Study of some Vegetables Oil in Polar organic Solvent by excess values of thermodynamic properties

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ABSTRACT :

We have experimentally determined ultrasound velocity, density, and viscosity using an ultrasonic interferometer M-80, a pyknometer, and an Ostwald viscometer. Coconut Oil's estimated acoustic and thermodynamic properties in polar solvents such as acetone and acetaldehyde at varying temperatures. We have studied coconut oil's acoustic characteristics, density, ultrasonic velocity, and viscosity in a polar solvent to compute different thermodynamic and uncommon excess values. In light of the different molecules between oil and polar solvents, the interactions between coconut oil and polar solvents have been discussed.

Keywords: Acetone, acetaldehyde, ultrasonic interferometer, viscometer, refined coconut oil, and redistilled acetone.

Introduction :

Since ultrasound is now an established method, it plays a larger role in theoretical studies. At low amplitude, different densities and viscosities were detected in pure liquid and their liquid-liquid mixture. Here, we have collected redistilled liquids in their purest form and unusual compounds in binary form. Several researchers took velocity and other measurements of organic liquids.[1-3] Ultrasound and viscometric behaviour of hexadecane-butanol mixtures at various temperatures were computed by Rita Mehra and Rekha Israni[4]. Many researchers have used ultrasonic velocity measurements to detect and evaluate both weak and strong molecular interactions in binary[5-9]. At 298.15 and 308.15k, the ultrasound velocity of water-pyridine and water-picoline binary mixes was determined as a function of composition. The value of isentropic compressibility published by Sharma and Singh[10] has been used to analyse the observed data.

Experimental :

Acetone and acetaldehyde of AR/BDH quality were redistilled and purified using coconut oil. The ultrasonic interferometer M-80 from M/s Mittal Enterprises in New Delhi was used to

measure the speed of sound in solutions containing these chemicals at a temperature of 30 degrees Celsius and a constant frequency of 2 megahertz. A calibrated pyknometer and an Oswald viscometer were used to determine the density and viscosity, respectively.

A number of acoustic and thermodynamic parameters, such as isentropic deformation (s), different chain length (Lf), particular attenuation coefficient (Z)[11], average molecular weight (Vm), available volume (Va), viscosity (n), WADA constant (B), and shear's relaxation time (ts), have been calculated using an empirical formula ():

1. $\beta_s = \frac{1}{v^2}\rho$
2. $L_f = K(\beta_s)^{1/2}$
3. $Z = v \times \rho \times 10^{-5}$
4. $B = \left[\frac{\overline{M}}{\rho}\right]\beta_s^{-1/7}$
5. $V_m = \frac{\overline{M}}{\rho}$
6. $V_a = V_T\left\{1 - V/V_\infty\right\}$
7. $\eta = \rho\left(at - b/t\right)$
8. $\tau = \frac{4}{3}\eta \times \beta_s$

The formula was used to determine the outlying values of the parameters above.

$$A^E = A_{\exp} - (X_1A_1 + X_2A_2)$$

Where V, ρ, β_s, η, Z, L_f, M, V_a, V_m, τ_s, B These include the speed of sound in a vacuum, density, isentropic compressibility, viscosity, specific attenuation coefficient, the free length among atoms, the capacity of the free space among atoms, the capacity of the molecules, the relaxing time of shear, and the Wada constant. Here

$$\overline{M} = \frac{M_1X_1 + M_2X_2}{X_1 + X_2}$$

The molecular weight, M1, and molecular fraction, M2, of the liquid component, and the molecular fraction, X1, and molecular weight, X2, of the liquid component.

Conclusions and Remarks:

We determined the ultrasonic velocity, density, and viscosity of coconut oil in acetone, acetaldehyde, and their binary liquid mixture at 303K and 308K. The isentropic compressibility, intermolecular free length, molar, and accessible volume are all calculated acoustic and thermodynamic properties. The viscosity, isentropic compressibility, and excess values of two coconut oil-based non-aqueous liquid mixes have been determined.

(i) Coconut Oil + Acetone

(ii) Coconut Oil + Acetaldehyde

Excess values of isentropic compressibility and viscosity are depicted in figures, while observed and computed results of various parameters at various temperatures are presented in tables.

