Scientific paper

Refractive Index, Molar Refraction and Comparative Refractive Index Study of Propylene Carbonate Binary Liquid Mixtures

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Received: 04-07-2011

Abstract

Refractive indices (n) have been experimentally determined for the binary liquid-liquid mixtures of Propylene carbonate (PC) (1) with benzene, ethylbenzene, o-xylene and p-xylene (2) at 298.15, 303.15 and 308.15 K over the entire mole fraction range. The experimental values of n are utilised to calculate deviation in refractive index (Δn), molar refraction (R) and deviation in molar refraction (ΔR).

A comparative study of Arago-Biot (A-B), Newton (NW), Eyring and John (E-J) equations for determining refractive index of a liquid has been carried out to test their validity for all the binary mixtures over the entire composition range at 298.15 K. Comparison of various mixing relations is represented in terms of average deviation (AVD). The Δn and ΔR values have been fitted to Redlich-Kister equation at 298.15 K and standard deviations have been calculated. The results are discussed in terms of intermolecular interactions present amongst the components.

Keywords: Refractive index; propylene carbonate; deviation in refractive index; molar refraction

1. Introduction

Refractive index measurement is an essential part of the thermodynamic studies of liquid-liquid mixtures, used to explain the intermolecular interactions present amongst the mixing components. Refractive index along with density measurement of liquid mixtures is important for the determination of composition of binary mixtures usually non-ideal mixtures where direct experimental measurements are performed over the entire composition range. Refractive index measurement along with other parameters such as density, melting point, boiling point and other analytical data are very useful for common substances which include oils, waxes, sugar syrups etc. Deviation in refractive index is used to explain the nature of solute-solvent interactions.

In continuation to our research work on thermodynamic properties of binary liquid-liquid mixtures of PC with polar, nonpolar, applicable solvents[1–6,] we represent here refractive indices (n), deviation in refractive index (Δn), molar refraction (R) and deviation in molar refraction (ΔR) values for four binary mixtures of PC (1) with benzene, ethylbenzene, o-xylene, and p-xylene (2) at 298.15, 303.15 and 308.15 K over the entire mole fraction range. Theoretical values of refractive index is calculated using different mixing rules such as Arago-Biot (A-B)[7], Newton (NW), and Eyring-John (E-J)[8] equations at 298.15 K to test the validity of the experimental results. The comparison of estimated refractive index (n_{cal}) values using different mixing rules with those of experimental one (n_{obs}) is represented in the form of average deviation (AVD). The deviation in refractive index (Δn) and deviation in molar refraction (ΔR) values have been fitted to Redlich-Kister equation at 298.15 K and standard deviations have been calculated. The results obtained are discussed in terms of intermolecular interactions present amongst the components.

2. Experimental

All the liquids used in the present study were of A. R. Grade. PC purchased from Merck (Purity >99% by mass) was refluxed over anhydrous calcium carbonate and distilled at atmospheric pressure[9]. Benzene, ethylbenzene,

o-xylene and p-xylene all purchased from S. D. Fine Chemicals, were distilled at atmospheric pressure. All the liquids were double distilled. The middle fraction collected of all the liquids was stored over 4 Å molecular sieves.

The binary liquid mixtures were prepared by mixing known masses of pure liquids in airtight-stoppered bottles in order to minimize the evaporation losses. All measurements of mass were performed on a Mettler one pan balance which can be read up to the fifth decimal place with an accuracy of ±0.05 mg.

The refractive indices were measured with a thermostated Abbe refractometer (Focus AR-201 85010) using the sodium D line. The refractometer was calibrated by means of glass test piece of known refractive index supplied by the manufacturer. The uncertainity in the refractive index measurement was $\pm 3 \times 10^{-4}$. For all the measurements, the temperature was controlled by circulating the water through an ultra thermostat Julabo F-25 (made in Germany) which has an accuracy of ± 0.02 °C.

