The Study of molecular interaction of Cotton seed oil in acetone, D.M.S.O. as the binary system at 303k & 308k by excess acoustic and thermodynamic properties

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Abstract :

In recent years, EEG signal analysis has become more reliable and accurate thanks to improvements in computers and how much they can do. It has become an important tool for diagnosing neurological problems, and it can be used in both the medical and physiological fields. Even for the most experienced neurologist, diagnosing and predicting epileptic seizures is hard because normal and abnormal signals often look the same. So, it would be best to have a fully automated Computer Aided Diagnostic (CAD) system that can use EEG signals to classify the severity of epileptic seizures. This is why the goal of the current Study is to create a computerised prediction model for figuring out how to read EEG data and make a diagnosis of epilepsy. This chapter talks about a computer-aided design (CAD) system that could find problems in the brain before and during seizures.

Keywords: ultrasonic interferometer, viscometer, pyknometer and used chemicals.

INTRODUCTION :

Understanding the behaviour of interacting molecules in their solvents requires knowledge of the physicochemical and thermodynamic properties of fluid mixtures with mole fractions and temperatures. Thermodynamic and acoustic research the[1-5] mixes of binary liquids are very useful in many fields. Cottonseed oil is a chemical with many intriguing properties, including its ability to react with acetone and dimethyl sulfoxide. The solvents acetone and dimethyl sulfoxide oleate (D.M.S.O.) contain sulfoxide groups, making cottonseed oil particularly useful. Cotton seed oil has cellulose, and other facts about it are acknowledged. At temperatures ranging from 308.15 to 323.15K, Prasad et al.[6] analysed acetophenone's ultrasonic velocities, densities, and viscosities in binary mixes with isopropanol as the common component. Ultrasound velocity, density, and viscosity are only a few parameters that can be determined experimentally for the pure components and the resulting mixes. Two intermolecular interactions can be better understood with the help of computed parameters such as isentropic compressibility, free length, interaction parameter, internal pressure, acoustic impedance, and Lennard Jones potential. In the temperature range of 303K to 313K, two binary liquid solutions, acetone-carbon tetra chloride and acetone-benzene were analysed.

EXPERIMENTAL :

Pure parts of a binary solvent and their liquid mixture at the full range of mole fraction determined by calibrated pyknometer at different temperatures 303K and 308K by an electronic thermostat. At 303K, a high-precision cannon Ostwald viscometer is used to measure the viscosity. At a constant temperature of 303K, an ultrasonic interferometer with a single 2Mhz crystal can measure the ultrasonographic velocity of pure compounds and their binary liquid mixtures over their entire range of mole fraction. This can be done with an accuracy of +0.05%. Procedures were used to clean up the chemicals that were used.[7]

Result & Discussion :

Isentropic compressibility (β_s), diffusion path length (L_f), molar volume (V_m), available volume (V_a), specific acoustic impedance (Z), molar sound velocity (R), and sear's relaxation time (τ_s) have been calculated for a wide range of cotton seed oil mixtures with acetone and D.M.S.O. at both 303K and 308K.

We used cottonseed oil with both acetone and dimethyl sulfoxide as the solvent. Cottonseed oil is thought to have the most cellulose, the ketonic gathering in acetone is polar and associative, while the double relationship in dimethyl sulfoxide, S=O, is polar because it connects two light methyl groups.

Two non-water systems were made by dissolving the cottonseed oil in acetone and dimethyl sulfoxide. The results of ultrasonic measurements of velocity, density, and viscosity are shown in Tables 1–4. At two different temperatures, you can use well-known relationships to figure out the other acoustic and thermodynamic properties, such as the isentropic compressibility, different chain length, molar volume, accessible volume, and excess values. Other important parameters, such as the acoustic impedance, the shear relaxation time, and Rao's constant, have also been calculated. The similarities and differences in how the molecules in the two binary systems interact will be at the centre of the discussion of the results. A description of molecular interactions in terms of adhesive and cohesive forces.[8]

Based on what we know about how molecules interact in binary systems right now. You can put them into two groups: polar-polar and polar-associating. When these two different molecules come together, they will have certain interactions. Figures 1–4 show the results of a poll that compared the properties of excess compressibility and viscosity. The results show that the two properties are opposites. A dangerous combination of the dissimilar molecules in the mixture is responsible for the negative excess readings.[9-10] As the strength of interactions between molecules of different types goes up, things like molar volume, specific diffusion path length, isentropic compressibility, and accessible volume all have negative values[11, 12].