It is demonstrated that the density and the speed of sound rise with rising temperatures. Both systems exhibit a downward trend in density variability.

Coconut oil's viscosity in acetone and acetaldehyde increases with increasing mole fraction but reduces with rising temperature. The different viscosity for both temperature systems is positive, even though the viscosity variation trend is the same. Acetone and acetaldehyde exhibit a negative trend in the fluctuation of their isentropic compressibility.

Based on the nature of the liquid, mixtures of non-liquids can be classified as either polar-polar or polar-non-polar, depending on the molecular interactions that might occur.

1. Non-specific Interactions
2. Specific Interaction

The literature review suggests that the interaction discussed here may be unique due to the positive deviation of viscosity and the negative deviation of isentropic compressibility[12]. Other computed metrics, such as intermolecular free length, compressibility, and accessible volume, all trend negatively with increasing molar volume[13], supporting the hypothesis of a particular interaction. Curves of velocity and compressibility against concentration for carboxylic acid-frequent solvent pairings exhibited unusual behaviour, as reported by Seshagiri et al. al[14]

Hydrogen bond and polar-polar solvent interactions were shown to be responsible for the observed physical attributes, estimated thermodynamic parameters, and excess values. There

will be mutual effects between the physical and chemical realms, and the sign of the excess function will change depending on which effect is more prominent. The parameter is more affected by the specific interaction effects than the non-specific or dominating effects. Specifically, the parameter is more important than the physical or non-specific interaction[15-17].

Coconut Oil + Acetone at 30° C

Mole Fraction of Coconut Oil	Density (exp.)	Ultrasound Velocity	Isentropic Compressibility (exp)	Intermolecular Free Length (exp)	Molar Volume (exp)	Available Volume (exp)	Viscosity (exp)
0.0000	0.7774	1160	95.60	0.6169	74.61	20.52	0.3153
0.0261	0.7800	1182	91.77	0.6045	81.94	21.41	0.3277
0.0568	0.7836	1211	87.02	0.5886	90.47	21.99	0.3410
0.0963	0.7875	1240	82.58	0.5734	100.61	22.64	0.3482
0.1383	0.7927	1265	78.83	0.5602	112.78	23.61	0.3560
0.1941	0.8000	1290	75.12	0.5469	127.58	24.72	0.3640
0.2654	0.8110	1317	71.09	0.5320	145.79	25.79	0.3670
0.3598	0.8254	1336	67.88	0.5199	169.21	27.92	0.3723
0.4907	0.8453	1352	64.72	0.5076	200.39	31.06	0.3807
0.6843	0.8741	1357	62.09	0.4972	244.07	37.00	0.3907
1.0000	0.9200	1392	56.10	0.4726	309.78	40.27	0.4126

Coconut Oil + Acetone at 35° C

Mole Fraction of Coconut Oil	Density (exp.)	Ultrasound Velocity	Isentropic Compressibility (exp)	Intermolecular Free Length (exp)	Molar Volume (exp)	Available Volume (exp)	Viscosity (exp)
0.0000	0.7586	1130	103.24	0.6468	76.46	22.46	0.2782
0.0261	0.7614	1155	98.46	0.6317	83.95	23.35	0.2941
0.0568	0.7651	1180	93.86	0.6168	92.65	24.32	0.3087
0.0963	0.7694	1205	89.51	0.6023	102.98	25.42	0.3164
0.1383	0.7752	1230	85.27	0.5878	115.33	26.67	0.3256
0.1941	0.7833	1255	81.06	0.5732	130.30	28.10	0.3349
0.2654	0.7950	1280	76.77	0.5578	148.73	29.75	0.3399
0.3598	0.8108	1305	72.42	0.5417	172.26	31.76	0.3468
0.4907	0.8322	1330	67.93	0.5247	203.52	34.34	0.3579
0.6843	0.8635	1355	63.07	0.5056	247.05	37.83	0.3738
1.0000	0.9140	1383	57.20	0.4815	311.82	42.29	0.3234