3. Results and Discussion

The experimental values of refractive index (n) were utilised to calculate deviation in refractive indices (Δn) using following equation

$$\Delta n = n_m - x_1 n_1 - x_2 n_2 \qquad (1)$$

where n_m is the refractive index values for the mixtures, x_1, x_2, n_1, n_2 are the mole fractions and refractive index values for the component (1) i.e PC and benzene, ethylbenzene, o-xylene and p-xylene (2) respectively.

Table 1: Refractive index (n) and molar refraction (R) values for the binary mixtures of PC (1) + benzene (2) at 298.15, 303.15 and 308.15 K.

Propylene carbonate (1) + benzene (2)						
	T = 298.15 K		T = 303.15 K		T = 308.15 K	
x_1	n	R	n	R	n	R
0.0000	1.4981	26.21	1.4937	26.18	1.4919	26.24
0.0191	1.4971	26.13	1.4926	26.08	1.4907	26.12
0.0416	1.4958	26.02	1.4912	25.97	1.4893	26.00
0.0585	1.4947	25.94	1.4902	25.88	1.4882	25.91
0.0771	1.4935	25.85	1.4890	25.79	1.4870	25.81
0.1030	1.4918	25.72	1.4873	25.65	1.4853	25.68
0.1982	1.4853	25.26	1.4810	25.19	1.4789	25.20
0.2949	1.4784	24.80	1.4744	24.73	1.4722	24.74
0.3972	1.4708	24.33	1.4669	24.25	1.4648	24.26
0.4938	1.4632	23.88	1.4596	23.80	1.4576	23.81
0.5987	1.4547	23.40	1.4514	23.33	1.4495	23.34
0.7002	1.4460	22.92	1.4431	22.88	1.4412	22.88
0.7907	1.4379	22.50	1.4350	22.45	1.4330	22.44
0.9024	1.4275	21.96	1.4254	21.96	1.4239	21.97
1.0000	1.4223	21.68	1.4205	21.69	1.4191	21.72

The molar refraction (R) values for all the binary mixtures at 298.15, 303.15, and 308.15 K were calculated using Lorentz-Lorenz equation[10]

$$R = V_m (n_m^2 - 1)/(n_m^2 + 2) \qquad (2)$$

where n_m & V_m is the refractive index & molar volume value for the binary mixtures respectively. The experimental n values along with calculated values of R at 298.15, 303.15 and 308.15 K are represented in Tables 1–4 for all the four binary mixtures of PC.

Table 2: Refractive index (n) and molar refraction (R) values for the binary mixtures of PC (1) + ethylbenzene (2) at 298.15, 303.15 and 308.15 K.

Propylene carbonate (1) + ethylbenzene (2)						
	T = 298.15 K		T = 303.15 K		T = 308.15 K	
x_1	n	R	n	R	n	R
0.0000	1.4932	35.79	1.4906	35.81	1.4886	35.88
0.0294	1.4913	35.16	1.4887	35.18	1.4867	35.24
0.0420	1.4905	34.89	1.4879	34.91	1.4859	34.97
0.0729	1.4885	34.26	1.4859	34.28	1.4839	34.33
0.0821	1.4879	34.07	1.4853	34.09	1.4833	34.15
0.1013	1.4866	33.69	1.4840	33.71	1.4820	33.76
0.2023	1.4795	31.79	1.4770	31.81	1.4750	31.85
0.3008	1.4723	30.11	1.4698	30.12	1.4678	30.15
0.4012	1.4647	28.54	1.4623	28.55	1.4603	28.58
0.5001	1.4571	27.13	1.4547	27.13	1.4528	27.16
0.6001	1.4494	25.82	1.4471	25.83	1.4453	25.85
0.7001	1.4419	24.63	1.4397	24.63	1.4380	24.66
0.8009	1.4346	23.53	1.4325	23.54	1.4309	23.57
0.8992	1.4279	22.56	1.4259	22.57	1.4244	22.61
1.0000	1.4223	21.68	1.4205	21.69	1.4191	21.72

Table 3: Refractive index (n) and molar refraction (R) values for the binary mixtures of PC (1) + o-xylene (2) at 298.15, 303.15 and 308.15 K.