The results show that as the mole fraction of cottonseed oil in acetone increases, its viscosity rises, while the opposite is true for dimethyl sulfoxide. One system's viscosity changes more slowly than the other, but at any temperature, the excess viscosity is always positive in both. Both acetone and D.M.S.O. have different trends of change in their isentropic compressibility, but the nature of the excess values in both systems is negative. Specific acoustic impudence, share's relaxation time, and Rao's constant all show that the amount of acetone is going down while the amount of D.M.S.O. is going up. From what has been said so far, it is clear that the molecular interactions are specific, since the excess deformation tends to change on the negative side and the excess viscosity tends to change on the positive side.'

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Table No. 1

Cotton Seed Oil + Acetone at 30°C

Mole Fraction of Cotton Seed Oil	Density (exp.) gm/ml.	Ultrasound Velocity m/sec.	(Exp) β_s x cm2/dyne. 10^{12}	Intermolecular Free Length (exp) A°	Molar Volume (Exp) ml/mole	Available Volume (Exp) ml/mole	Viscosity (Exp) C.P.	Shear's Relaxation Time (τ_s)	Specific Acoustic Impedance (Z) C.G.S.	Rao's Constant (R)
0.0000	0.7774	1160	95.60	0.6169	74.61	20.52	0.3153	40.1885	0.9018	783.94
0.0255	0.7799	1180	92.09	0.6055	82.02	21.53	0.3306	40.5987	0.9203	853.68
0.0556	0.7831	1202	88.38	0.5932	90.68	22.56	0.3454	40.6992	0.9413	936.46
0.0917	0.7871	1223	84.94	0.5815	100.94	23.78	0.3543	40.1216	0.9627	1035.32
0.1357	0.7924	1242	81.81	0.5707	113.28	25.35	0.3641	39.7236	0.9841	1155.24
0.1906	0.7995	1263	78.41	0.5587	128.33	27.03	0.3748	39.1854	1.0098	1305.48
0.2611	0.8105	1282	75.07	0.5467	146.93	29.20	0.3813	38.1642	1.0390	1497.27
0.3547	0.8251	1304	71.27	0.5327	170.87	31.61	0.3911	37.1703	1.0759	1753.41
0.4851	0.8450	1330	66.90	0.5161	202.96	34.25	0.4060	36.2151	1.1239	2112.35
0.6795	0.8743	1359	61.93	0.4966	248.19	37.38	0.4257	35.1501	1.1882	2648.94
1.0000	0.9218	1386	56.47	0.4742	316.77	42.37	0.3234	24.3509	1.2776	3531.82

Table No. 2

Cotton Seed Oil + Acetone at 35°C

Mole Fraction of Cotton Seed Oil	Density (exp.) gm/ml.	Ultrasound Velocity m/sec.	(Exp) β_s x cm2/dyne. 10^{12}	Intermolecular Free Length (exp) A°	Molar Volume (Exp) ml/mole	Available Volume (Exp) ml/mole	Viscosity (Exp) C.P.	Shear's Relaxation Time (τ_s)	Specific Acoustic Impedance (Z) C.G.S.	Rao's Constant (R)
0.0000	0.7586	1130	103.24	0.6467	76.46	22.46	0.2782	38.2936	0.8572	796.39
0.0255	0.7608	1151	99.22	0.6340	84.08	23.60	0.2950	39.0231	0.8757	866.54
0.0556	0.7643	1176	94.61	0.6191	92.92	24.62	0.3107	39.1939	0.8988	950.35

