Original Article

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TMU Journal of Basic & Applied Chemistry
Vol.2
January-December, 2022: pp.57-60.
ISSN 2583- 1518 (Online)

Dielectric Constants for Methoxybenzene ($C_6H_5OCH_3$)+ Dichloromethane (CH_2Cl_2), Ethylene dichloride (EDC), Trichloroethene ($CHClCCl_2$), Tetrachloroethylene (CCl_2CCl_2) at 303.15 K

Abstract
Dielectric constants or relative permittivity ,ε, have been determined at 303.15 ± 0.01 K and at a frequency of 1.8 MHz with a dekameter (type DK03, made in Germany), using two cells, first cell for mixtures having dielectric constants less than 7.0 and other cell , for mixtures having dielectric constants more than 7.0 for mixtures of Methoxybenzene ($C_6H_5OCH_3$) + dichloromethane (CH_2Cl_2), ethylene dichloride (EDC) (CH_2ClCH_2Cl),Trichloroethylene ($CHClCCl_2$), Tetrachloroethene(CCl_2CCl_2) at 303.15 K.
The quantities Δ ε, which refer, to the deviations of the value of ε of the mixtures from the values developing from the mole fraction combination law, have been calculated and deciphered.

Keywords: Methoxybenzene, dekameter,hydrogen bonding, specific interaction, binary mixture

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Received on 2.10.2021
Accepted on 29.11.2021

Introduction

Mixtures of methoxybenzene with all mentioned chlorocompounds are of huge interest due to presence of a molecular interaction amongst the individual compound. As pointed out by Mulliken ,1964, methoxybenzene $C_6H_5OCH_3$, containing a benzene and a methoxy (-OCH3 group), performs as a nπ-type donor. All chlorocompounds in the present programme, will perform as σ acceptor toward C_6H_5- OCH_3, and forms hydrogen bond on account of the presence of Cl and H atoms in $CHClCCl_2$, CH_2ClCH_2Cl, t**etrachloroethene** and CH_2Cl_2 . Measurements of ε data for above mentioned mixtures at 303.15 K have been undertaken in the present research for understanding the interactions between methoxybenzene and other mentioned chlorocompounds in the liquid state.

Materials

CH_2Cl_2 (qualickem), and CCl_2CCl_2 (E. Merck, Darmstadt, FRG), , were dried over anh.$CaCl_2$ before use for removing moisture content. CH_2ClCH_2Cl (E.Merck) was shaken with solution of $NaHCO_3$, and then dried over anh. CaCl2 , and then distilled from P_2O_5. $CHClCCl_2$ (A.R.grade) was washed with an aq. solution of K2CO3, then rinsed with H2O, and dried above anh.K_2CO_3 and $CaCl_2$, and then distilled fractionaliy . Methoxybenzene ($C_6H_5OCH_3$) (E.Merck) was obtained by distillation from Na.

Method

Dielectric constants for pure as well as their mixtures were determined at 303.15 ± 0.01 K and at a known frequency of 1.8 MHz using a dekameter as described by Nath and Tripathi, 1984.

Results and Discussion

The values of relative permittivity data for different mixtures are collected in table 1. The values of ε for pure liquids CH_2Cl_2, CH_2ClCH_2Cl, $CHClCCl_2$, CCl_2CCl_2, and $C_6H_5COCH_3$ at 303.15 K are obtained to be 8.703, 10.071, 3.346, 2.295, , and 4.246, correspondingly, which are in good agreement with the literature (Lange,1973) values. The dielectric constants ε of the various mixtures have been used to calculate the quantityΔ ε from the relation

$$\Delta \varepsilon = \varepsilon - x1\ \varepsilon 1 - x2\ \varepsilon 2$$

where ε1,x1 and ε2,x2 refer to the dielectric constants and mole fraction of the two pure components 1 and 2. The values of Δ ε vs x1, is plotted in Fig.1. As indicated by Fig.1 the Δ ε data are negative for mixtures of Methoxybenzene+ CH_2Cl_2,Methoxybenzene + CH_2ClCH_2Cl, , Methoxybenzene + CCl_2CCl_2, and positive for Methoxybenzene +$CHClCCl_2$. The negative values of Δ ε **,** for all the systems except for Methoxybenzene +$CHClCCl_2$, can be explained as due to a lower within the degree of combination of the molecular dipoles with converting composition of the combination.Δ ε is found to be in reversed sign for those mixtures where strong interaction occurs between the components as shown by the system Methoxybenzene +$CHClCCl_2$ in the present case (Rivail et.al,1974).

