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Dielectric relaxation studies of brompheniramine with 1-methanol, 1-ethanol and 1-propanol at 303K

Sampandam Elangovan*, Dereje Wakgari Amente and Abraham Abebe Kibret
Department of Physics, Wollega University, Nekemte-395, Ethiopia.

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ABSTRACT
Molecular interaction between brompheniramine with 1-methanol, 1-ethanol and 1-propanol were analyzed by Time Domain Reflectometry technique at 303K. Dielectric relaxation times, Dielectric constants, dielectric loss, were calculated. Physical and chemical parameters varied with alcohols concentrations in brompheniramine medium. Intermolecular interaction strength of alcohols with brompheniramine was observed in the order of 1-methanol<1-ethanol<1-propanol.

Introduction

Intermolecular interaction in binary and ternary liquid mixtures studies is useful in pharmaceutical and chemical industries.[1-3] Dielectric relaxation study is one of the reliable techniques to analyze nature interactions exist in the liquid mixtures of non polar and polar molecules[4,5]. Brompheniramine is used in pharmaceutical industries as one of the drugs of common cold.

Alcohols self associated through hydrogen bonding. Amine groups (N-H) present in the brompheniramine leads to hydrogen bonding interaction with hydroxyl (OH-) group exist in the alcohols. Here intermolecular interactions among brompheniramine with 1-methanol, 1-ethanol and1-propanol by time domain reflectometry method at 303K.

Materials and Methods

AR grade of brompheniramine and 1-methanol,1-ethanol and 1propanol were obtained from E-Merck India and used with out further purification. Purity of liquids analysed with the standard liquids physical values. Dielectric constant (ε') and dielectric loss (ε'') were determined by oscillator of frequency 9.36 GHz at 303K. Abbe's refractometer was used to measure refractive indices (μ) of solution. Ostwald's viscometer was used to find viscosities of the liquid mixture. Densities were determined by using 5cc specific gravity bottle.

Methods

Higasi's Method:

Dielectric relaxation time (τ) was calculated by Higasi's method[6].Let ϵ_0 ϵ', ϵ'' , ϵ_∞ linearly change with solute concentration. Slopes a_0,a',a'' and a_∞ were calculated from experimental data. Here

$$\varepsilon_0 = \varepsilon_1 + a_0 w_2$$
$$\varepsilon' = \varepsilon_1 + a' w_2 \quad \text{-----(1)}$$
$$\varepsilon'' = a'' w_2$$
$$\varepsilon_\infty = \varepsilon_{1\infty} + a_\infty w_2$$

$$\tau_{(1)} = \frac{a''}{\omega(a' - a_\infty)} \quad \text{------(2)}$$

$$\tau_{(2)} = \frac{(a_0 - a')}{\omega a''}$$

$$\tau_{(0)} = \sqrt{\tau_{(1)}\tau_{(2)}}$$

Dielectric relaxation ΔF_τ , Mean relaxation time(τ_0), and viscous flow were determined by Eyring's equation [7].

$$\tau = \left(\frac{h}{kT}\right)\exp\left(\frac{\Delta F_\tau}{RT}\right) \quad \text{-----(3)}$$

$$\eta = \left(\frac{Nh}{V}\right)\exp\left(\frac{\Delta F_\eta}{RT}\right) \quad \text{------(4)}$$

Cole-Cole Method:

Calculated values of ε_0, ε', ε'' and ε_∞ were fitted in a graph. Diameter angle with respect to centre from ε_∞ point and abscissa axis is equal to πα/2. Relaxation time τ was determined by

$(\omega\tau)^{1-\alpha}=V/U$ ------(5)

Result and Discussion

Table1 listed with various dielectric parameters of the solution. Dielectric relaxation time changes with intermolecular interaction of the selected liquid mixtures. Relaxation time (τ) variation observed with carbon chain length of alcohols and their concentration. It signifies that hydrogen bonding formation in amine of brompheniramine and hydroxyl group of the selected alcohols. Here, ε_0 values varied with the alcohol concentration. It shows that dissociation takes place with increasing the concentration of alcohols. It shows that viscous flow (ΔF_η) is greater than dielectric relaxation (ΔF_τ) of the liquid system. It suggests that viscous flow changed with molecular rotational and translation vibrations [8-10].Strength of intermolecular interaction depends proton donor alcohols and was observed in the order of l-methanol<1-ethanol<1-propanol.

