Densities, Excess Molar Volumes at T = (298.15 to 313.15) K, Speeds of Sound, Excess Isentropic Compressibilities, Relative Permittivities, and Deviations in Molar Polarizations at T = (298.15 and 308.15) K for Methyl Methacrylate + 2-Butoxyethanol or Dibutyl Ether + Benzene, Toluene, or *p*-Xylene

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The experimental densities at T = (298.15 to 318.15) K, speeds of sound, and relative permittivities at T = (298.15 and 308.15) K are measured for the six ternary mixtures: methyl methacrylate (1) + 2-butoxyethanol (2) or dibutyl ether (2) + benzene (3), toluene (3), and *p*-xylene (3). Excess molar volumes, excess isentropic compressibilities, and deviations in molar polarizations are calculated. The above functions of ternary systems were also calculated using the data of constituent binary pairs and employing Redlich−Kister, Tsao and Smith, and Kohler equations. Compared to others, the Redlich−Kister equation has been found to reproduce the experimental excess molar volumes adequately, while excess isentropic compressibilities and deviations in molar polarizations of the above ternary mixtures could not be adequately calculated using the respective binary contributions.

Introduction

Under real use conditions involving various processes such as separation of chemicals, fluid flow, heat flow, or chemical reactions, the common practice is that several liquid components that differ in chemical nature and polarity are mixed together. This situation results in a very complex fluid state, the understanding of which becomes very difficult. Due to this, thermodynamic information, especially literature data on various thermophysical properties of ternary and multicomponent systems, has been found to be scarce in the literature. This is in contrast to the large amount of experimental data and theoretical interpretations available for binary mixtures. The availability of high precision density meters made the density measurements on ternary systems quite easy and accurate. Numerous studies[1−9] have been performed for developing expressions and verifying their applicability to predict excess molar volumes of ternary mixtures from the data on their constituent binary pairs. It has now been generally accepted that, of all the expressions tried, the three relations developed by Redlich−Kister (RK),[10] Tsao and Smith (TS),[11] and Kohler (K)[12] are so far the most successful in predicting the excess molar enthalpies of ternary systems. The applicabilities of these three expressions were also put to rigorous tests[13−17] for correlating ternary excess volumes from binary pair data. Similarly, these expressions were also used to correlate the deviations in isentropic compressibilities of ternary mixtures of 2-methoxyethanol + butyl acetate + benzene, toluene, chlorobenzene, bromobenzene, or nitrobenzene,[18] 1,3-dichlorobenzene + methylethyl ketone + 1-alcohols,[19] and propan-1-ol + *n*-hexane + butylamine. [20]

The studies involving ternary mixtures consisting of acrylic esters, alcohols, and hydrocarbons are essential and provide vital information useful for the efficient design of reactors for the transesterification process in which an acrylic ester is reacted with a chosen alcohol in an inert solvent media consisting of hydrocarbons. Systematic investigations on various thermophysical properties of acrylic esters + alcohols[21−26] and + hydrocarbons[27−33] and also alcohols + hydrocarbons[34−36] have been made in our laboratory. In an effort to extend our studies to ternary systems of the above components, we have recently reported[37] the thermophysical properties of methyl methacrylate + propan-1-ol or butan-1-ol + hydrocarbons (*n*-hexane, *n*-heptane, cyclohexane, benzene, and toluene) at T = 308.15 K. As far as we are aware, no experimental data on thermophysical properties of systems containing acrylic esters, 2-butoxyethanol, dibutyl ether, benzene, toluene, *p*-xylene, and so forth exist in the literature. Hence, we report the densities at T = (298.15 to 313.15) K, speeds of sound, and relative permittivities of the six ternary mixtures methyl methacrylate + 2-butoxyethanol + benzene, toluene, or *p*-xylene and methyl methacrylate + dibutyl ether + benzene, toluene, or *p*-xylene over the entire composition range and at T = (298.15 and 308.15) K. From these primary properties, excess molar volumes, V_m^E, excess isentropic compressibilities, κ_s^E, and deviations in molar polarizations, δP_m, were calculated. The applicabilities of the Redlich−Kister, Tsao−Smith, and Kohler equations were tested for predicting the ternary V_m^E, κ_s^E, and δP_m values from the respective data on the constituent binary pairs.

Experimental Section

Materials. Methyl methacrylate of laboratory reagent grade (99% pure on a mole basis) was obtained from Chiti-Chem, India. It was further washed with 25% (w/v) sodium hydroxide solution, and then the alkali was washed out repeatedly with triple distilled water. A vacuum distillation was carried out under a stream of nitrogen. 2-Butoxyetha-

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Table 1. Densities, ρ, Speeds of Sound, v, and Relative Permittivities, ϵ_r, for the Pure Components

	T/K = 298.15		T/K = 303.15		T/K = 308.15		T/K = 313.15	
	exp	lit.	exp	lit.	exp	lit.	exp	lit.
				MMA				
ρ/g·cm^{-3}	0.93763	0.93766[21]	0.93174	0.93174[20]	0.92574	0.9257[20]	0.92026	
v/m·s^{-1}	1181	1182[22]			1153	1152[22]		
ϵ_r	6.534	6.533[20]			6.449	6.442[24]		
				2-Butoxyethanol				
ρ/g·cm^{-3}	0.89625	0.89625[20]	0.89203	0.8924[26]	0.88891	0.8889[23]	0.88340	0.8834[26]
v/m·s^{-1}	1304	1304[23]			1285	1283[27]		
ϵ_r	9.446	9.43[24]			8.352			
				Dibutyl Ether				
ρ/g·cm^{-3}	0.76407	0.7641[20]	0.75973	0.7600[28]	0.75545		0.75121	0.7522[28]
v/m·s^{-1}	1220.1				1179.0			
ϵ_r	3.040				2.964			
				Benzene				
ρ/g·cm^{-3}	0.87361	0.87360[20]	0.86829	0.86829[20]	0.86296	0.8630[30]	0.85797	0.85799[30]
v/m·s^{-1}	1299	1309[29]			1260	1260[29]		
ϵ_r	2.271	2.270[24]			2.250	2.250[24]		
				Toluene				
ρ/g·cm^{-3}	0.86220	0.86219[20]	0.85755	0.85754[20]	0.85286	0.8528[24]	0.84816	
v/m·s^{-1}	1304	1304[31]			1262	1262[29]		
ϵ_r	2.408	2.408[24]			2.381	2.381[24]		
				p-Xylene				
ρ/g·cm^{-3}	0.85662	0.85661[20]	0.85225	0.85225[20]	0.84788	0.8479[29]	0.84364	
v/m·s^{-1}	1308	1312[29]			1276	1272[29]		
ϵ_r	2.268	2.268[24]			2.119	2.119[24]		

nol was a product with 99.5% purity on a mole basis and supplied by Chiti-Chem, India. It was used after a simple distillation. Dibutyl ether, a Fluka Analar quality product with a stated purity of 99.8% on a mole basis, was used as such without any further purification. Benzene (99.5% on a mole basis) was an Analytical Reagent chemical and acquired locally. Toluene and *p*-xylene (99.5% purity on a mole basis) were obtained from Chiti-Chem, India. These three chemicals were further purified by standard procedures.[38] Gas chromatographic analysis of the distilled chemicals showed that their purities were greater than 99.5%.

Methods. The solutions were prepared by mass in hermetically sealed glass vials. The solutions of the various compositions were prepared fresh, and all the properties were measured the same day. The mass measurements, accurate to ±0.01 mg, were made on a Dhona single pan analytical balance, Dhona 100 DS (India). The estimated accuracy in the mole fraction was ±0.0001.

Densities of the pure liquids and their mixtures were measured with a high precision vibrating tube digital density meter (Anton Paar, DMA 5000). The instrument had a built-in thermostat for maintaining the desired temperatures in the range 0 to 90 °C. The instrument displays the cell temperature up to three digits after the decimal point on the front panel. The repeatability of the temperature has been found to be ±0.002 and ±0.003 °C for a single session and two different sessions, respectively. The accuracy of the temperature during the measurements, however, is ±0.01 °C because Pt 100 measuring sensors were used. The instrument was calibrated with air and four times distilled and freshly degassed water at T = (293.15, 313.15, and 333.15) K during every session. The repeatability in the densities for the distilled water, freshly distilled pure liquids, and prepared binary mixtures has been found to be better than 3×10^{-6} g·cm^{-3}. We have estimated the accuracy in the densities of the pure liquids used in this study by comparing our experimental data at different temperatures with the literature values. This comparison gave a mean absolute deviation value of 4.2×10^{-5} g·cm^{-3}. Hence, the precision and accuracy of the densities reported in the present work are 3×10^{-6} and 4.2×10^{-5} g·cm^{-3}, respectively. The speeds of sound, v, were measured using an ultrasonic interferometer (Mittal Enterprises, New Delhi, India) operating at a fixed frequency of 2 MHz. The measured speeds of sound have a precision of ±0.8 m·s^{-1} and an accuracy better than ±1.9 m·s^{-1}. The relative permittivities of the individual pure components and binary mixtures were calculated from the capacitance measurements with a universal dielectrometer, type OH-301 of Radelkis, Hungary. The procedure used in the calibration of the dielectric cells was the same as that described in detail elsewhere.[39] The measured relative permittivities have an estimated precision and accuracy of ±0.001 and ±0.004, respectively. The temperature during the measurements of all the above properties was maintained accurate to ±0.01 K by using a thermostated INSREF (India) circulator (model 020A). A comparison of the experimentally measured properties of all the pure components with the literature reported values is given in Table 1.

