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Molecular interaction studies in binary mixtures of methyl amine with benzene and toluene

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Abstract: Excess isentropic compressibility $\beta\frac{E}{S}$ and Excess molar volume $V\frac{E}{M}$ for binary liquid mixture- Methyl amine + o–benzene and Methyl amine + p-toluene as function of composition have been reported. The isentropic compressibilities of the binary mixtures were determined from the sound velocity and density measurements. Both $\beta\frac{E}{S}$ and $V\frac{E}{M}$ are found to be negative in all the systems, indicates strong interactions between components.

(**Keywords :**Molecular interaction study, Binary mixture, Methyl amine and benzene and toluene).

Introduction

Considerable interest has been stimulated by the ultrasonic investigation of binary liquid mixtures. The non-ideal behaviour of liquid mixtures has been predicted byToumikoski and Nurmi , Fort and Moore and Nurmi , Fort and Moore. Flory and coworkers, prakash*et al* and Raman and Naidu .the deviation from the law of addivity in the values of various parameters indicates the existence of specific interaction between inlike molecules. Methyl amine is a polar liquid, where as benzene and toluene also polar and show hydrogen bonding among themselves. The present work is carried out at 30˚C of ultrasonic velocity, isentropic compressibility, molar volume and their excess values for the system methyl amine + benzene and methyl amine + p-toluene have been computed.

Experimental

Ultrasonic velocity a $2MH_z$was measured by ultrasonic interferometer manufactured by M/S mittal Enterprises Model F-81. The transducer was a gold plated quartz crystal. The accuracy of velocity measurement were made using a double walled pyknometer having capillaries of narrow bore provide with well fitted glass caps in order to avoid changes composition due to

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evaporation of the volatile liquids. The accuracy in density measurement is within the range of ±0.05% . Density measurement were made using a double walled pyknometer having capillaries of narrow bore provide with well fitted glass caps in order to avoid changes composition due to evaporation of the volatile liquids. The accuracy in density measurement is within the range of ±0.05 gm/ml. Mixtures were prepared by mixing appropriate volume of each pure liquids are kept for 2 hours.

The isentropic compressibility, âsis given byâs= $\frac{1}{v^2\rho}$ ……(1)

Where V i9s the ultrasonic velocity and r is the density, Molar Value v of a mixture is defined as : v=$\frac{M}{\rho}$ …….(2)

Where M = XM_1+ (1-X)M_2, $M_1$and M_2 being the molecular weights of the components and X the first molar fraction of the first.

Table 1:

Methyl amine + 0-benzene at 30˚C

Mole fraction of methyl amine	Ultrasonic velocity m/s	Density gm/cm^3	Excess molar volume ml/mol	Excess isentropic compressibility 10^{12}cm^2/dyne
1.1000	1382	0.8421	0.00	0.00
0.6798	1360	0.8311	-0.58	-9.38
0.5185	1336	0.8193	-0.89	-15.44
0.4784	1314	0.8068	-0.99	-19.52
0.4769	1286	0.7924	-1.13	-21.63
0.3822	1250	0.7767	-0.71	-20.13
0.3079	1220	0.7591	-0.71	-20.00
0.2442	1180	0.7426	-0.84	-16.42
0.1895	1150	0.8248	-0.50	-13.04
0.0419	1114	0.7046	-0.28	-7.32
0.0000	1078	0.6822	0.00	0.00

Table 2:

Methyl amine + p-toluene at 30˚C

Mole fraction of methyl amine	Ultrasonic velocity m/s	Density gm/cm^3	Excess molar volume ml/mol	Excess isentropic compressibility 10^{12}cm^2/dyne
1.0000	1284	0.9427	0.00	0.00
0.7358	1270	0.9280	-0.15	-4.79
0.6936	1248	0.9132	-0.26	-8.50
0.6691	1222	0.7978	-0.32	-10.48
0.5592	1198	0.7829	-031	-12.09
0.3615	1172	0.7671	-0.42	-12.38
0.2739	1144	0.7510	-0.41	-11.70
0.0954	1118	0.7341	-0.33	-10.38
0.0240	1094	0.7173	-0.26	-8.34
0.0594	1062	0.6997	-0.14	-4.77
0.0000	1030	0.6817	0.00	0.00