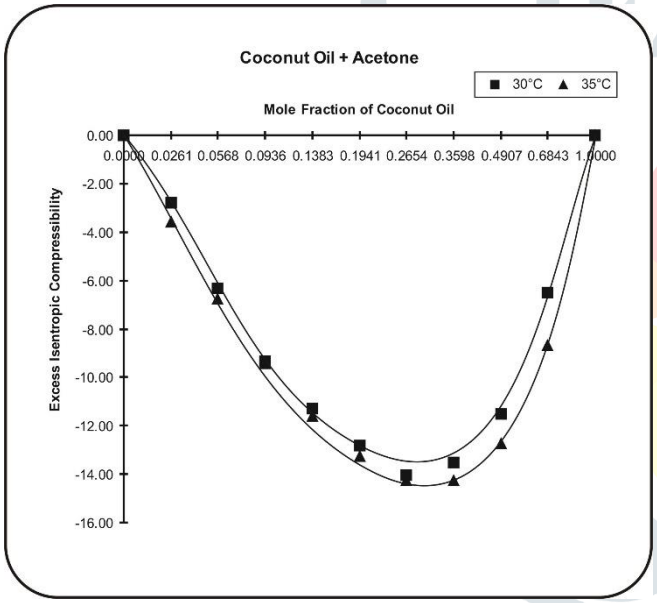
Coconut Oil + Acetaldehyde at 30° C

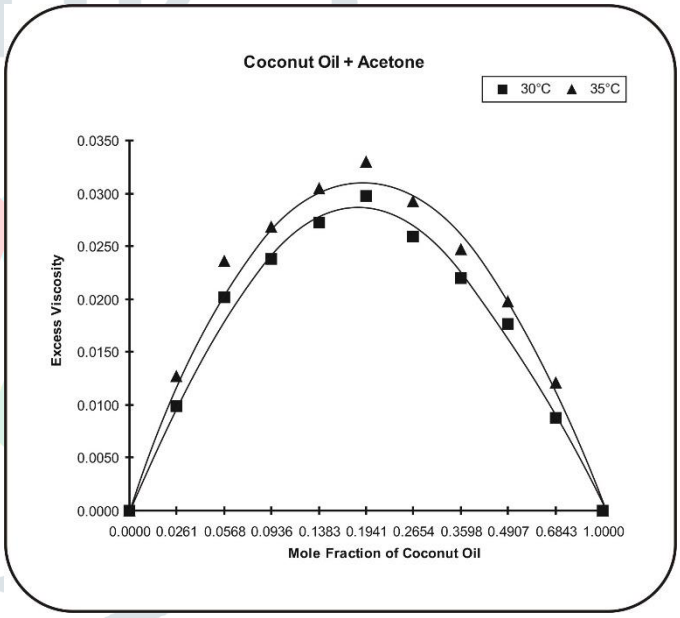
Mole Fraction of Coconut Oil	Density (exp.)	Ultrasound Velocity	Isentropic Compressibility (exp)	Intermolecular Free Length (exp)	Molar Volume (exp)	Available Volume (exp)	Viscosity (exp)
0.0000	0.7482	1160	99.33	0.6289	205.83	56.60	0.2758
0.0207	0.7502	1184	95.08	0.6153	203.61	52.94	0.2894
0.0453	0.7534	1208	90.96	0.6018	200.80	49.20	0.3037
0.0753	0.7573	1232	86.99	0.5885	197.38	45.40	0.3110
0.1124	0.7626	1256	83.12	0.5753	193.10	41.52	0.3198
0.1596	0.7699	1280	79.28	0.5618	187.59	37.52	0.3287
0.2217	0.7814	1304	75.26	0.5474	180.06	33.31	0.3335
0.3070	0.7971	1328	71.13	0.5322	170.08	28.91	0.3406