Results and Discussion

Densities, ρ_{123}, and Excess Molar Volumes, $V^E_{m,123}$. The experimental data on ρ_{123} and calculated $V^E_{m,123}$ over the whole mole fraction range and at T = (298.15 to 313.15) K for the six ternary mixtures methyl methacrylate (1) + 2-butoxyethanol (2) + benzene (3), toluene (3), or *p*-xylene (3) and methyl methacrylate (1) + dibutyl ether (2) + benzene (3), toluene (3), or *p*-xylene (3) are given in Tables 2 and 3, respectively. The $V^E_{m,123}$ values were also calculated from the binary contributions, that is, $V^E_{m,12}$, $V^E_{m,23}$, and $V^E_{m,13}$, using the Redlich−Kister, Tsao-Smith, and Kohler equations, as given below:

$$V^E_{m,123}(RK) = V^E_{m,12} + V^E_{m,23} + V^E_{m,13} \quad (1)$$

Table 2. Experimental Densities, ρ_{123} for MMA (1) + 2-Butoxyethanol (2) +, Dibutyl Ether (2) + Aromatic Hydrocarbons (3) at T = (298.15 to 313.15) K

		ρ_{123}/g·cm^{-3}						ρ_{123}/g·cm^{-3}			
x_1	x_2	T = 298.15 K	T = 303.15 K	T = 308.15 K	T = 313.15 K	x_1	x_2	T = 298.15 K	T = 303.15 K	T = 308.15 K	T = 313.15 K
MMA (1) + 2-Butoxyethanol (2) + Benzene (3)						MMA (1) + 2-Butoxyethanol (2) + Toluene (3)					
0.0420	0.1020	0.87807	0.87279	0.86770	0.86252	0.0465	0.1020	0.86906	0.86439	0.85993	0.85496
0.6349	0.1038	0.91668	0.91107	0.90556	0.90015	0.6432	0.0955	0.91387	0.90847	0.90319	0.89784
0.8413	0.1036	0.92952	0.92383	0.91820	0.91270	0.8320	0.0972	0.92772	0.92209	0.91653	0.91107
0.1887	0.0986	0.88783	0.88243	0.87720	0.87197	0.1940	0.0962	0.88037	0.87563	0.87109	0.86613
0.4343	0.1509	0.90466	0.89923	0.89400	0.88867	0.4348	0.1401	0.89997	0.89491	0.89003	0.88481
0.7392	0.1554	0.92398	0.91840	0.91297	0.90747	0.7444	0.1514	0.92282	0.91732	0.91197	0.90651
0.1431	0.2378	0.88794	0.88273	0.87783	0.87247	0.1391	0.2469	0.88145	0.87673	0.87218	0.86701
0.5428	0.2771	0.91378	0.90846	0.90345	0.89798	0.5255	0.3257	0.91204	0.90690	0.90206	0.89660
0.3376	0.4522	0.90475	0.89974	0.89522	0.88973	0.3463	0.4459	0.90305	0.89818	0.89365	0.88821
0.2761	0.5270	0.90269	0.89779	0.89347	0.88797	0.2355	0.5771	0.89943	0.89474	0.89053	0.88506
0.0775	0.6619	0.89460	0.88996	0.88600	0.88052	0.1013	0.6437	0.89268	0.88814	0.88410	0.87861
0.1426	0.7539	0.89953	0.89498	0.89126	0.88577	0.1460	0.7495	0.89846	0.89396	0.89028	0.88474
0.0939	0.8598	0.89869	0.89429	0.89085	0.88535	0.0985	0.8499	0.89816	0.89377	0.89037	0.88482
0.4670	0.0439	0.90516	0.89957	0.89404	0.88881	0.3772	0.0516	0.89313	0.88817	0.88331	0.87831
MMA (1) + 2-Butoxyethanol (2) + *p*-Xylene (3)						MMA (1) + Dibutyl Ether (2) + Benzene (3)					
0.0446	0.1014	0.86288	0.85853	0.85406	0.84958	0.0410	0.1025	0.85620	0.85100	0.84580	0.84090
0.6448	0.0957	0.91016	0.90495	0.89958	0.89440	0.6421	0.1041	0.89468	0.88907	0.88342	0.87818
0.8400	0.1096	0.92798	0.92253	0.91694	0.91151	0.8214	0.1030	0.90665	0.90078	0.89497	0.88964
0.1977	0.0987	0.87366	0.86916	0.86443	0.85975	0.1927	0.0986	0.86685	0.86155	0.85622	0.85122
0.4420	0.1511	0.89521	0.89019	0.88519	0.88012	0.4218	0.1509	0.87201	0.86672	0.86135	0.85630
0.7473	0.1509	0.92149	0.91617	0.91078	0.90539	0.7425	0.1550	0.89216	0.88646	0.88079	0.87554
0.1478	0.2456	0.87606	0.87156	0.86703	0.86195	0.1524	0.2378	0.84134	0.83630	0.83123	0.82638
0.5327	0.3172	0.91002	0.90490	0.90006	0.89459	0.5428	0.2775	0.85956	0.85436	0.84905	0.84400
0.3419	0.4450	0.89980	0.89494	0.89052	0.88492	0.3376	0.4522	0.82471	0.81993	0.81503	0.81018
0.2450	0.5505	0.89673	0.89205	0.88790	0.88221	0.2761	0.5275	0.81324	0.80857	0.80380	0.79903
0.1010	0.6399	0.88992	0.88546	0.88158	0.87579	0.0781	0.6619	0.79055	0.78601	0.78147	0.77697
0.1478	0.7479	0.89741	0.89295	0.88925	0.88360	0.1431	0.7545	0.78659	0.78213	0.77763	0.77310
0.0998	0.8513	0.89782	0.89345	0.88999	0.88443	0.0939	0.8598	0.77685	0.77245	0.76806	0.76363
0.3804	0.0510	0.88615	0.88125	0.87624	0.87145	0.1679	0.0445	0.87572	0.87032	0.86488	0.85984
MMA (1) + Dibutyl Ether (2) + Toluene (3)						MMA (1) + Dibutyl Ether (2) + *p*-Xylene (3)					
0.0457	0.1020	0.85079	0.84618	0.84156	0.83693	0.0447	0.1010	0.84722	0.84309	0.83822	0.83428
0.6428	0.0995	0.89346	0.88807	0.88264	0.87749	0.6448	0.0952	0.88817	0.88625	0.88079	0.87574
0.8287	0.0978	0.90720	0.90139	0.89566	0.89037	0.8421	0.1091	0.90135	0.90014	0.89438	0.88911
0.1954	0.0972	0.86235	0.85769	0.85299	0.84830	0.1982	0.0981	0.85669	0.85314	0.84840	0.84384
0.4365	0.1405	0.87258	0.86763	0.86259	0.85766	0.4420	0.1511	0.86579	0.86295	0.85786	0.85303
0.7521	0.1514	0.89266	0.88702	0.88143	0.87622	0.7425	0.1509	0.88728	0.88561	0.88002	0.87486
0.1425	0.2458	0.83851	0.83393	0.82932	0.82470	0.1478	0.2456	0.83648	0.83272	0.82810	0.82359
0.5255	0.3257	0.85176	0.84675	0.84161	0.83663	0.5328	0.3165	0.85028	0.84765	0.84249	0.83753
0.3463	0.4458	0.82667	0.82202	0.81722	0.81242	0.3425	0.4455	0.82472	0.82147	0.81666	0.81189
0.2357	0.5771	0.80730	0.80279	0.79819	0.79353	0.2450	0.5505	0.80949	0.80593	0.80129	0.79664
0.1027	0.6427	0.79504	0.79059	0.78614	0.78165	0.1015	0.6394	0.79559	0.79158	0.78713	0.78268
0.1457	0.7495	0.78789	0.78348	0.77902	0.77451	0.1471	0.7479	0.78790	0.78401	0.77956	0.77505
0.0985	0.8524	0.77796	0.77358	0.76920	0.76477	0.0992	0.8519	0.77792	0.77387	0.76949	0.76506
0.3779	0.0516	0.88287	0.87797	0.87300	0.86813	0.3801	0.0510	0.87514	0.87215	0.86712	0.86238

$$V^{E}_{m,123}(TS) = [x_2 V^{E}_{m,12}/(1 - x_1)] + [x_3 V^{E}_{m,13}/(1 - x_1)] + (1 - x_1) V^{E}_{m,23} \quad (2)$$

where $V^{E}_{m,ij}$ refer to the excess molar volumes for the binary mixtures at the compositions $x_i°$ and $x_j°$ such that $x_i° = x_1$ for the 1,2 and 1,3 pairs and $x_j° = x_2/(x_2 + x_3)$ for the 2,3 binary pair.