The excess values $\beta\frac{E}{S}$ and $V\frac{E}{M}$ have been computed from the following equation :

$=(\hat{a}_s)$ Mix – $\{X\hat{a}_{s2} + (1\text{-}X)\hat{a}_{s2}\}$, …….(3)

=(V) Mix – $\{XV_1 + (1\text{-}X)V_2\}$, …….(4)

Subscripts 1 and 2 refer to component 1 and 2.

Result and Discussion

The ultrasonic velocity, density, isentropic compressibility and molar volume together with their excess values for the system studied here are presented in Tables 1 and 2. Excess molar volume and excess isentropic compressibility of binary mixtures have showed the strength of the interactions between unlike molecules. The value of and, become increasing negative which indicate h strong interaction.

In many cases where there is a possibility of formation of hydrogen bond between the components, the approach which suppose that the real components, A and B in equilibrium with one or more complexes forms on mixing, has been successful. Addition of Methyl amine + o-benzene breakup clustering in alcohols.

Attempt have been made to explain the behaviour of liquid mixture on the basis of sign and magnitude of the excess value as discussed by Bensen*et al*[9], it is responsible to assume thathydrogen bonding plays relatively an important role in the energetic behaviour of benzene and toluene and methyl amine mixtures. Dilution of an Methyl amine result in the breaking of hydrogen bond between methyl molecules, however, when diluents molecules contain C=O (Carbonyl group) an in the present case. The formation of the bond with the carbonyl oxygen will produce a compensating effect , it has been observed by Kiyohara*et al* that in the case of mixture of Methyl amine with benzene and toluene both the breaking of hydrogen bond between methyl amine leads to expansion on the other hand, the formation of hydrogen bond between Benzene and Toluene an methyl amine molecule and the fitting of Benzene and toluene molecules into the hydrogen bonded methyl amine structure lead to contraction, at present there is no reliable way of estimating the relative contribution of these effect.

In the present study it has been studies the excess isentropic compressibility of all the system. Fort and moore have suggested that excess compressibility became increasingly negative if the strength of interaction increases it has also been observed that excess isentropic compressibility of all the system are negative, which is in conformity with the above observation of existence of specific interaction of ketone and methyl amine.

In addition of this, dipole-dipole interaction might occur in almost all the systems. This interaction occurs between two polar molecules of different polar liquids Prigoggine explained the negative value of excess molar volume ($V\frac{E}{M}$) due to different size of unlike molecules or the dipole-dipole interaction.

References

1. *F. Tumikoski and V.Nurmi, Comments, Phys, Math Helsingf., 10, 11(1940).*
2. *R. J. Fort And W.R. Moore , Trans, Faraday Soc., 61,2012 (1965).*
3. *R. J. Fort And W.R.Moore , Trans, Faraday Soc., 62,1112 (1966).*
4. *P.J. Floory, J. Amer. Chem. Soc., 87, 1883 (1965).*
5. *A. Abe and P.J Flory, J. Amer. Chem. Soc., 87,1838 (1965).*
6. *S. Prakash S., N. Prasad, R. Singh and O. Prakash, Acoustica, 34, 121 (1965).*
7. *A. Kumar, O. Prakash and S. Prakash, J. Chem. Eng. Data, 26,64 (1981).*
8. *G.K. Raman and P. R. Naidu, Proc. Indian Acad,Sc., 77, 263 (1973).*
9. *G. C Benson, S. Murakami and D. E. jones, J. Chem.Thermodyn., 3,719 (1971).*
10. *O. Kiyohara, S. C. Anand and G. C. Benson, J. Chem. Thermodyn., 6, 355.*