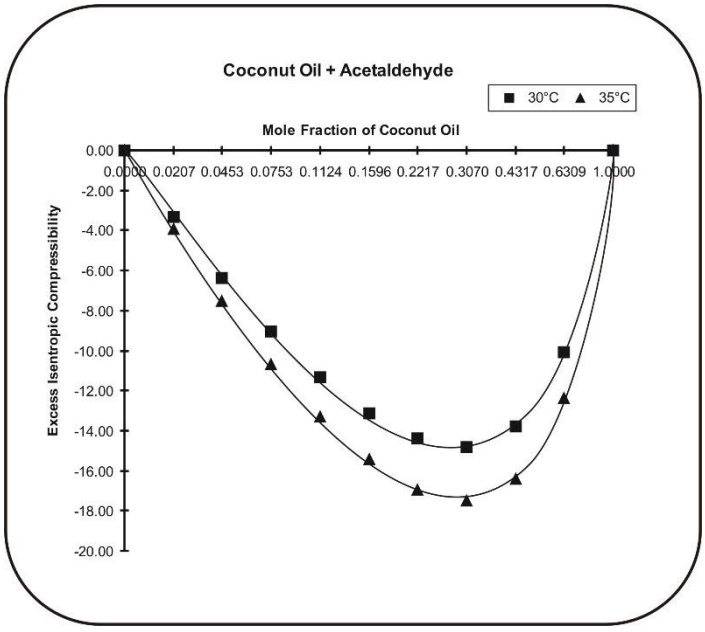
0.4317	0.8197	1352	66.74	0.5155	156.28	24.22	0.3528
0.6309	0.8551	1376	61.77	0.4959	135.28	19.02	0.3723
1.0000	0.9200	1396	55.78	0.4712	102.17	13.03	0.3234

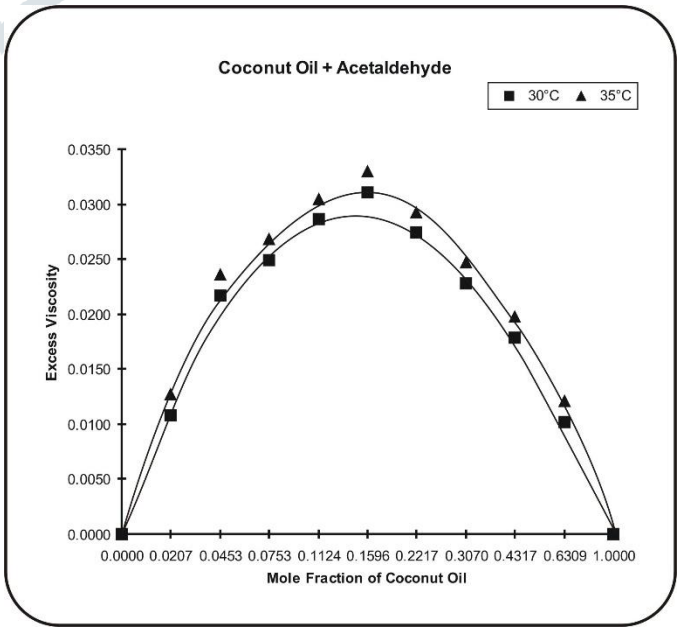
Coconut Oil + Acetaldehyde at 35° C

Mole Fraction of Coconut Oil	Density (exp.)	Ultrasound Velocity	Isentropic Compressibility (exp)	Intermolecular Free Length (exp)	Molar Volume (exp)	Available Volume (exp)	Viscosity (exp)
0.0000	0.7284	1142	105.27	06531	211.42	60.52	0.2654
0.0207	0.7305	1168	100.34	0.6376	209.11	56.46	0.2809
0.0453	0.7340	1194	95.56	0.6222	206.10	52.30	0.2951
0.0753	0.7384	1220	90.99	0.6072	202.45	48.08	0.3023
0.1124	0.7442	1246	86.56	0.5922	197.89	43.78	0.3110
0.1596	0.7521	1272	82.17	0.5770	192.02	39.36	0.3199
0.2217	0.7644	1298	77.64	0.5609	184.05	34.74	0.3246
0.3070	0.7814	1324	73.01	0.5438	173.51	29.93	0.3315
0.4317	0.8056	1350	68.11	0.5253	159.01	24.84	0.3434
0.6309	0.8438	1376	62.59	0.5036	137.65	19.27	0.3625
1.0000	0.9140	1383	57.20	0.4814	102.84	13.95	0.3234









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