$$V^{E}_{m,123}(K) = (x_1 + x_2)^2 V^{E}_{m,12} + (x_1 + x_3)^2 V^{E}_{m,13} + (x_2 + x_3) 2 V^{E}_{m,23} \quad (3)$$

where $V^{E}_{m,ij}$ refer to the excess molar volumes of the binary mixtures at the compositions $x_i°$ and $x_j°$ such that $x_i° = 1 - x_j° = x_i/(x_i + x_j)$. The subscripts i and j are 1, 2, 3, and so forth. The excess molar volume contributions of the respective 12, 13, and 23 binary pairs were calculated using the relation

$$V^{E}_{m,ij} = x_i(1 - x_i) \sum_{i=0}^{i=n} a_i (2x_i - 1)^i \quad (4)$$

where x_i is the mole fraction of the ith component in the binary system and $(1 - x_i)$ is the jth component. a_i are the coefficients obtained from the fit of experimental binary V^{E}_{m} data using multiple regression analysis based on the least-squares method. The summary of a_i values along with the values of standard deviations (that represent the maximum uncertainties) is given in Table 4.

The deviations between experimental and calculated V^{E}_{m} values are listed in Table 5. The examination of the data revealed that the values varied from zero to 0.0004, −0.001 to 0.138, and −0.001 to 0.183 cm^3·mol^{-1}, respectively, when RK, TS, and K equations were employed. Hence, it can be concluded that $V^{E}_{m,123}$ values predicted by the RK equation agree closely with the experimental data while values calculated with the TS and K equations differ significantly from experimental data.

The $V^{E}_{m,123}$ values for methyl methacrylate + 2-butoxyethanol + benzene are found to be mostly positive, while the same for the methyl methacrylate + 2-butoxyethanol + toluene and + *p*-xylene systems are small and mostly negative at the four temperatures. Thus, in the ternary system methyl methacrylate + 2-butoxyethanol + benzene,

Table 3. Excess Molar Volumes, $V^E_{m,123}$, for MMA (1) + 2-Butoxyethanol (2) + Dibutyl Ether (2) + Aromatic Hydrocarbons (3) at T = (298.15 to 313.15) K

		$V^E_{m,123}$/cm³·mol⁻¹ at the following values of T/K						$V^E_{m,123}$/cm³·mol⁻¹ at the following values of T/K			
x_1	x_2	298.15	303.15	308.15	313.15	x_1	x_2	298.15	303.15	308.15	313.15
MMA (1) + 2-Butoxyethanol (2) + Benzene (3)						MMA (1) + 2-Butoxyethanol (2) + Toluene (3)					
0.0420	0.1020	0.194	0.206	0.212	0.226	0.0465	0.1020	0.094	0.098	0.086	0.105
0.6349	0.1038	0.146	0.157	0.164	0.171	0.6432	0.0955	−0.035	−0.031	−0.035	−0.027
0.8413	0.1036	−0.001	0.004	0.009	0.014	0.8320	0.0972	−0.020	−0.016	−0.016	−0.012
0.1887	0.0986	0.233	0.249	0.258	0.269	0.1940	0.0962	0.011	−0.001	−0.026	−0.023
0.4343	0.1509	0.232	0.244	0.251	0.257	0.4348	0.1401	−0.039	−0.043	−0.054	−0.046
0.7392	0.1554	0.038	0.045	0.053	0.060	0.7444	0.1514	−0.030	−0.024	−0.023	−0.016
0.1431	0.2378	0.255	0.275	0.295	0.315	0.1391	0.2469	0.060	0.065	0.084	0.104
0.5428	0.2771	0.105	0.115	0.126	0.134	0.5255	0.3257	−0.037	−0.031	−0.015	−0.005
0.3376	0.4522	0.103	0.116	0.136	0.147	0.3463	0.4459	−0.031	−0.024	0.007	0.019
0.2761	0.5270	0.079	0.092	0.113	0.124	0.2355	0.5771	−0.030	−0.023	0.012	0.026
0.0775	0.6619	0.012	0.025	0.052	0.063	0.1013	0.6437	−0.046	−0.036	0.008	0.032
0.1426	0.7539	0.016	0.022	0.035	0.039	0.1460	0.7495	−0.014	−0.009	0.002	0.018
0.0939	0.8598	0.011	0.013	0.018	0.019	0.0985	0.8499	0.003	0.005	0.003	0.015
0.4670	0.0439	0.209	0.217	0.219	0.219	0.3772	0.0516	−0.082	−0.098	−0.123	−0.128
MMA (1) + 2-Butoxyethanol (2) + *p*-Xylene (3)						MMA (1) + Dibutyl Ether (2) + Benzene (3)					
0.0446	0.1014	0.161	0.155	0.181	0.193	0.0410	0.1025	0.094	0.099	0.104	0.108
0.6448	0.0957	−0.007	−0.011	0.01	0.019	0.6421	0.1041	0.169	0.183	0.197	0.208
0.8400	0.1096	−0.042	−0.055	−0.048	−0.046	0.8214	0.1030	−0.008	0.025	0.044	0.055
0.1977	0.0987	0.181	0.169	0.202	0.219	0.1927	0.0986	0.182	0.189	0.198	0.205
0.4420	0.1511	0.085	0.099	0.127	0.147	0.4218	0.1509	0.277	0.278	0.285	0.294
0.7473	0.1509	−0.036	−0.046	−0.034	−0.027	0.7425	0.1550	0.059	0.090	0.111	0.125
0.1478	0.2456	0.187	0.187	0.228	0.284	0.1524	0.2378	0.232	0.236	0.245	0.257
0.5327	0.3172	0.001	0.013	0.032	0.058	0.5428	0.2775	0.274	0.280	0.298	0.320
0.3419	0.4450	0.036	0.052	0.078	0.133	0.3376	0.4522	0.386	0.373	0.383	0.415
0.2450	0.5505	0.02	0.033	0.059	0.125	0.2761	0.5275	0.379	0.364	0.372	0.405
0.1010	0.6399	−0.024	−0.015	0.015	0.105	0.0781	0.6619	0.216	0.213	0.215	0.231
0.1478	0.7479	−0.008	−0.004	0.011	0.051	0.1431	0.7545	0.266	0.254	0.255	0.283
0.0998	0.8513	−0.002	−0.001	0.007	0.024	0.0939	0.8598	0.180	0.171	0.170	0.192
0.3804	0.0510	0.088	0.094	0.119	0.129	0.1679	0.0445	0.130	0.139	0.148	0.153
MMA (1) + Dibutyl Ether (2) + Toluene (3)						MMA (1) + Dibutyl Ether (2) + *p*-Xylene (3)					
0.0457	0.1020	−0.053	−0.060	−0.069	−0.074	0.0447	0.1010	−0.036	−0.051	−0.043	−0.036
0.6428	0.0995	−0.025	−0.018	−0.015	−0.007	0.6448	0.0952	−0.014	−0.014	0.009	0.022
0.8287	0.0978	−0.050	−0.019	−0.007	0.000	0.8421	0.1091	−0.082	−0.063	−0.044	−0.037
0.1954	0.0972	−0.079	−0.101	−0.124	−0.137	0.1982	0.0981	0.051	0.03	0.048	0.065
0.4365	0.1405	−0.039	−0.056	−0.066	−0.064	0.4420	0.1511	0.058	0.062	0.082	0.101
0.7521	0.1514	−0.021	0.008	0.023	0.034	0.7425	0.1509	−0.031	−0.019	0.005	0.018
0.1425	0.2458	−0.073	−0.090	−0.107	−0.109	0.1478	0.2456	−0.006	−0.028	−0.015	0.004
0.5255	0.3257	0.140	0.138	0.151	0.176	0.5328	0.3165	0.153	0.157	0.181	0.211
0.3463	0.4458	0.166	0.145	0.146	0.174	0.3425	0.4455	0.207	0.193	0.209	0.246
0.2357	0.5771	0.159	0.137	0.134	0.162	0.2450	0.5505	0.186	0.166	0.176	0.213
0.1027	0.6427	−0.001	−0.013	−0.018	−0.004	0.1015	0.6394	0.011	−0.003	0.001	0.022
0.1457	0.7495	0.151	0.136	0.133	0.158	0.1471	0.7479	0.164	0.148	0.15	0.18
0.0985	0.8524	0.132	0.122	0.119	0.140	0.0992	0.8519	0.135	0.125	0.123	0.146
0.3779	0.0516	−0.107	−0.129	−0.150	−0.161	0.3801	0.0510	0.045	0.047	0.067	0.081

structure weakening effects are expected to be predominant while specific but weak donor−acceptor interactions are more prevalent in methyl methacrylate + 2-butoxyethanol + toluene and + *p*-xylene systems. Similar trends and conclusions can be applied to methyl methacrylate + dibutyl ether + aromatics systems.