Propylene carbonate (1) + o-xylene (2)						
	T = 298.15 K		T = 303.15 K		T = 308.15 K	
x_1	n	R	n	R	n	R
0.0000	1.5052	35.97	1.5027	35.99	1.5006	35.99
0.0230	1.5019	35.31	1.5001	35.37	1.4982	35.40
0.0428	1.4992	34.82	1.4978	34.90	1.4964	34.96
0.0618	1.4966	34.35	1.4956	34.45	1.4945	34.53
0.0804	1.4942	33.79	1.4935	33.91	1.4924	34.00
0.1015	1.4915	33.36	1.4908	33.47	1.4902	33.59
0.2056	1.4790	31.06	1.4786	31.18	1.4785	31.34
0.2993	1.4692	29.43	1.4685	29.53	1.4680	29.65
0.3992	1.4595	27.96	1.4586	28.04	1.4580	28.15
0.4995	1.4510	26.64	1.4502	26.72	1.4495	26.82
0.5986	1.4434	25.54	1.4430	25.63	1.4425	25.72
0.7001	1.4367	24.45	1.4365	24.55	1.4362	24.64
0.8004	1.4307	23.52	1.4302	23.60	1.4300	23.69
0.8990	1.4252	22.61	1.4250	22.70	1.4240	22.75
1.0000	1.4223	21.68	1.4205	21.69	1.4191	21.72

Table 4: Refractive index (n) and molar refraction (R) values for the binary mixtures of PC (1) + p-xylene (2) at 298.15, 303.15 and 308.15 K.

Propylene carbonate (1) + p-xylene (2)						
	T = 298.15 K		T = 303.15 K		T = 308.15 K	
x_1	n	R	n	R	n	R
0.0000	1.4933	36.03	1.4910	36.07	1.4878	36.06
0.0227	1.4915	35.40	1.4893	35.44	1.4862	35.43
0.0397	1.4900	34.93	1.4880	34.98	1.4850	34.98
0.0573	1.4885	34.46	1.4866	34.52	1.4837	34.52
0.0816	1.4865	33.84	1.4846	33.90	1.4819	33.91
0.0980	1.4851	33.44	1.4833	33.50	1.4806	33.51
0.2090	1.4765	31.01	1.4748	31.07	1.4724	31.08
0.3029	1.4695	29.28	1.4678	29.33	1.4656	29.34
0.3993	1.4625	27.75	1.4608	27.79	1.4588	27.81
0.5028	1.4551	26.33	1.4535	26.37	1.4516	26.39
0.5978	1.4485	25.20	1.4470	25.24	1.4452	25.27
0.7068	1.4412	24.09	1.4396	24.12	1.4382	24.16
0.8012	1.4350	23.25	1.4335	23.28	1.4322	23.33
0.8996	1.4289	22.50	1.4273	22.53	1.4259	22.56
1.0000	1.4223	21.68	1.4205	21.69	1.4191	21.72

The ΔR values for all the binary mixtures, at all the said temperatures were calculated using following equation

$$\Delta R = R_m - x_1R_1 - x_2R_2 \quad (3)$$

where R_m is the molar refraction values for the binary liquid mixtures. The calculated values of Δn and ΔR are represented in Tables 5–8.

Table 5: Deviation in refractive index (Δn) and deviation in molar refraction (ΔR) values for the binary mixtures of PC at 298.15, 303.15 and 308.15 K.

