of medium.

The reason might be the attractive force may arise from temporary dipole formation in solvent which may produce weak intermolecular force like dispersion force. The stronger deviation in electron cloud and the dispersion force result in increased polarizability with increase in % of more polar solvent. This may attributed due to the solute-solvent interaction and dipole orientation.

REFERENCES