Speeds of Sound, v_{123}, and Excess Isentropic Compressibilities, $\kappa^E_{s,123}$. The experimental values of v_{123} and the calculated $\kappa^E_{s,123}$ values for the six binary mixtures are given in Table 6. The κ^E_s values were calculated using the relation

$$\kappa_s^E/(\mathrm{TPa}^{-1}) = \kappa_s - \kappa_s^{id} \quad (5)$$

where κ_s is the isentropic compressibility in a given composition of the ternary mixture and was calculated using the Laplace equation, that is, $\kappa_s = 1/(v^2\rho)$, and κ_s^{id} was calculated from the relation

$$\kappa_s^{id} = \sum_{i=1}^{3}\phi_i[\kappa_{s,i} + TV_i(\alpha_i^2)/C_{p,i}] - \{T(\sum_{i=1}^{3}x_iV_i)(\sum_{i=1}^{3}\phi_i\alpha_i)^2/\sum_{i=1}^{3}x_iC_{p,i}\} \quad (6)$$

and ϕ_i is the ideal state volume fraction and is defined by the relation

$$\phi_i = x_iV_i/(\sum_{i=1}^{3}x_iV_i) \quad (7)$$

$\kappa^E_{s,123}$ values were also estimated from the data on respective binary pairs using RK, TS, and K equations. The binary $\kappa^E_{s,ij}$ values were obtained using the values of the coefficients given in Table 4. The observed deviations

Table 4. Values of the Binary Coefficients, a_i, Obtained by the Representation (Eq 4) of Excess and Deviation Functions of Respective Binary Systems

	T/K	a_0	a_1	a_2	σ	a_0	a_1	a_2	σ
		MMA (1) + 2-Butoxyethanol (2)				MMA (1) + Dibutyl Ether (2)			
V_m^E/cm^3·mol^{-1}	298.15	−0.085	−0.454	−0.025	0.001	1.324	−1.931	−1.524	0.001
	303.15	−0.059	−0.470	−0.075	0.001	1.310	−1.584	−1.253	0.001
	308.15	−0.032	−0.485	−0.122	0.001	1.404	−1.476	−1.300	0.001
	313.15	−0.006	−0.501	−0.171	0.001	1.571	−1.627	−1.335	0.001
κ_s^E/TPa^{-1}	298.15	−1.7	−18.1	4.9	0.2	−1	−31	−52	1.3
	308.15	5.4	−2.9	2.5	0.1	−53	−18	−7	0.6
δP_m	298.15	11.7	−11.3	−11.0	0.3	−32.9	11.2	34.8	0.3
	308.15	18.1	−6.2	−19.2	0.1	−24.9	13.6	28.3	0.2
		MMA (1) + Benzene (3)				MMA (1) + Toluene (3)			
V_m^E/cm^3·mol^{-1}	298.15	0.701	−0.119	−0.248	0.001	−0.507	0.480	0.530	0.001
	303.15	0.727	−0.103	−0.116	0.001	−0.560	0.643	0.552	0.001
	308.15	0.740	−0.064	0.060	0.001	−0.625	0.797	0.504	0.001
	313.15	0.724	−0.003	0.232	0.001	−0.662	0.935	0.482	0.001
κ_s^E/TPa^{-1}	298.15	−42	11	−23	0.1	−55	14	−11	0.4
	308.15	−59	−17	−62	0.4	−61	25	−42	0.4
δP_m	298.15	18.7	−12.6	3.3	0.2	17.2	−3.7	0.2	0.1
	308.15	15.6	−10.8	4.6	0.2	18.4	−5.9	1.9	0.1
		MMA (1) + *p*-Xylene (3)				2-Butoxyethanol (2) + Benzene (3)			
V_m^E/cm^3·mol^{-1}	298.15	−0.009	−0.696	−0.425	0.001	0.305	−1.463	0.778	0.001
	303.15	0.025	−0.781	−0.201	0.001	0.373	−1.495	0.768	0.001
	308.15	0.100	−0.774	−0.052	0.001	0.527	−1.458	0.596	0.001
	313.15	0.134	−0.809	0.022	0.001	0.611	−1.533	0.576	0.001
κ_s^E/TPa^{-1}	298.15	−27	−13	−7	0.5	−3	−69	22	0.4
	308.15	−37	−15	−20	0.4	20	0	29	0.4
δP_m	298.15	20.6	−8.1	1.7	0.1	16.7	−7.5	10.8	0.1
	308.15	25.9	−8.0	−3.5	0.1	19.3	2.8	10.0	0.1
		2-Butoxyethanol (2) + Toluene (3)				2-Butoxyethanol (2) + *p*-Xylene (3)			
V_m^E/cm^3·mol^{-1}	298.15	−0.069	−1.031	0.854	0.001	−0.055	−1.333	0.635	0.001
	303.15	0.032	−1.077	0.840	0.001	0.064	−1.385	0.555	0.001
	308.15	0.412	−1.161	0.091	0.001	0.225	−1.431	0.586	0.001
	313.15	0.558	−1.155	0.348	0.001	0.746	−1.269	0.098	0.001
κ_s^E/TPa^{-1}	298.15	−42	−26	−1	0.1	−14	−24	14	0.4
	308.15	16	0	−19	0.1	39	0	32	0.5
δP_m	298.15	37.7	6.5	3.5	0.1	−10.6	41.1	25.2	0.1
	308.15	17.1	−0.4	7.2	0.1	22.6	−6.8	12.1	0.1
		Dibutyl Ether (2) + Benzene (3)				Dibutyl Ether (2) + Toluene (3)			
V_m^E/cm^3·mol^{-1}	298.15	0.632	−0.077	0.091	0.001	−0.698	−0.047	0.294	0.001
	303.15	0.639	−0.072	0.097	0.001	−0.689	−0.046	0.285	0.001
	308.15	0.647	−0.075	0.087	0.001	−0.682	−0.040	0.288	0.001
	313.15	0.655	−0.078	0.091	0.001	−0.674	−0.043	0.288	0.001
κ_s^E/TPa^{-1}	298.15	40.7	24.9	7.7	0.1	10.2	34.5	−36.1	0.2
	308.15	16.0	35.2	21.6	0.4	−17.3	42.5	−20.1	0.1
δP_m	298.15	1.2	−7.8	4.4	0.1	−4.3	−2.3	8.1	0.1
	308.15	−1.6	−8.1	0.3	0.1	−10.5	1.7	13.2	0.1
		Dibutyl Ether (2) + *p*-Xylene (3)							
V_m^E/cm^3·mol^{-1}	298.15	−0.863	0.177	0.097	0.001				
	303.15	−0.853	0.176	0.096	0.001				
	308.15	−0.844	0.176	0.098	0.001				
	313.15	−0.837	0.170	0.094	0.001				
κ_s^E/TPa^{-1}	298.15	−10.6	20.9	14.7	0.1				
	308.15	−32.4	19.2	8.1	0.2				
δP_m	298.15	−5.7	0.4	−2.9	0.1				
	308.15	−12.9	1.8	6.2	0.1				

between the $\kappa_{s,123}^E$(exp) values and the values calculated by using the respective equations were estimated using the relation $\Delta\kappa_{s,123}^E = \kappa_{s,123}^E(\text{exp}) - \kappa_{s,123}^E(\text{cal})$ and are listed in Table 7. A perusal of the data showed that the deviations are as high as −27.7 (RK), −25.8 (TS), and −25.7 (K) TPa^{-1} for methyl methacrylate + 2-butoxyethanol + aromatics and −13.3 (RK), −12.5 (TS), and −11.0 (K) for methyl methacrylate + dibutyl ether + aromatics at T = 298.15 K. Hence, it can be stated that the three expressions give only rough estimates of $\kappa_{s,123}^E$ values. The $\kappa_{s,123}^E$ values in the six ternary systems otherwise are negative with the following general increasing trends: *p*-xylene > benzene ≈ toluene for methyl methacrylate + 2-butoxyethanol + aromatics and toluene ≈ *p*-xylene > benzene for methyl methacrylate + dibutyl ether + aromatics.

The negative $\kappa_{s,123}^E$ values in general indicate the predominance of weak but specific structure making interactions of the type n···π or −OH···π between the ester carbonyl lone pair of electrons and the π clouds of aromatics and also between the hydroxyl hydrogen of butoxyethanol and the π clouds of aromatics.