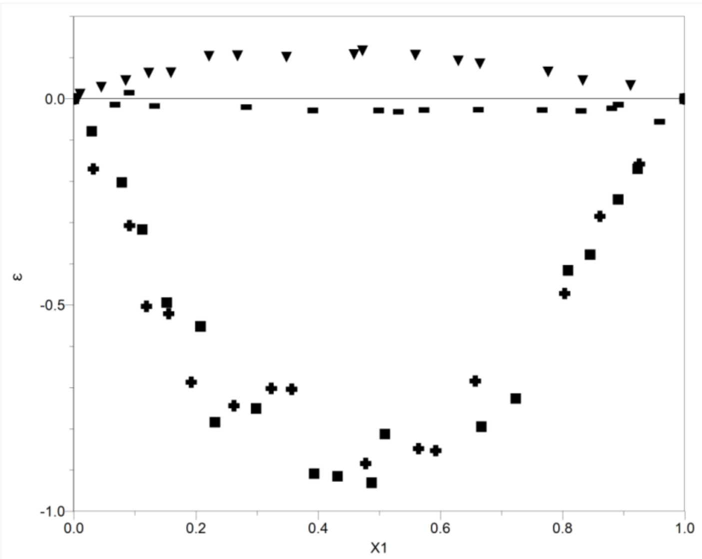

Fig.1. Plot of Δ ε vs x1 at 303.15K for the systems of methyloxybenzene+ Dichloromethane , ✚,+ Ethylene dichloride , ■, + Tetrachloroethylene , ▼ , and + $CHClCCl_2$, ▬ .

The data also display that $CHClCCl_2$ creates strong interaction with methoxybenzene. The occurrence of a interaction between methoxybenzene and all mentioned chlorocompounds may be because of the formation of a weak hydrogen bond between the H atoms of chlorocompounds and the π-electrons in the benzene ring of methoxybenzene.There's, however, additionally an opportunity that methoxybenzene can create a r complex with the methoxybenzene, ***via Cl*** atom-π-electron interactions, such type of complexes may be charge transfer. Alternatively, the complex formation between methoxybenzene + CH_2Cl_2,or + CH_2ClCH_2Cl ,or + $CHClCCl_2$ may be due to the creation of strong interaction (probably creation of H- bonds) between the H atom of these chlorocompounds and the non-bonding pair of electrons on the O atom of methoxybenzene.

Table1. Dielectric constants for methoxybenzene in different mixtures mixtures at 303.15 K

Methoxybenzene+ CH_2Cl_2		**Methoxybenzene + CH_2ClCH_2Cl**	
$x1$	ε	$x1$	ε
0.0000	8.703	0.0000	10.071
0.0321	8.39	0.0295	9.82
0.0912	7.99	0.0787	9.41
0.1189	7.67	0.1122	9.10
0.1553	7.49	0.1523	8.69
0.1921	7.16	0.2076	8.31
0.2623	6.79	0.2312	7.94
0.3233	6.56	0.2987	7.58
0.3565	6.41	0.3934	6.87
0.4776	5.69	0.432	6.64
0.5643	5.34	0.4876	6.30
0.5923	5.21	0.5095	6.29
0.6571	5.09	0.6672	5.39
0.8034	4.65	0.7234	5.13
0.8611	4.58	0.8091	4.94
0.9255	4.42	0.8452	4.77
1.000	4.246	0.8911	4.64
		0.923	4.53
		1.0000	4.246

Methoxybenzene + CCl_2CCl_2		Methoxybenzene + $CHClCCl_2$	
x1	ε	x1	ε
0.0000	2.295	0.0000	3.346
0.0673	2.412	0.0102	3.367
0.0906	2.487	0.0451	3.415
0.1321	2.536	0.0851	3.468
0.2823	2.826	0.1227	3.519
0.3912	3.031	0.1592	3.553
0.4991	3.241	0.2215	3.649
0.5312	3.311	0.2682	3.692
0.5733	3.387	0.3483	3.761
0.6622	3.561	0.4589	3.867
0.7665	3.763	0.4724	3.888
0.8301	3.886	0.5592	3.956
0.8804	3.989	0.6292	4.005
0.8911	4.056	0.6647	4.032
0.9587	4.169	0.7762	4.111
1.0000	4.246	0.8332	4.141
		0.9111	4.199
		1.0000	4.246

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