Available online at www.scientiaresearchlibrary.com

Scientia Research Library

ISSN 2348-0408
USA CODEN: JACOGN

Journal of Applied Chemistry, 2014, 2 (3):17-20
(*http://www.scientiaresearchlibrary.com/arhcive.php*)

Analysis of Diethylether And Methyl Parathion Pesticide by Ultrasonic Measurements

[1]Amit Kumar, [1a]Ashish kumar Saxena,[2]Rajeev Agarwal
[1]Department of Physics, N.M.S.N. Dass College-Budaun-243601 (U.P.)India
[2]Department of Physics, S.M.(P.G.) College, Chandausi-244412 (U.P.)India

ABSTRACT
Binary liquid mixtures find practical applications in most physical and chemical processes. Derived parameters from ultrasonic velocity measurement provide qualitative information regarding the nature and strength of interactions in liquid mixtures. The ultrasonic velocity, density and viscosity have been measured for the binary liquid mixture of Diethyl ether with pesticide (methyl parathion) at 303K and 308K. The experimental data have been used to calculate the acoustical parameters namely isentropic compressibility, intermolecular free length, free volume, specific acoustic impedance and shears relaxation time. These parameters have been discussed in the light of molecular interaction present in the mixture.

Keywords: Pesticides, Acoustical parameters, Molecular interaction.

INTRODUCTION

Globally pesticides are toxic to non- target receptors including humans and reach them through food chain [1]. Most of the pesticides are non- biodegradable because of their molecular structure with stable internal bonds [2]. The overall impact of a pesticides depends on its behavior in the environment, its toxicity and the amount applied [3].

The high crop yield obtained in agriculture at present really on the wide use of pesticides. As a consequence, these chemicals are frequently found in soil and other environmental matrices where the risk they may pose has to be controlled [4]

After green revolution the use of pesticides increased very rapidly for all crops. In this area formers are using pesticides in huge quantity to prevent pest which covers the identification of methyl – parathion, fenvalerate [5-6].

Parathion has been used as a chemical weapon, most notably by the Selous Scouts during the Rhodesian Bush War [7]. Based on animal studies, parathion is considered by the U.S. Environmental Protection Agency to be a possible human carcinogen [8]. Studies show that parathion is toxic to fetuses, but does not cause birth defects [9]. It is classified as a UNEP

Persistent Organic Pollutant and WHO Toxicity Class, "Ia, Extremely Hazardous". Parathion is very toxic to bees, fish, birds, and other forms of wildlife. Parathion can be replaced by many safer and less toxic alternatives.

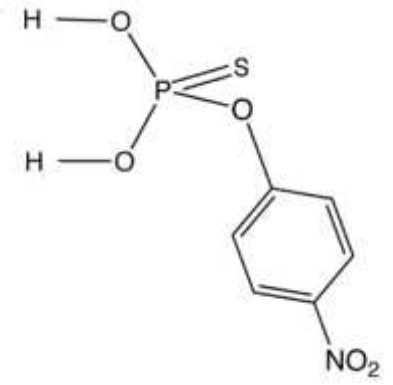

Figure 1: Structure of Methyl-Parathion

In this study, the density, ultrasonic velocity and viscosity, values of pure diethyl ether, and parathion and those of their binary mixtures over the entire composition range have been measured and reported at 303K and 308K, respectively.

The variation of these properties with composition and temperature of the binary mixtures are studied in terms of molecular interactions between unlike molecules of the mixtures.

RESULTS AND DISCUSSION

Various acoustical parameters such as isentropic compressibility (β), Intermolecular free length (L_f), free volume (V_f), and specific acoustical impedance (Z), were calculated using the experimental data of ultrasonic sound velocity, density and viscosity by the following equations (1-5).

$$\beta = 1/U^2\rho \quad (1)$$

$$L_f = k\mathrm{T}(\beta)^{1/2} \quad (2)$$

$$V_f = (M_{eff}U/\eta k)^{3/2} \quad (3)$$

$$Z = U\rho \quad (4)$$

$$\tau = 4/3\beta\eta \quad (5)$$

Where *kT* is the temperature dependent constant having a value 199.53 x 10^{-8} in MKS system , k is the constant equal to 4.28 x 10^9 in MKS system, independent of temperature of all liquids, and all the notations having the usual meanings. The experimental and the calculated data for two binary liquids mixtures are listed in Table-1 to Table-4.

From the experimental data, it is observed that decrease in density and viscosity with increase in temperature indicates decrease in intermolecular forces due to increase in thermal energy of the system. These cause expansions in volume and hence increase in free length [10-11]. Isentropic compressibility and the relaxation time increases with increase in concentration. A large portion of diethyl ether molecules exerts electronegative forces which attract the neighboring molecules increasing the effective volume. This leads to the increase in relaxation time and compressibility [12-13].