Relative Permittivities, $\epsilon_{r,123}$, and Deviations in Molar Polarizations, $\delta P_{m,123}$. The experimental relative permittivities, $\epsilon_{r,123}$, and deviations in molar polarizations, $\delta P_{m,123} = P_{m,123} - x_1P_{m,1} - x_2P_{m,2} - x_3P_{m,3}$, for the six ternary mixtures at T = (298.15 and 308.15) K are listed

Table 5. Deviations in Experimental and Calculated Excess Molar Volumes ΔV_m^E for MMA (1) + 2-Butoxyethanol (2) + Dibutyl Ether (2) + Aromatic Hydrocarbons (3) at T = (298.15 and 313.15) K

		$\Delta V_{m,123}^E$/cm^3·mol^{-1} at the following values of T/K											
		RK				TS				K			
x_1	x_2	298.15	303.15	308.15	313.15	298.15	303.15	308.15	313.15	298.15	303.15	308.15	313.15
Methyl Methacrylate (1) + 2-Butoxyethanol (2) + Benzene (3)													
0.0420	0.1020	0.000	0.000	0.000	0.000	0.010	0.011	0.012	0.013	0.019	0.021	0.022	0.023
0.6349	0.1038	−0.001	0.000	−0.001	−0.001	0.053	0.058	0.061	0.064	0.060	0.064	0.066	0.070
0.8413	0.1036	0.000	0.001	0.000	0.000	0.012	0.016	0.019	0.023	0.012	0.014	0.014	0.016
0.1887	0.0986	−0.001	0.000	0.000	0.000	0.039	0.042	0.044	0.046	0.067	0.071	0.074	0.078
0.4343	0.1509	−0.001	−0.001	−0.001	−0.001	0.078	0.083	0.086	0.090	0.106	0.112	0.116	0.122
0.7392	0.1554	0.000	0.000	0.000	0.000	0.033	0.038	0.042	0.047	0.032	0.035	0.038	0.041
0.1431	0.2378	0.000	0.000	0.000	0.000	0.048	0.053	0.057	0.060	0.081	0.088	0.094	0.100
0.5428	0.2771	0.001	0.000	0.001	0.000	0.064	0.069	0.075	0.078	0.071	0.076	0.082	0.087
0.3376	0.4522	0.000	0.000	0.001	0.000	0.052	0.057	0.065	0.068	0.063	0.070	0.081	0.086
0.2761	0.5270	0.001	0.001	0.000	0.000	0.039	0.044	0.051	0.053	0.047	0.054	0.064	0.069
0.0775	0.6619	0.000	0.001	0.000	0.000	0.012	0.015	0.018	0.019	0.015	0.020	0.025	0.027
0.1426	0.7539	0.000	0.000	0.000	0.000	0.009	0.011	0.014	0.014	0.009	0.012	0.016	0.016
0.0939	0.8598	0.000	0.000	0.000	0.000	0.003	0.003	0.004	0.004	0.003	0.003	0.004	0.004
0.4670	0.0439	−0.001	−0.001	−0.002	−0.001	0.035	0.036	0.036	0.039	0.048	0.050	0.049	0.052
Methyl Methacrylate (1) + 2-Butoxyethanol (2) + Toluene (3)													
0.0465	0.1020	0.000	0.000	0.000	0.000	0.005	0.004	0.003	0.004	0.008	0.008	0.006	0.006
0.6432	0.0955	0.000	0.001	0.001	0.000	−0.003	0.000	−0.001	0.004	0.013	0.017	0.015	0.022
0.8320	0.0972	0.000	0.000	0.000	0.000	−0.004	−0.001	−0.002	0.001	0.005	0.007	0.006	0.008
0.1940	0.0962	0.000	−0.001	0.001	0.000	0.011	0.009	0.008	0.010	0.020	0.018	0.015	0.019
0.4348	0.1401	0.000	0.000	0.000	0.000	0.002	0.003	0.002	0.008	0.017	0.020	0.019	0.029
0.7444	0.1514	0.000	0.001	0.000	0.000	−0.009	−0.005	−0.005	0.000	0.005	0.009	0.009	0.014
0.1391	0.2469	0.000	−0.001	0.000	0.001	0.005	0.004	0.005	0.007	0.011	0.010	0.013	0.017
0.5255	0.3257	0.000	0.000	0.000	0.000	−0.022	−0.020	−0.013	−0.009	−0.011	−0.008	0.004	0.010
0.3463	0.4459	0.000	0.000	0.000	0.000	−0.026	−0.026	−0.018	−0.016	−0.025	−0.022	−0.006	−0.001
0.2355	0.5771	−0.001	−0.001	0.001	0.000	−0.021	−0.023	−0.017	−0.017	−0.025	−0.025	−0.013	−0.009
0.1013	0.6437	0.000	−0.001	0.000	0.000	−0.011	−0.013	−0.011	−0.011	−0.015	−0.016	−0.010	−0.008
0.1460	0.7495	−0.001	0.000	0.000	0.000	−0.010	−0.010	−0.011	−0.010	−0.012	−0.012	−0.011	−0.008
0.0985	0.8499	0.000	0.000	0.000	0.000	−0.003	−0.004	−0.005	−0.004	−0.004	−0.004	−0.005	−0.004
0.3772	0.0516	0.000	−0.001	0.001	0.001	0.007	0.006	0.005	0.008	0.015	0.015	0.012	0.017
Methyl Methacrylate (1) + 2-Butoxyethanol (2) + *p*-Xylene (3)													
0.0446	0.1014	0.000	0.000	0.000	0.000	0.011	0.010	0.011	0.012	0.019	0.017	0.020	0.022
0.6448	0.0957	0.000	−0.001	−0.001	0.000	0.005	0.005	0.013	0.018	0.020	0.021	0.028	0.032
0.8400	0.1096	0.000	0.000	0.000	0.000	−0.014	−0.022	−0.017	−0.015	0.001	−0.001	0.002	0.003
0.1977	0.0987	0.000	0.000	0.000	0.000	0.032	0.031	0.037	0.040	0.053	0.052	0.061	0.066
0.4420	0.1511	0.000	−0.001	−0.001	−0.001	0.035	0.040	0.050	0.059	0.053	0.060	0.073	0.084
0.7473	0.1509	0.000	0.000	−0.001	0.000	−0.012	−0.018	−0.010	−0.006	0.005	0.003	0.008	0.013
0.1478	0.2456	0.000	0.000	−0.001	−0.001	0.041	0.038	0.046	0.056	0.065	0.063	0.075	0.093
0.5327	0.3172	0.000	0.000	0.000	0.000	0.004	0.010	0.020	0.033	0.012	0.018	0.029	0.047
0.3419	0.445	0.000	0.000	0.000	0.000	0.018	0.024	0.034	0.054	0.021	0.029	0.044	0.075
0.2450	0.5505	−0.001	0.001	0.000	0.000	0.016	0.018	0.027	0.045	0.015	0.020	0.033	0.062
0.1010	0.6399	0.000	0.000	0.001	0.000	0.014	0.010	0.016	0.026	0.015	0.011	0.020	0.039
0.1478	0.7479	0.000	0.001	0.000	0.000	0.006	0.005	0.008	0.015	0.003	0.002	0.008	0.019
0.0998	0.8513	0.000	0.000	0.000	0.000	0.002	0.001	0.003	0.004	0.001	0.000	0.002	0.005
0.3804	0.051	0.000	−0.001	−0.001	−0.001	0.022	0.023	0.027	0.028	0.034	0.035	0.042	0.043
Methyl Methacrylate (1) + Dibutyl Ether (2) + Benzene(3)													
0.0410	0.1025	−0.001	0.000	0.000	0.000	0.011	0.012	0.012	0.013	0.016	0.017	0.018	0.019
0.6421	0.1041	0.000	0.000	0.000	−0.001	0.074	0.082	0.089	0.095	0.058	0.062	0.067	0.071
0.8214	0.1030	0.000	0.000	0.000	0.000	0.004	0.019	0.028	0.034	0.005	0.011	0.014	0.016
0.1927	0.0986	0.000	0.000	0.001	0.001	0.053	0.052	0.055	0.059	0.069	0.069	0.071	0.076
0.4218	0.1509	0.000	0.000	0.000	0.000	0.128	0.127	0.131	0.139	0.135	0.134	0.138	0.146
0.7425	0.1550	0.000	0.000	0.000	0.000	0.036	0.050	0.060	0.066	0.024	0.031	0.035	0.038
0.1524	0.2378	−0.001	0.000	0.001	0.000	0.082	0.082	0.085	0.092	0.113	0.113	0.117	0.126
0.5428	0.2775	0.000	0.000	0.001	0.000	0.127	0.130	0.138	0.146	0.115	0.118	0.125	0.132
0.3376	0.4522	0.001	0.000	0.000	0.000	0.143	0.139	0.142	0.152	0.174	0.169	0.173	0.185
0.2761	0.5275	0.001	0.000	0.000	0.000	0.122	0.118	0.121	0.129	0.159	0.154	0.158	0.169
0.0781	0.6619	0.001	0.000	0.000	0.000	0.045	0.044	0.046	0.051	0.071	0.070	0.072	0.079
0.1431	0.7545	0.001	0.000	0.000	0.000	0.041	0.040	0.041	0.044	0.063	0.061	0.062	0.067
0.0939	0.8598	0.000	0.000	0.000	0.000	0.013	0.012	0.013	0.014	0.021	0.020	0.021	0.023
0.1679	0.0445	0.000	0.000	0.000	0.000	0.023	0.022	0.023	0.026	0.030	0.029	0.031	0.033
Methyl Methacrylate (1) + Dibutyl Ether (2) + Toluene (3)													
0.0457	0.1020	−0.001	0.000	0.000	0.000	0.003	0.002	0.001	0.002	0.000	−0.001	−0.003	−0.003
0.6428	0.0995	0.000	0.001	0.000	0.000	0.007	0.012	0.016	0.022	−0.002	0.001	0.004	0.007
0.8287	0.0978	0.000	0.000	0.000	0.000	−0.022	−0.008	−0.004	0.000	−0.010	−0.005	−0.004	−0.003
0.1954	0.0972	0.000	0.000	0.001	0.000	0.016	0.011	0.010	0.011	0.007	0.001	−0.002	−0.002
0.4365	0.1405	0.000	0.000	0.000	0.000	0.032	0.026	0.026	0.033	0.015	0.009	0.009	0.015
0.7521	0.1514	0.000	0.001	0.000	−0.001	−0.013	−0.001	0.005	0.009	−0.010	−0.004	−0.002	0.000
0.1425	0.2458	0.000	0.000	0.000	0.000	0.021	0.014	0.009	0.012	0.012	0.002	−0.005	−0.002
0.5255	0.3257	0.000	0.000	0.000	0.000	0.023	0.022	0.024	0.031	0.013	0.012	0.014	0.021
0.3463	0.4458	0.000	0.000	0.000	0.001	0.035	0.026	0.023	0.030	0.035	0.025	0.023	0.032