Propylene carbonate (1) + benzene (2)						
	T = 298.15 K		T = 303.15 K		T = 308.15 K	
x_1	n	R	n	R	n	R
0.0000	0.0000	0.00	0.0000	–0.00	0.0000	–0.00
0.0191	0.0004	0.00	0.0003	–0.01	0.0002	–0.03
0.0416	0.0009	–0.00	0.0005	–0.02	0.0004	–0.05
0.0585	0.0010	–0.00	0.0008	–0.03	0.0006	–0.07
0.0771	0.0012	–0.01	0.0009	–0.05	0.0007	–0.08
0.1030	0.0015	–0.02	0.0011	–0.07	0.0009	–0.09
0.1982	0.0022	–0.05	0.0018	–0.10	0.0014	–0.14
0.2949	0.0027	–0.07	0.0023	–0.13	0.0018	–0.17
0.3972	0.0028	–0.08	0.0023	–0.15	0.0018	–0.19
0.4938	0.0025	–0.09	0.0020	–0.16	0.0016	–0.19
0.5987	0.0020	–0.10	0.0015	–0.16	0.0012	–0.19
0.7002	0.0010	–0.11	0.0007	–0.16	0.0003	–0.20
0.7907	–0.0003	–0.13	–0.0008	–0.18	–0.0013	–0.23
0.9024	–0.0022	–0.16	–0.0022	–0.17	–0.0023	–0.19
1.0000	0.0000	–0.00	0.0000	–0.00	0.0000	0.00

Table 6: Deviation in refractive index (Δn) and deviation in molar refraction (ΔR) values for the binary mixtures of PC at 298.15, 303.15 and 308.15 K.

Propylene carbonate (1) + ethylbenzene (2)						
	T = 298.15 K		T = 303.15 K		T = 308.15 K	
x_1	Δn	ΔR	Δn	ΔR	Δn	ΔR
0.0000	0.0000	–0.00	0.0000	0.00	0.0000	–0.00
0.0294	0.0002	–0.22	0.0002	–0.22	0.0001	–0.22
0.0420	0.0003	–0.31	0.0002	–0.30	0.0002	–0.31
0.0729	0.0005	–0.50	0.0004	–0.50	0.0004	–0.52
0.0821	0.0005	–0.56	0.0005	–0.56	0.0004	–0.57
0.1013	0.0006	–0.67	0.0005	–0.67	0.0004	–0.69
0.2023	0.0006	–1.14	0.0006	–1.14	0.0005	–1.17
0.3008	0.0004	–1.43	0.0003	–1.44	0.0001	–1.47
0.4012	–0.0001	–1.59	–0.0002	–1.59	–0.0004	–1.62
0.5001	–0.0006	–1.60	–0.0008	–1.61	–0.0010	–1.64
0.6001	–0.0013	–1.50	–0.0014	–1.51	–0.0016	–1.53
0.7001	–0.0017	–1.28	–0.0018	–1.28	–0.0019	–1.30
0.8009	–0.0018	–0.96	–0.0020	–0.95	–0.0020	–0.97
0.8992	–0.0015	–0.54	–0.0017	–0.53	–0.0017	–0.54
1.0000	0.0000	–0.00	0.0000	0.00	0.0000	0.00

Table 7: Deviation in refractive index (Δn) and deviation in molar refraction (ΔR) values for the binary mixtures of PC at 298.15, 303.15 and 308.15 K.

Propylene carbonate (1) + o-xylene (2)						
	T = 298.15 K		T = 303.15 K		T = 308.15 K	
x_1	Δn	ΔR	Δn	ΔR	Δn	ΔR
0.0000	0.0000	–0.00	0.0000	0.01	0.0000	–0.00
0.0230	–0.0014	–0.33	–0.0007	–0.28	–0.0005	–0.27
0.0428	–0.0024	–0.53	–0.0014	–0.46	–0.0007	–0.41
0.0618	–0.0035	–0.74	–0.0020	–0.64	–0.0011	–0.58
0.0804	–0.0043	–1.03	–0.0026	–0.92	–0.0016	–0.85
0.1015	–0.0053	–1.16	–0.0036	–1.05	–0.0021	–0.95
0.2056	–0.0092	–1.98	–0.0072	–1.86	–0.0053	–1.72
0.2993	–0.0112	–2.27	–0.0096	–2.17	–0.0082	–2.07
0.3992	–0.0126	–2.31	–0.0113	–2.23	–0.0101	–2.14
0.4995	–0.0128	–2.19	–0.0114	–2.11	–0.0104	–2.04
0.5986	–0.0122	–1.88	–0.0105	–1.79	–0.0093	–1.73
0.7001	–0.0105	–1.52	–0.0086	–1.42	–0.0073	–1.36
0.8004	–0.0081	–1.01	–0.0067	–0.93	–0.0054	–0.88
0.8990	–0.0055	–0.51	–0.0038	–0.42	–0.0033	–0.41
1.0000	0.0000	–0.00	0.0000	0.01	0.0000	0.00

