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Research Article

VERIFICATION OF THE MOLAR REFRACTION AS AN ADDITIVE AND CONSTITUTIVE PROPERTY OF BINARY LIQUID MIXTURES OF WATER ETHANOL, TOLUENE BENZENE AND BENZENE ETHANOL

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ABSTRACT
Refractive indices and densities have been experimentally determined for the binary mixtures of Toluene Benzene, Benzene Ethanol and Water Ethanol systems at room temperature.
Molar refraction for the above system was calculated theoretically. Experimental data and theoretical values of molar refraction were compared from these observations. It has been verified that the molar refraction is additive and constitutive property. Further it has also observed the intermolecular interaction contribute nothing to molar refraction.

Key Words: *Molar Refraction, Refractive Indices Binary Mixtures Additive Property Constitute Property*

INDRUDCUTION
Refractive index measurement is an essential part of the thermo dynamic studies of liquid – liquid mixtures physical property of a substance depend on the internal structure or constitution of the molecule. Thus the determination of properties such as refractive index molar refraction molar polarization electronic polarization etc. can provide valuable information about the structure of the molecules. Binary, ternary mixture of the liquid organic liquids are very important in various fields such as biomedical science, pharmaceuticals solvent systems for the refraction medium chromatographic techniques and solvent system for the refraction medium, chromatographic techniques and solvent system in spectroscopy. The present paper explains the result of experimental and the theoretical values of molar refractions refractive indices and various other parameters for the liquid mixture of water ethanol, toluene benzene, and benzene ethanol. Refractive indices and other related parameters were determined for the binary mixture of ethanol with water. Benzene with ethanol and toluene with benzene though a large number of preliminary investigations are available in the literature, but no comprehensive study has yet been reported related to binary studies.

MATERIALS AND METHODS
All the chemicals used were of L.R. grades, chemicals were purified by distillation and only middle fraction were used in the experimental solutions were prepared by mole fraction method. Nine bottles of each system were kept in special air tight stopper glass bottles so as to avoid evaporation. The weighing was done by using electronic balance with precision of ± 0.1 mg. Refractive indices densities of pure liquids and their binary mixture were measured by using Abbe refractometer and densities bottle method respectively, at the room temp (22^0c). By using above experimental values of refractive indices and densities, molar refraction and electronic polarization was calculated by following formulae.
For pure liquid
$Rm= [n^2-1 / n^2+2] m/d$
Where Rm – molar refraction: n- Refractive index; M- Molar mass; d-density and for binary mixture equation (l) becomes
$RMS = [n^2-1 / n^2+2] [(M_1x_1 + M_2x_2)d]$
Where, Rms = Molar refraction of solution; n = Refractive index of solution; M_1 = Molar Mass of ^{Ist} compound; x_1 = Molar fraction of I^{st} compound; M_2 = Molar Mass of II^{nd} compound; and

x_2 = Molar fraction of II[nd] compound

Table 1: For Pure Liquids

S. No.	Compound	Molar Mass	Refractive Index (n)	D densities (g/ml)	$E=n^2$ electronic polarization	Observed molar refraction Rm_{obs} (cm^3/mol	Calculated molar refraction Rm_{cal} (cm^3/mol)
1	H_2O	18.0	1.3534	1.0084	1.0084	3.8896	3.574
2	C_2H_5OH	46.07	1.3797	0.8508	0.7239	12.5353	12.961
3	C_6H_6	78.00	1.5218	0.8978	0.8060	26.5267	26.289
4	$C_7H_{8\ toluene}$	92.14	1.497	0.8736	2.2410	30.67	30.78

Table 2: For Water ethanol

S. No.	Compound Mole fraction of H_2O (x_1)	Molar Mass Mole fraction C_2H_5OH x_2	Refractive Index (n)	$E=n^2$ electronic polarization	D densities (g/ml)	Rm_{obs} (cm^3/mol	Rm_{cal} (cm^3/mol)
1	0.1	0.9	1.3829	1.9124	0.8607	13.2138	12.0223
2	0.2	0.8	1.3840	1.9154	0.8724	10.8420	11.083
3	0.3	0.7	1.3840	1.9154	0.8841	09.9562	10.145
4	0.4	0.6	1.3830	1.9127	0.8968	09.0640	09.206
5	0.5	0.5	1.3829	1.9124	0.9130	08.1824	08.074
6	0.6	0.4	1.3808	1.9066	0.9283	07.3077	07.3288
7	0.7	0.3	1.3787	1.9008	0.9428	06.4707	06.3901
8	0.8	0.2	1.3745	1.8893	0.9675	05.5794	05.451
9	0.9	0.1	1.3648	1.8627	0.9841	04.7212	04.513

Table 3: For Benzene ethanol

S. No.	Compound Mole fraction of H_2O (x_1)	Molar Mass Mole fraction C_2H_5OH x_2	Refractive Index (n)	$E=n^2$ electronic polarization	D densities (g/ml)	Rm_{obs} (cm^3/mol	Rm_{cal} (cm^3/mol)
1	0.1	0.9	1.3946	1.9455	0.8227	14.3525	14.2938
2	0.2	0.8	1.4198	2.0158	0.8382	15.8714	15.6266
3	0.3	0.7	1.4324	2.0158	0.8449	17.1019	16.9594
4	0.4	0.6	1.4459	2.0906	0.8533	18.3979	18.2122
5	0.5	0.5	1.4574	2.1240	0.8588	19.7014	19.625
6	0.6	0.4	1.4720	2.1668	0.8663	21.1039	20.9578
7	0.7	0.3	1.4825	2.1978	0.8730	22.3854	22.2106
8	0.8	0.2	1.4974	2.2437	0.8789	23.9115	23.6234
9	0.9	0.1	1.5146	2.2940	0.8883	25.4155	24.9562

Table 4: For Toluene benzene

S.No.	Compound Mole fraction of H_2O (x_1)	Molar Mass Mole fraction C_2H_5OH x_2	Refractive Index (n)	$E=n^2$ electronic polarization	D densities (g/ml)	Rm_{obs} (cm^3/mol	Rm_{cal} (cm^3/mol)
1	0.1	0.9	1.45564	2.1188	0.8168	30.17329	30.3301
2	0.2	0.8	1.46066	2.1335	0.8189	29.9082	29.8818
3	0.3	0.7	1.46268	2.1394	0.8195	29.5241	29.4327
4	0.4	0.6	1.46369	2.1423	0.8200	29.0860	28.9836
5	0.5	0.5	1.46972	2.1600	0.8215	28.87715	28.5345
6	0.6	0.4	1.47274	2.1689	0.8271	28.3603	28.0854
7	0.7	0.3	1.48076	2.1926	0.8493	27.5459	27.6363
8	0.8	0.2	1.48879	2.2165	0.8596	27.1284	27.1872
9	0.9	0.1	1.49682	2.2404	0.8637	26.8971	26.7381

RESULTS AND DISCUSSION

By using the observation of table 1, 2, 3 and 4 it is clearly concluded that the experimental values of molar refraction of the systems are in good agreement with the calculated values of molar refractions. Also intermolecular interactions do not play any role in the contribution of molar refractions. This further confirmed that the contribution for molar refraction is only due to the atoms and bonds present in the molecules or mixture to summarize it is verified that molar refractions (Rm) is an additive and constitutive property and the refraction of molecule is sum of contribution of atoms (atomic refraction) and bonds (bond refraction).

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