Table 5. (Continued)

		$\Delta V^E_{m,123}$/cm^3·mol^{-1} at the following values of T/K											
		RK				TS				K			
x_1	x_2	298.15	303.15	308.15	313.15	298.15	303.15	308.15	313.15	298.15	303.15	308.15	313.15
Methyl Methacrylate (1) + Dibutyl Ether (2) + Toluene (3) (Continued)													
0.2357	0.5771	0.000	0.000	0.000	0.000	0.026	0.017	0.013	0.017	0.035	0.025	0.021	0.028
0.1027	0.6427	0.001	0.000	0.000	0.000	0.014	0.008	0.004	0.006	0.022	0.014	0.009	0.013
0.1457	0.7495	0.000	0.001	0.001	−0.001	0.011	0.008	0.005	0.005	0.020	0.016	0.013	0.015
0.0985	0.8524	0.000	0.001	0.000	−0.001	0.004	0.003	0.002	0.001	0.008	0.007	0.005	0.006
0.3779	0.0516	0.000	−0.001	−0.001	0.000	0.015	0.011	0.011	0.014	0.007	0.003	0.002	0.004
Methyl Methacrylate (1) + Dibutyl Ether (2) + *p*-Xylene (3)													
0.0447	0.1010	0.000	0.000	0.000	0.000	0.007	0.006	0.006	0.008	0.008	0.005	0.006	0.008
0.6448	0.0952	0.000	0.000	0.000	0.000	0.005	0.009	0.019	0.026	−0.008	−0.006	0.000	0.005
0.8421	0.1091	0.000	0.000	−0.001	0.000	−0.032	−0.032	−0.024	−0.020	−0.013	−0.013	−0.011	−0.010
0.1982	0.0981	0.000	0.000	0.000	0.000	0.029	0.026	0.028	0.033	0.025	0.020	0.024	0.030
0.4420	0.1511	0.000	0.000	0.000	0.000	0.052	0.052	0.061	0.071	0.030	0.030	0.038	0.048
0.7425	0.1509	0.000	0.000	0.000	0.000	−0.021	−0.018	−0.007	−0.001	−0.019	−0.017	−0.012	−0.008
0.1478	0.2456	0.000	0.001	−0.001	−0.001	0.047	0.039	0.042	0.051	0.048	0.037	0.042	0.053
0.5328	0.3165	0.000	0.000	0.000	0.001	0.039	0.041	0.051	0.062	0.020	0.021	0.030	0.040
0.3425	0.4455	0.000	0.000	0.000	0.001	0.072	0.067	0.075	0.088	0.069	0.063	0.072	0.087
0.2450	0.5505	0.000	0.000	0.000	0.001	0.063	0.056	0.061	0.073	0.072	0.063	0.069	0.085
0.1015	0.6394	0.000	0.000	0.000	0.000	0.037	0.030	0.032	0.039	0.049	0.038	0.041	0.052
0.1471	0.7479	0.000	0.000	0.000	0.000	0.027	0.023	0.024	0.029	0.036	0.031	0.033	0.040
0.0992	0.8519	0.000	0.001	0.000	0.000	0.009	0.009	0.008	0.010	0.014	0.012	0.012	0.014
0.3801	0.0510	0.000	−0.001	0.000	0.000	0.023	0.021	0.025	0.029	0.014	0.012	0.016	0.020

Table 6. Experimental Speeds of Sound, v_{123}, and Excess Isentropic Compressibilities, $\kappa^E_{s,123}$, for MMA (1) + 2-Butoxyethanol (2) + Dibutyl Ether (2) + Aromatic Hydrocarbons (3) at T = (298.15 and 308.15) K

		v_{123}/m·s^{-1}		$\kappa^E_{s,123}$/TPa^{-1}				v_{123}/m·s^{-1}		$\kappa^E_{s,123}$/TPa^{-1}	
		T =	T =	T =	T =			T =	T =	T =	T =
x_1	x_2	298.15 K	308.15 K	298.15 K	308.15 K	x_1	x_2	298.15 K	308.15 K	298.15 K	308.15 K
MMA (1) + 2-Butoxyethanol (2) + Benzene (3)						MMA (1) + 2-Butoxyethanol (2) + Toluene (3)					
0.0420	0.1020	1284.7	1250.2	1.3	0.0	0.0465	0.1020	1299.8	1258.7	−6.8	−4.4
0.6349	0.1038	1227.1	1195.8	−13.0	−11.6	0.6432	0.0955	1232.5	1197.4	−15.0	−10.2
0.8413	0.1036	1201.4	1171.8	−6.1	−3.8	0.8320	0.0972	1204.6	1173.5	−7.3	−3.7
0.1887	0.0986	1274.3	1239.8	−8.5	−8.6	0.1940	0.0962	1287.7	1248.6	−14.6	−13.1
0.4343	0.1509	1251.2	1216.1	−15.9	−11.5	0.4348	0.1401	1260.8	1222.0	−19.4	−13.0
0.7392	0.1554	1216.6	1183.2	−12.0	−5.1	0.7444	0.1514	1218.3	1184.1	−12.3	−4.8
0.1431	0.2378	1278.9	1240.7	−9.9	−2.9	0.1391	0.2469	1296.4	1251.4	−19.4	−7.7
0.5428	0.2771	1247.9	1204.0	−23.2	−3.9	0.5255	0.3257	1253.5	1211.2	−23.3	−5.9
0.3376	0.4522	1278.5	1228.5	−29.1	−2.7	0.3463	0.4459	1280.1	1232.8	−28.3	−5.9
0.2761	0.5270	1285.3	1236.9	−27.2	−2.1	0.2355	0.5771	1290.4	1246.7	−23.6	−3.8
0.0775	0.6619	1296.5	1256.7	−13.7	2.9	0.1013	0.6437	1302.3	1260.1	−18.9	−1.1
0.1426	0.7539	1291.7	1257.4	−11.6	1.3	0.1460	0.7495	1292.7	1260.0	−11.7	−1.0
0.0939	0.8598	1292.9	1267.2	−3.7	1.6	0.0985	0.8499	1293.7	1268.2	−4.5	0.1
0.4670	0.0439	1244.6	1215.6	−11.9	−17.3	0.3772	0.0516	1265.2	1230.0	−14.6	−16.0
MMA (1) + 2-Butoxyethanol (2) + *p*-Xylene (3)						MMA (1) + Dibutyl Ether (2) + Benzene (3)					
0.0446	0.1014	1302.3	1266.3	−2.6	3.7	0.0410	0.1025	1275.5	1237.9	−1.3	−3.2
0.6448	0.0957	1238.2	1199.9	−16.2	−4.7	0.6421	0.1041	1217.2	1186.9	−12.2	−16.4
0.8400	0.1096	1204.0	1172.9	−6.7	−1.9	0.8214	0.1030	1196.2	1167.7	−7.3	−10.8
0.1977	0.0987	1291.2	1251.5	−10.8	0.0	0.1927	0.0986	1264.9	1228.5	−10.3	−12.3
0.4420	0.1511	1269.0	1222.4	−22.2	−1.5	0.4218	0.1509	1237.7	1203.2	−14.6	−17.1
0.7473	0.1509	1221.0	1185.2	−13.5	−3.0	0.7425	0.1550	1200.9	1171.6	−7.6	−11.9
0.1478	0.2456	1301.4	1252.2	−18.5	4.6	0.1524	0.2378	1252.5	1213.2	−8.0	−8.1
0.5327	0.3172	1256.5	1211.4	−24.5	−2.4	0.5428	0.2775	1211.3	1179.0	−5.8	−9.9
0.3419	0.4450	1285.5	1233.7	−29.8	−0.3	0.3376	0.4522	1215.9	1181.8	0.2	−5.0
0.2450	0.5505	1293.4	1244.8	−25.2	1.3	0.2761	0.5275	1215.9	1181.5	2.2	−3.5
0.1010	0.6399	1303.5	1258.8	−17.2	5.9	0.0781	0.6619	1223.2	1184.3	4.5	2.8
0.1478	0.7479	1292.3	1258.4	−10.3	2.9	0.1431	0.7545	1216.6	1179.4	3.0	−0.9
0.0998	0.8513	1292.8	1266.9	−3.3	2.5	0.0939	0.8598	1217.7	1178.9	1.3	−1.1
0.3804	0.0510	1267.9	1233.9	−9.2	−4.9	0.1679	0.0445	1274.4	1238.4	−8.9	−11.1
MMA (1) + Dibutyl Ether (2) + Toluene (3)						MMA (1) + Dibutyl Ether (2) + *p*-Xylene (3)					
0.0457	0.1020	1287.9	1248.1	−7.5	−10.1	0.0447	0.1010	1291.3	1257.8	−4.2	−4.7
0.6428	0.0995	1223.8	1189.5	−14.8	−14.7	0.6448	0.0952	1228.2	1192.2	−14.4	−9.1
0.8287	0.0978	1197.9	1167.4	−7.9	−9.0	0.8421	0.1091	1195.7	1165.5	−7.1	−7.8
0.1954	0.0972	1277.1	1238.3	−15.6	−17.9	0.1982	0.0981	1280.0	1242.4	−11.0	−6.3
0.4365	0.1405	1246.4	1208.5	−18.8	−18.4	0.4420	0.1511	1251.2	1208.4	−18.9	−7.6
0.7521	0.1514	1203.0	1171.5	−8.9	−10.5	0.7425	0.1509	1206.5	1174.1	−9.6	−9.1
0.1425	0.2458	1264.5	1224.5	−14.2	−15.9	0.1478	0.2456	1271.3	1228.8	−15.1	−7.0
0.5255	0.3257	1211.9	1178.6	−5.0	−8.8	0.5328	0.3165	1214.7	1180.9	−5.8	−6.9
0.3463	0.4458	1221.0	1184.7	−4.2	−6.9	0.3425	0.4455	1225.9	1187.7	−6.3	−4.2
0.2357	0.5771	1221.3	1184.3	−1.2	−4.5	0.2450	0.5505	1227.0	1188.4	−4.6	−3.6
0.1027	0.6427	1229.2	1190.0	−1.9	−4.0	0.1015	0.6394	1235.6	1195.0	−6.5	−4.4
0.1457	0.7495	1219.7	1181.7	−0.1	−3.3	0.1471	0.7479	1221.6	1183.8	−1.3	−3.6
0.0985	0.8524	1219.3	1180.4	−0.6	−3.0	0.0992	0.8519	1220.1	1181.4	−1.0	−3.3
0.3779	0.0516	1260.7	1224.4	−15.9	−18.0	0.3801	0.0510	1263.0	1228.6	−9.8	−7.1