The calculated Δn and ΔR values were correlated by Redlich-Kister polynomial[11] at 298.15 K as shown in equation

$$Y^E = x_1x_2\sum_{i=0}^{m} a_i (x_1 - x_2)^I \quad (4)$$

where m is no of coefficients. The coefficients a_i in equation (4) were estimated by the least square fit method and the standard deviations σ_i were calculated by equation

Table 8: Deviation in refractive indices (Δn) and deviation in molar refraction (ΔR) values for the binary mixtures of PC at 298.15, 303.15 and 308.15 K.

Propylene carbonate (1) + p-xylene (2)						
	T = 298.15 K		T = 303.15 K		T = 308.15 K	
x_1	Δn	ΔR	Δn	ΔR	Δn	ΔR
0.0000	0.0000	0.00	0.0000	0.00	0.0000	0.03
0.0227	–0.0002	–0.30	–0.0001	–0.30	0.0000	–0.27
0.0397	–0.0005	–0.53	–0.0002	–0.51	–0.0001	–0.48
0.0573	–0.0007	–0.75	–0.0004	–0.72	–0.0002	–0.69
0.0816	–0.0010	–1.02	–0.0006	–0.99	–0.0003	–0.95
0.0980	–0.0012	–1.18	–0.0008	–1.16	–0.0005	–1.12
0.2090	–0.0020	–2.02	–0.0015	–1.99	–0.0010	–1.95
0.3029	–0.0023	–2.40	–0.0018	–2.38	–0.0014	–2.34
0.3993	–0.0024	–2.55	–0.0020	–2.53	–0.0016	–2.49
0.5028	–0.0025	–2.49	–0.0021	–2.47	–0.0017	–2.42
0.5978	–0.0024	–2.25	–0.0019	–2.27	–0.0015	–2.19
0.7068	–0.0019	–1.80	–0.0016	–1.78	–0.0010	–1.73
0.8012	–0.0014	–1.28	–0.0010	–1.26	–0.0006	–1.21
0.8996	–0.0005	–0.62	–0.0003	–0.60	–0.0001	–0.56
1.0000	0.0000	–0.00	0.0000	0.00	0.0000	0.04

$$\sigma = [\Sigma (Y^{E}_{expt} - Y^{E}_{cal})^2/(D–N)]^{0.5} \quad (5)$$

where D and N are the number of data points and parameters respectively. Regression results for Δn and ΔR values of binary mixtures at 298.15 K are as shown in Table 9.

Table 9: Adjustable parameters a_i of the Redlich-Kister (Eq. (4)) and standard deviations σ, (Eq. (5)) of deviation in refractive index (Δn) and deviation in molar refraction (ΔR) values of the binary mixtures of PC at 298.15 K.

Property	a_0	a_1	a_2	σ
Propylene carbonate (1) + Benzene (2)				
Δn	0.0105	–0.0156	–0.0144	0.0005
ΔR	0.0475	0.0924	0.1938	0.0212
Propylene carbonate (1) + ethylbenzene (2)				
Δn	–0.0026	–0.0131	–0.0030	0.0001
ΔR	0.0047	0.0092	0.0189	0.0021
Propylene carbonate (1) + o-xylene (2)				
Δn	–0.0509	0.0030	–0.0090	0.0002
ΔR	0.0617	0.1228	0.2637	0.0275
Propylene carbonate (1) + p-xylene (2)				
Δn	–0.0100	0.0029	–0.0003	0.0001
ΔR	0.0455	0.0884	0.1046	0.0204

Different refractive index mixing rules such as Lorentz-Lorenz, Gladstone-Dale, Arago-Biot, Weiner, Heller etc are most frequently employed to test the validity of the experimental results. In present case, we have used Arago-Biot equation (A-B), Newton equation (NW), Eyring and John (E-J) equation for the comparison purpose.