Table-1:- Value of U, ρ, η and β at 303^0K for diethyl ether and parathion binary liquid mixture

Mole fraction (X)	Ultrasound Velocity (U) m/s	Density gm/mol	Viscosity (η) x 10^3N.s.m^{-2}	Adiabatic compressibility (β)x 10^{10} cm^2/dyne
0.0000	1288	1.0238	1.6920	58.88
0.0487	1294	0.8281	1.8001	59.69
0.1033	1300	0.8119	1.7989	60.59
0.1649	1309	0.7983	1.7902	61.61
0.2350	1321	0.7828	1.7773	62.78
0.3154	1333	0.7673	1.7590	64.11
0.4086	1344	0.7518	1.7366	65.66
0.5180	1356	0.7363	1.7139	67.47
0.6482	1366	0.7208	1.6845	69.63
0.8057	1376	0.7078	1.6540	72.24
1.0000	1381	0.6948	1.6126	75.47

Table-2:- Value of V_f, L_f, Z, and τ at 303^0K for diethyl ether and parathion binary liquid mixture

Free Volume (V_f) x 10^7/m^3.mol^{-1}	Intermolecular Free Length (L_f) x 10^{11}/m	Specific impedance (C.G.S.)	Shear's relaxation time (τ) x 10^{-9}sec.
98.75	0.4841	1.3187	1.3283
101.96	0.5358	1.0716	1.7310
115.41	0.5386	1.0555	1.7489
131.98	0.5395	1.0450	1.7450
151.75	0.5398	1.0341	1.7348
175.26	0.5404	1.0228	1.7202
202.92	0.5414	1.0104	1.7050
235.39	0.5423	0.9984	1.6879
274.32	0.5440	0.9846	1.6699
320.51	0.5450	0.9739	1.6456
376.98	0.5481	0.9595	1.6226

Table-3:- Value of U, ρ, η and β at 308^0K for diethyl ether and parathion binary liquid mixture

Mole fraction (X)	Ultrasound Velocity (U) m/s	Density gm/mol	Viscosity (η) x 10^3N.s.m^{-2}	Adiabatic compressibility (β)x 10^{10} cm^2/dyne
0.0000	1278	1.0028	1.5986	61.06
0.0487	1286	0.8201	1.7021	61.87
0.1033	1291	0.8068	1.7043	62.79
0.1649	1300	0.7928	1.6960	63.82

0.2350	1311	0.7788	1.6807	65.00
0.3154	1322	0.7648	1.6632	66.35
0.4086	1333	0.7508	1.6402	67.92
0.5180	1344	0.7368	1.6170	69.75
0.6482	1355	0.7228	1.5934	71.94
0.8057	1361	0.7061	1.5716	74.59
1.0000	1368	0.6864	1.5536	77.85

Table-4:- Value of V_f, L_f, Z, and τ at 308^0K for diethyl ether and parathion binary liquid mixture

Free Volume (V_f) x 10^7/m^3.mol^{-1}	Intermolecular Free Length (L_f) x 10^{11}/m	Specific impedance (C.G.S.)	Shear's relaxation time (τ) x 10^{-9}sec.
106.278	0.4973	1.2816	1.3014
109.872	0.5465	1.0546	1.6733
123.956	0.5488	1.0416	1.6899
141.652	0.5498	1.0306	1.6878
163.161	0.5501	1.0210	1.6741
188.260	0.5505	1.0111	1.6591
218.349	0.5510	1.0008	1.6393
253.456	0.5517	0.9903	1.6199
294.587	0.5525	0.9794	1.6009
340.401	0.5565	0.9610	1.6022
393.044	0.5615	0.9390	1.6126

REFRENCES

[1]. J.Weng, W.Sun, Z.H.Zhang, et. al. J.Mol.Catal.A.Chem. 2007, 272, 1, 84-90.
[2]. H.F.Cheng, W.P.Xu, J.L.Liu, H.J.Wang, G.Chen, J.Hazard. Mater. 2007, 146, 2, 385-392.
[3]. S.Chen, D.Z.Sun, J.S.Chung, J.Hazard.Mater. 2007, 144, 2, 577-584.
[4]. L Li-An, M Ying-Shih, K.Mathva et, al. J.Chem.Eng. 2011, 166, 150-156.
[5]. A.Cabeza, A.Urtiaga, M.J.Rivero, I.Ortiz, J.Hazard.Mater. 2007, 144, 715.
[6]. C.A.Martinez, S.Ferro, Chem.Soc.Rev. 2006, 35, 1324.
[7]. Moorcraft, Paul, McLaughlin Peter, 2008, The Rhodesian War: A Military History. Yorkshire: Pen & Sword. p. 106.
[8]. "Parathion". Integrated Risk Information System.2007, U. S. Environmental Protection Agency. 26 January.
[9]. "Pesticide Information Profiles - Parathion".Extension Toxicology Network. Oregon State University, September 1993.
[10]. Yujing Sun, Xingqian Ye, Molecules, 2013, 18, 4858-4867.
[11]. D.Pingret, E.Petitcolas et.al. J.Food Sci. 2011, 76, 287-292.
[12]. Z.L.Pan, W.J.Qu, H.L.Ma et.al. Ultrason. Sonochem. 2011, 18, 1249-1257.
[13]. F.Chemat, M.K.Khan, Ultrason. Sonochem. 2011, 18, 813-835.