Table 7. Deviations in Experimental and Calculated Excess Isentropic Compressibilities for MMA (1) + 2-Butoxyethanol (2) +, Dibutyl Ether (2) + Aromatic Hydrocarbons (3) at T = (298.15 and 308.15) K

		$\Delta\kappa_{s,123}^{E}$/TPa^{-1} at the following values of T/K								$\Delta\kappa_{s,123}^{E}$/TPa^{-1} at the following values of T/K					
		RK		TS		K				RK		TS		K	
x_1	x_2	298.15	308.15	298.15	308.15	298.15	308.15	x_1	x_2	298.15	308.15	298.15	308.15	298.15	308.15
MMA (1) + 2-Butoxyethanol (2) + Benzene (3)								MMA (1) + 2-Butoxyethanol (2) + Toluene (3)							
0.0420	0.1020	−2.0	0.0	−2.1	1.1	−1.9	2.7	0.0465	0.1020	−1.9	−0.1	−1.8	0.0	−1.9	0.0
0.6349	0.1038	−7.6	−1.7	−8.1	−5.8	−6.2	−3.0	0.6432	0.0955	−5.3	−1.0	−3.8	−1.7	−4.9	−1.0
0.8413	0.1036	−3.4	0.2	−2.4	−4.0	−2.7	−2.3	0.8320	0.0972	−3.2	−0.4	−1.5	−2.4	−2.9	−1.5
0.1887	0.0986	−5.6	−1.7	−6.3	−1.3	−5.2	0.1	0.1940	0.0962	−4.0	−0.8	−3.6	−1.3	−3.7	−1.6
0.4343	0.1509	−11.6	−3.6	−11.8	−5.2	−9.9	−3.2	0.4348	0.1401	−7.5	−1.7	−5.8	−3.0	−6.9	−3.2
0.7392	0.1554	−8.6	0.2	−6.7	−5.9	−6.8	−2.9	0.7444	0.1514	−6.9	−0.9	−4.4	−4.0	−6.3	−2.7
0.1431	0.2378	−10.7	−0.4	−10.4	0.7	−9.6	1.7	0.1391	0.2469	−9.4	−1.1	−8.4	−2.6	−9.0	−2.8
0.5428	0.2771	−20.3	0.0	−16.7	−7.0	−17.0	−3.5	0.5255	0.3257	−17.0	−2.8	−13.3	−6.8	−15.9	−6.0
0.3376	0.4522	−26.8	−1.4	−22.7	−5.7	−23.9	−3.6	0.3463	0.4459	−21.0	−3.1	−17.3	−6.0	−19.9	−6.3
0.2761	0.5270	−24.8	−1.8	−21.1	−5.1	−22.4	−3.4	0.2355	0.5771	−17.0	−2.7	−14.1	−3.7	−16.2	−4.5
0.0775	0.6619	−9.2	0.2	−7.8	0.4	−8.4	1.3	0.1013	0.6437	−9.9	−1.3	−8.3	−0.6	−9.4	−1.1
0.1426	0.7539	−9.6	−0.6	−8.2	−1.3	−9.0	0.1	0.1460	0.7495	−7.8	−1.3	−6.4	0.0	−7.4	−0.5
0.0939	0.8598	−3.1	−0.2	−2.6	1.0	−2.9	2.0	0.0985	0.8499	−2.8	−0.4	−2.3	2.1	−2.7	1.9
0.4670	0.0439	−3.8	−5.1	−4.9	−5.8	−3.5	−4.5	0.3772	0.0516	−1.4	−1.1	−0.9	−1.0	−1.2	−1.3
MMA (1) + 2-Butoxyethanol (2) + *p*-Xylene (3)								MMA (1) + Dibutyl Ether (2) + Benzene (3)							
0.0446	0.1014	−3.1	0.0	−3.1	5.8	−3.0	6.1	0.0410	0.1025	−1.0	0.2	−1.1	0.2	−1.1	0.2
0.6448	0.0957	−10.9	0.7	−10.8	−3.3	−10.0	−0.6	0.6421	0.1041	−5.3	−1.3	−7.0	−1.6	−2.9	0.8
0.8400	0.1096	−4.0	−0.3	−3.2	−3.2	−3.5	−1.6	0.8214	0.1030	−1.2	0.8	−2.9	−0.1	0.2	2.3
0.1977	0.0987	−9.0	0.6	−9.0	5.0	−8.4	6.0	0.1927	0.0986	−4.2	−1.7	−4.7	−1.8	−4.2	−1.8
0.4420	0.1511	−18.2	1.1	−17.7	−2.7	−16.7	0.0	0.4218	0.1509	−8.5	−3.6	−10.2	−3.9	−7.2	−2.7
0.7473	0.1509	−9.9	−0.6	−8.7	−4.5	−8.8	−1.9	0.7425	0.1550	−1.6	1.6	−4.0	0.1	0.2	3.7
0.1478	0.2456	−17.4	0.5	−16.9	4.6	−16.6	5.8	0.1524	0.2378	−6.5	0.2	−7.5	−0.1	−7.4	−0.4
0.5327	0.3172	−21.6	−2.3	−19.7	−7.6	−19.6	−4.1	0.5428	0.2775	−2.7	4.0	−6.2	1.6	−1.5	6.0
0.3419	0.4450	−27.7	−2.5	−25.8	−5.0	−25.7	−2.2	0.3376	0.4522	−0.6	5.4	−4.2	2.0	−2.1	4.4
0.2450	0.5505	−23.4	−2.4	−21.9	−3.4	−22.0	−1.4	0.2761	0.5275	0.3	4.8	−3.0	1.5	−1.7	3.2
0.1010	0.6399	−14.4	−0.6	−13.8	1.0	−14.0	1.8	0.0781	0.6619	−2.0	1.7	−3.4	0.2	−3.1	0.3
0.1478	0.7479	−9.7	−1.2	−9.3	−1.3	−9.4	−0.5	0.1431	0.7545	0.2	1.9	−1.3	0.0	−0.9	0.5
0.0998	0.8513	−3.6	−0.4	−3.4	0.6	−3.5	0.9	0.0939	0.8598	−0.1	0.7	−0.6	−0.1	−0.5	0.1
0.3804	0.0510	−4.5	0.6	−4.7	0.8	−4.1	2.0	0.1679	0.0445	−1.9	−0.9	−2.0	−0.9	−1.7	−0.9
MMA (1) + Dibutyl Ether (2) + Toluene (3)								MMA (1) + Dibutyl Ether (2) + *p*-Xylene (3)							
0.0457	0.1020	−0.9	0.3	−0.9	0.5	−1.1	0.2	0.0447	0.1010	−1.8	0.7	−1.7	0.9	−1.9	0.7
0.6428	0.0995	−4.3	0.2	−4.4	1.4	−2.7	0.4	0.6448	0.0952	−7.8	2.8	−7.1	4.5	−5.1	4.1
0.8287	0.0978	−1.0	0.8	−1.9	0.8	−0.2	1.1	0.8421	0.1091	−1.1	1.1	−1.2	1.6	−0.2	1.6
0.1954	0.0972	−3.4	0.1	−3.1	0.9	−3.6	−0.3	0.1982	0.0981	−6.7	2.4	−6.4	3.1	−6.4	2.6
0.4365	0.1405	−6.4	0.2	−6.7	1.3	−5.8	−0.7	0.4420	0.1511	−13.3	4.8	−12.5	6.5	−11.0	5.8
0.7521	0.1514	−1.4	1.9	−2.8	1.6	−0.4	2.2	0.7425	0.1509	−3.4	2.6	−3.3	3.7	−1.3	3.7
0.1425	0.2458	−5.3	1.0	−5.9	1.2	−6.7	−0.2	0.1478	0.2456	−10.4	3.8	−10.1	4.7	−10.8	3.8
0.5255	0.3257	0.0	6.8	−2.1	5.5	0.0	6.0	0.5328	0.3165	−2.2	7.1	−2.9	7.8	−0.7	8.2
0.3463	0.4458	−1.0	7.8	−3.0	6.4	−2.4	5.5	0.3425	0.4455	−3.9	8.9	−4.9	9.1	−4.3	8.9
0.2357	0.5771	0.0	6.7	−1.0	5.6	−1.2	4.5	0.2450	0.5505	−2.7	7.7	−4.0	7.6	−3.9	7.2
0.1027	0.6427	−2.2	2.8	−2.7	2.1	−2.9	1.4	0.1015	0.6394	−4.7	3.8	−5.5	3.6	−5.7	3.1
0.1457	0.7495	0.1	3.1	0.1	2.7	−0.1	2.1	0.1471	0.7479	−0.7	3.4	−1.7	3.0	−1.5	2.9
0.0985	0.8524	−0.1	1.0	0.0	0.9	−0.1	0.7	0.0992	0.8519	−0.6	1.1	−1.0	0.9	−0.9	0.9
0.3779	0.0516	−1.8	0.1	−1.2	1.1	−1.0	0.0	0.3801	0.0510	−4.1	2.6	−3.8	3.3	−2.9	3.0