Arago-Biot equation (A-B)

$$n = n_1\phi_1 + n_2\phi_2 \quad (6)$$

Newton equation (NW)

$$n^2 - 1 = (n_1^2 - 1)\phi_1 + (n_2^2 - 1)\phi_2 \quad (7)$$

Eyring and John equation (E-J)

$$n = n_1\phi_1^2 + 2\,(n_1n_2)^{1/2}\,\phi_1\phi_2 + n_2\phi_2^2 \quad (8)$$

The comparison of the experimental refractive index (n_{obs}) with the calculated one (n_{cal}) with different mixing relations is represented in terms of average deviation (AVD) at 298.15, 303.15 and 308.15 K using following equation

$$AVD = [(n_{obs} - n_{cal})/n_{obs}] \quad (9)$$

The average deviation values obtained by comparison of the experimental refractive index values with those calculated by using different mixing rules at 298.15 K is represented in Table 10.

Table 10. Average deviations in the refractive index for different mixing relations for binary mixtures of PC (1) with aromatic hydrocarbons (2) at 298.15 K.

System/Mixing relations	Arago-Biot (A-B)	Newton (NW)	Eyring-John (E-J)
	T = 298.15 K		
Benzene	0.0004	0.0023	0.0026
Ethylbenzene	–0.0024	–0.0025	–0.0023
o-xylene	–0.0069	–0.0071	–0.0069
p-xylene	–0.0031	–0.0032	–0.0030
	T = 303.15 K		
Benzene	0.0002	0.0000	0.0003
Ethylbenzene	–0.0024	–0.0025	–0.0023
o-xylene	–0.0060	–0.0062	–0.0060
p-xylene	–0.0028	–0.0027	–0.0028
	T = 308.15 K		
Benzene	0.0000	–0.0001	0.0001
Ethylbenzene	–0.0025	–0.0026	–0.0024
o-xylene	–0.0054	–0.0056	–0.0053
p-xylene	–0.0026	–0.0027	–0.0025

From perusal of Tables 1–4, it can be observed that, the n values decrease both with increasing mole fraction of PC and with increasing temperatures while the R values are found to be decreasing for all the mixtures with increasing mole fraction of PC.

A closer look at Tables 5–8 reveals that the Δn are positive for benzene becoming slightly negative towards the end (i.e. 0.8–1.0 moles of PC). The values decrease with increasing temperature. For o- and p-xylenes the values are found to be negative and the negative values are

increasing with increasing temperature. For ethylbenzene mixtures a slight varying trend is observed. The values are positive up to 0.4 moles of PC and then becoming negative, thus showing sigmoidal shape.

Figure 1 shows the graphical representation of Δn values for all the four binary liquid mixtures at 298.15 K. The Δn values follow the order of benzene > ethylbenzene > p-xylene > o-xylene upto 0.75 mole fractions of PC. After 0.80 mole fraction of PC this order is slightly changed for the binary mixtures becoming benzene > p-xylene > ethylbenzene > o-xylene at 0.80 and p-xylene > ethylbenzene > benzene > o-xylene at 0.90 mole fraction of PC.

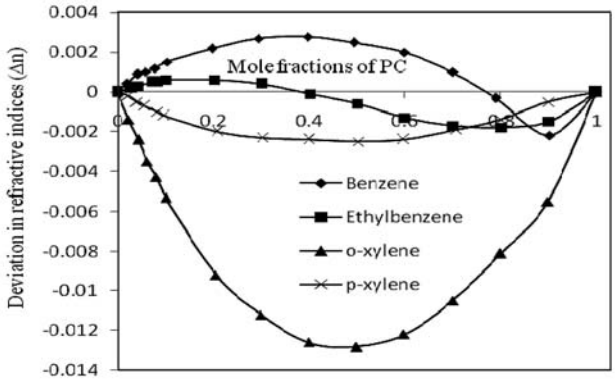

Fig.1: Deviation in refractive indices (Δn) with of mole fractions x1, for PC (1) + benzene, ethylbenzene, o-xylene and p-xylene (2) at 298.15 K.