0.0917	0.7686	1201	90.21	0.6045	103.38	25.78	0.3197	38.4485	0.9230	1050.67
0.1357	0.7741	1227	85.80	0.5896	115.94	27.03	0.3304	37.8004	0.9499	1173.26
0.1906	0.7817	1255	81.22	0.5736	131.26	28.30	0.3417	37.0040	0.9811	1326.74
0.2611	0.7932	1280	76.95	0.5583	150.13	30.03	0.3493	35.8331	1.0153	1522.19
0.3547	0.8086	1305	72.62	0.5424	174.37	32.15	0.3596	34.8233	1.0552	1781.75
0.4851	0.8295	1326	68.56	0.5270	206.76	35.41	0.3756	34.3370	1.1000	2141.11
0.6795	0.8603	1341	64.64	0.5117	252.23	40.83	0.3990	34.3892	1.1537	2672.43
1.0000	0.9108	1364	59.01	0.4890	320.60	47.29	0.3234	25.4464	1.2423	3555.51

Table No. 3

Cotton Seed Oil + D.M.S.O. at 30°C

Mole Fraction of Cotton Seed Oil	Density (exp.) gm/ml.	Ultrasound Velocity m/sec.	(Exp) β_s x cm2/dyne. 10^{12}	Intermolecular Free Length (exp) A°	Molar Volume (Exp) ml/mole	Available Volume (Exp) ml/mole	Viscosity (Exp) C.P.	Shear's Relaxation Time (τ_s)	Specific Acoustic Impedance (Z) C.G.S.	Rao's Constant (R)
0.0000	1.2510	1383	41.79	0.4079	62.45	8.47	2.9340	163.4923	1.7301	695.78
0.0214	1.2458	1380	42.15	0.4097	66.39	9.13	2.8929	162.5841	1.7192	755.97
0.0470	1.2384	1381	42.34	0.4106	71.19	9.74	2.8401	160.3341	1.7102	828.47
0.0779	1.2291	1382	42.60	0.4118	77.12	10.51	2.7675	157.1978	1.6986	916.30
0.1162	1.2174	1383	42.95	0.4135	84.58	11.47	2.6749	153.1729	1.6836	1024.91
0.1647	1.2024	1384	43.42	0.4158	94.26	12.73	2.5589	148.1397	1.6641	1162.65
0.2282	1.1805	1385	44.16	0.4193	107.52	14.45	2.3976	141.1722	1.6350	1343.08
0.3151	1.1510	1386	45.23	0.4244	126.42	16.91	2.1792	131.4120	1.5953	1589.64
0.4409	1.1087	1387	46.89	0.4321	155.52	20.70	1.8639	116.5206	1.5377	1946.89
0.6395	1.0422	1388	49.80	0.4453	206.20	27.32	1.3638	90.5627	1.4466	2510.91
1.0000	0.9218	1386	56.47	0.4742	316.77	42.37	0.4623	34.8096	1.2776	3531.82

Table No. 4

Cotton Seed Oil + D.M.S.O. at 35°C

Mole Fraction of Cotton Seed Oil	Density (exp.) gm/ml.	Ultrasound Velocity m/sec.	(Exp) β_s x cm2/dyne. 10^{12}	Intermolecular Free Length (exp) A°	Molar Volume (Exp) ml/mole	Available Volume (Exp) ml/mole	Viscosity (Exp) C.P.	Shear's Relaxation Time (τ_s)	Specific Acoustic Impedance (Z) C.G.S.	Rao's Constant (R)
0.0000	1.1874	1372	44.74	0.4257	65.79	9.38	2.4606	146.7826	1.6291	731.05
0.0214	1.1795	1374	44.91	0.4265	70.12	9.90	2.4300	145.5042	1.6206	792.12
0.0470	1.1713	1375	45.16	0.4277	75.27	10.58	2.3892	143.8522	1.6105	864.66
0.0779	1.1619	1376	45.46	0.4291	81.58	11.42	2.3298	141.2143	1.5987	952.55
0.1162	1.1501	1377	45.85	0.4310	89.52	12.48	2.2562	137.9414	1.5837	1061.22
0.1647	1.1360	1378	46.36	0.4334	99.78	13.84	2.1606	133.5515	1.5653	1199.04
0.2282	1.1191	1379	46.99	0.4363	113.42	15.67	2.0284	127.0852	1.5432	1379.55
0.3151	1.0963	1380	47.90	0.4405	132.73	18.25	1.8481	118.0323	1.5128	1626.25
0.4409	1.0622	1381	49.37	0.4472	162.33	22.22	1.5888	104.5738	1.4668	1983.68
0.6395	1.0083	1382	51.93	0.4587	213.13	29.04	1.1793	81.6501	1.3935	2547.99
1.0000	0.9108	1384	59.01	0.4890	320.60	47.29	0.4382	34.4794	1.2423	3555.51