Tele:
E-mail address: elangovan.physics@rediffmail.com

Table 1. Dielectric constant ($\varepsilon_{0)}$, relaxation time (τ) of brompheniramine with alcohols at 303K.

Volume % of alcohols	ε_0	ε'	ε''	ε_∞	Relaxation Time τ (ps)				Activation energy	
					Higasi's			Cole-Cole	ΔF_τ kJ/mol	ΔF_η kJ/mol
					$\tau_{(1)}$	$\tau_{(2)}$	$\tau_{(0)}$	τ		
System : Brompheniramine + 1-Methanol										
0	5.3799	4.7381	2.9512	4.3333	11.9569	14.8339	13.2799	6.5508	9.2129	5.3799
25	5.2945	4.7626	2.9659	4.3305	12.3699	15.2119	13.7139	6.9085	9.5139	5.2945
50	5.2203	4.7668	2.9862	4.3452	13.6369	15.7299	14.6449	8.9301	9.8709	5.2203
75	5.1216	4.7514	2.9764	4.3375	12.1319	15.7859	13.8329	9.6756	9.5769	5.1216
100	5.0593	4.7339	2.9687	4.3263	11.8449	14.7079	13.1959	10.0991	9.1429	5.0593
System : Brompheniramine + 1-Ethanol										
0	5.2581	4.6674	3.6239	4.9276	13.8749	19.1109	16.2969	18.1190	9.4649	5.2581
25	5.1608	4.6660	2.9113	4.8303	12.5939	15.9399	14.1619	13.4031	9.2969	5.1608
50	5.1594	4.6653	2.9120	4.8303	12.3069	17.2559	14.5609	18.8526	7.9739	5.1594
75	5.0845	4.6513	2.9029	4.7547	11.8799	13.7769	12.7899	12.8984	8.8349	5.0845
100	5.0831	4.6576	2.9043	4.7526	11.8659	14.5189	13.1189	19.6590	9.0449	5.0831
System : Brompheniramine + 1-Propanol										
0	5.2427	4.6891	2.9309	4.3487	14.9319	22.1069	18.1519	20.9414	9.3599	5.2427
25	5.1342	4.6716	2.9113	4.3424	13.8539	18.8659	16.1499	16.9605	9.1429	5.1342
50	5.1097	4.6723	2.9085	4.3445	13.9589	18.7469	16.1639	21.7303	9.3039	5.1097
75	5.0922	4.6674	2.9050	4.3368	13.0629	16.0449	14.4699	16.6168	8.6669	5.0922
100	5.0334	4.6240	2.9008	4.3361	13.0139	15.2399	14.0779	22.5234	8.9119	5.0334

Conclusion

Physical and chemical parameters were determined in the liquid mixture of brompheniramine, 1-methanol, 1-ethanol and 1- propanol in various concentrations at 303K. Dielectric relaxation time varied with alcohol concentration in the liquid mixtures. Variations in dielectric parameters with alcohols suggests that intermolecular interaction strength of alcohols with brompheniramine was observed as 1-methanol<1-ethanol<1-propanol.

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References

[1] K.V. Ivanov, O.S. Ivanova, A.V. Agafonov and S.A. Kozyukhin, Colloid. J., 79, 204-211 (2017).

[2] V.I. Zhuravlev, Russ. J Phys Chem A., 90, 1578-1586 (2016).

[3] D.S.Kovalev, S.V.Kostromin, V.Musteaţa ,V.Cozan andS. V. Bronnikov, Phys.Solid State., 57, 1673-1677 (2015).

[4] D.N.Rander,, Y.S.JoshiK , S.Kanse and A.C Kumbharkhane, Indian J. Phys.,90, 67-72 (2016).

[5] Jian Chuan Liu and Guo zhu Jia, Colloid Polym Sci.,293, 2053-2059(2015).

[6] K.Higasi , Y.Koya and M.Nakamura, Bull. Chem. Soc. Jpn., 44, 988-992(1971).

[7] H.Eyring H and F.Cernuschi, J. Chem. Phy., 7, 547-551 (1939).

[8] S.Elangovan and S.Mullainathan., Mat. Sci. Res. Ind., 9, 81(2012).

[9] A.Mohan, M.Malathi, S.S.Shaikh and A.C. Kumbharkhane, J. Solution Chem., 45, 221-234(2016).

[10] T.Vijaya Krishna, S.Sreehari Sastry and V.R.K. Murthy, Indian. J Phys., 85, 379-390(2011).