The negative values of Δn observed in case of o- and p-xylene mixtures indicate the presence of strong intermolecular interactions amongst the mixing components. Whereas the positive values for benzene mixtures indicate weaker interactions are present. In case of ethylbenzene, increasing the mole fractions of PC is increasing the interaction amongst the components. The alkyl group present in all the three mixtures might be playing a role because of their donating inductive effect because of which these interactions are observed.

Also it can be revealed from Tables 5–8, that the ΔR values are negative for all the four binary mixtures. The deviation in molar refraction, ΔR, gives more information than Δn about the mixture phenomenon because it takes into account the electronic perturbation of molecular orbitals during the liquid mixing process[12] and *R* is also directly related to the dispersion forces. The positive values of ΔR indicate that the dispersion forces are higher in the mixtures than in the pure liquids[13] whereas negative values of those indicate the presence of interactions amongst the mixture components.

Figure 2 shows the graphical representation of ΔR values for all the binary mixtures at 298.15 K. The negative values of ΔR follows the trend benzene > ethylbenzene > o-xylene > p-xylene almost over the entire range of mole fractions of PC.

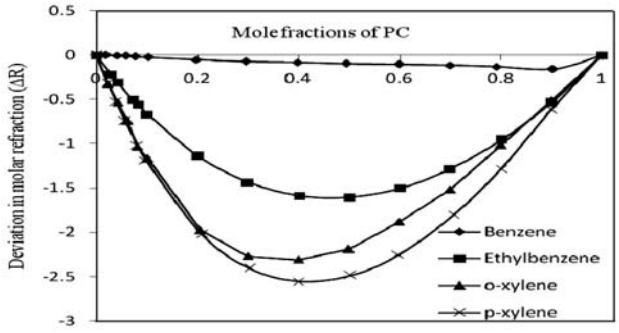

Fig.2: Deviation in molar refraction (ΔR) with mole fractions x1, for PC (1) + benzene, ethylbenzene, o-xylene and p-xylene (2) at 298.15 K.

The negative values of ΔR observed for all the mixtures show the presence of interactions in all the binary mixtures.

A closer look at Table 3 indicates that all the four binary mixtures show good agreement with the values obtained by mixing rules. Slightly larger values are obtained in case of o-xylene mixtures. Benzene mixtures are showing least variation from the experimental values in case of all the four mixing rules. Deviations are significant up to three decimal places in all the four mixing relations. The systems are not showing much deviation and are near to ideal for testing using other mixing rules.

4. Conclusion

Deviation in refractive index (Δn) and deviation in molar refraction (ΔR) values estimated for four binary mixtures of PC with benzene, ethylbenzene, o-xylene and p-xylene at 298.15, 303.15 and 308.15 K show the presence of strong intermolecular interactions amongst the mixture components. The four mixing rules can be applied successfully to these mixtures and show good agreement with the experimental values of refractive indices. A slightly larger deviation is observed in case o-xylene mixture compared to other three mixtures whereas benzene mixture show the least variation.

5. References

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Povzetek

Binarnim mešanicam propilen karbonata (PC) (1) z benzenom, etilbenzenom, o-ksilenom in p-ksilenom (2) smo izmerili lomni količnik,n, v celotnem koncentracijskem območju ($0 \leq x_2 \leq 1$) pri treh temperaturah (298.15, 303.15 in 308.15 K). Iz eksperimentalnih vrednosti za n smo izračunali presežni lomni količnik, Δn, molsko refrakcijo, R, in presežno molsko refrakcijo, ΔR. Pri 298.15 K smo za vse proučevane sisteme preverili veljavnost Argo-Biotove (A–B), Dale-Gladstonove (D–G), Newtonove (NW), Eyringove in Johnove (E–J) enačbe za določanje lomnega količnika. Presežne vrednosti (Δn in ΔR) smo pri 298.15 K ponazorili z Redlich-Kisterjevo enačbo. Odstopanja smo interpretirali z intermolekularnimi interakcijami med komponentami.