Fig No. 1

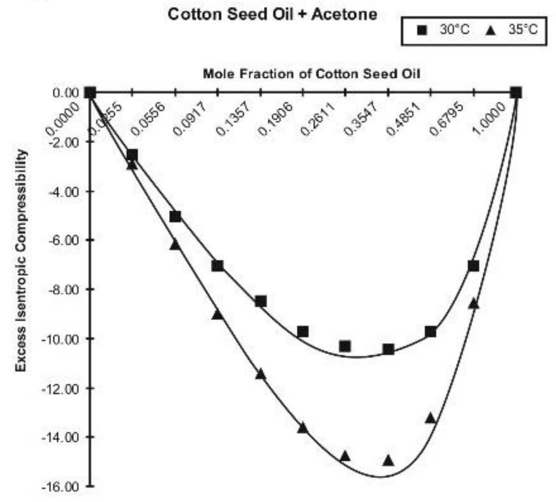

Fig No. 2

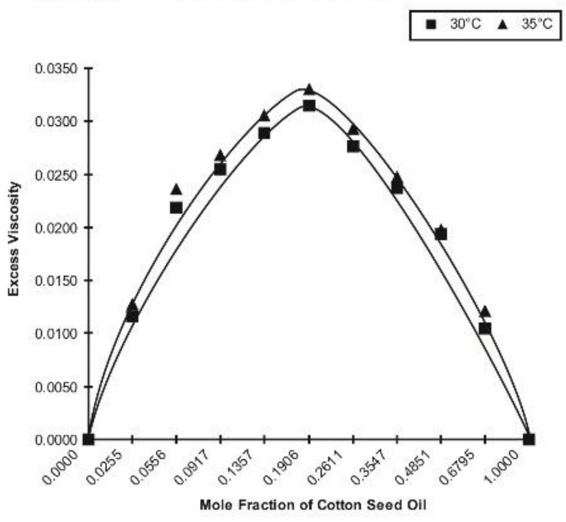

Fig No. 3

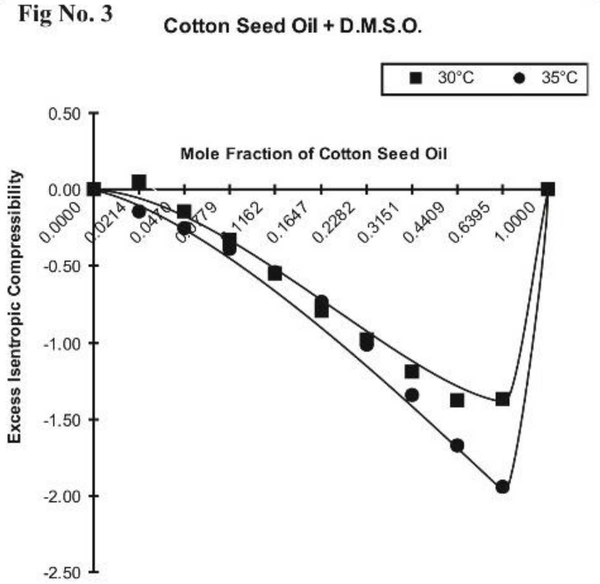

Fig No. 4