Table 8. Relative Permittivities, ϵ_{r123}, and Deviations in Molar Polarization, $\delta P_{m,123}$ for MMA (1) + 2-Butoxyethanol (2) + Aromatic Hydrocarbons (3) at T = (298.15 and 308.15) K

		ϵ_{r123}		$\delta P_{m,123}$/cm^3·mol^{-1}				ϵ_{r123}		$\delta P_{m,123}$/cm^3·mol^{-1}	
x_1	x_2	T = 298.15 K	T = 308.15 K	T = 298.15 K	T = 308.15 K	x_1	x_2	T = 298.15 K	T = 308.15 K	T = 298.15 K	T = 308.15 K
MMA (1) + 2-Butoxyethanol (2) + Benzene (3)											
0.0420	0.1020	3.591	3.401	3.2	2.9	0.0465	0.1020	3.607	3.372	4.7	2.8
0.6349	0.1038	5.739	5.677	−4.6	−1.3	0.6432	0.0955	5.672	5.646	−3.0	1.0
0.8413	0.1036	6.745	6.591	1.1	2.5	0.8320	0.0972	6.615	6.484	0.8	2.5
0.1887	0.0986	4.076	3.925	0.2	0.8	0.1940	0.0962	4.023	3.897	1.4	2.2
0.4343	0.1509	5.247	5.128	−6.4	−3.2	0.4348	0.1401	5.143	5.079	−3.7	0.4
0.7392	0.1554	6.907	6.667	5.1	5.9	0.7444	0.1514	6.814	6.586	4.5	5.4
0.1431	0.2378	5.057	4.801	0.0	2.5	0.1391	0.2469	5.016	4.732	2.2	3.7
0.5428	0.2771	7.636	7.049	19.5	15.3	0.5255	0.3257	8.271	7.294	31.8	18.6
0.3376	0.4522	8.773	7.656	37.2	24.3	0.3463	0.4459	8.574	7.383	36.6	20.7
0.2761	0.5270	9.042	7.827	37.6	23.9	0.2355	0.5771	8.919	7.610	34.1	18.1
0.0775	0.6619	8.128	7.291	8.4	8.0	0.1013	0.6437	8.131	7.134	14.4	8.3
0.1426	0.7539	9.079	8.034	14.9	10.8	0.1460	0.7495	9.061	7.901	17.2	9.3
0.0939	0.8598	9.112	8.136	3.8	4.0	0.0985	0.8499	9.111	8.064	6.1	3.8
0.4670	0.0439	4.979	4.690	4.4	0.5	0.3772	0.0516	4.571	4.356	5.3	2.8

Table 8. (Continued)

		ϵ_{r123}		$\delta P_{m,123}$/cm^3·mol^{-1}				ϵ_{r123}		$\delta P_{m,123}$/cm^3·mol^{-1}	
x_1	x_2	T = 298.15 K	T = 308.15 K	T = 298.15 K	T = 308.15 K	x_1	x_2	T = 298.15 K	T = 308.15 K	T = 298.15 K	T = 308.15 K
MMA (1) + 2-Butoxyethanol (2) + *p*-Xylene (3)											
0.0446	0.1014	3.095	3.050	−2.0	4.0	0.0410	0.1025	2.631	2.568	1.1	0.4
0.6448	0.0957	5.444	5.459	−4.6	1.4	0.6421	0.1041	4.842	4.734	−5.1	−6.1
0.8400	0.1096	6.700	6.549	0.8	2.6	0.8214	0.1030	5.672	5.607	−1.1	−0.7
0.1977	0.0987	3.612	3.592	−3.4	2.9	0.1927	0.0986	3.178	3.069	−1.4	−3.0
0.4420	0.1511	4.833	4.888	−8.6	0.5	0.4218	0.1509	3.830	3.691	−8.7	−10.8
0.7473	0.1509	6.685	6.501	3.2	5.5	0.7425	0.1550	5.271	5.220	−2.6	−1.9
0.1478	0.2456	4.366	4.401	−7.8	4.3	0.1524	0.2378	3.015	2.898	−3.5	−5.3
0.5327	0.3172	7.860	7.097	25.9	18.1	0.5428	0.2775	4.371	4.343	−5.7	−4.5
0.3419	0.4450	8.059	7.131	29.3	20.3	0.3376	0.4522	3.679	3.670	−5.4	−3.6
0.2450	0.5505	8.330	7.298	27.5	18.3	0.2761	0.5275	3.520	3.508	−4.7	−2.9
0.1010	0.6399	7.623	6.879	7.5	8.5	0.0781	0.6619	3.039	2.955	−2.3	−2.9
0.1478	0.7479	8.842	7.794	14.2	9.4	0.1431	0.7545	3.251	3.192	−2.8	−2.3
0.0998	0.8513	9.017	8.024	4.5	3.8	0.0939	0.8598	3.181	3.110	−1.8	−1.7
0.3804	0.0510	4.243	4.050	3.7	3.5	0.1679	0.0445	3.169	3.082	1.6	0.5
MMA (1) + Dibutyl Ether (2) + Toluene (3)											
0.0457	0.1020	2.675	2.617	0.0	−0.6	0.0447	0.1010	2.506	2.365	−0.5	−0.6
0.6428	0.0995	4.809	4.720	−4.5	−5.1	0.6448	0.0952	4.684	4.650	−4.5	−2.7
0.8287	0.0978	5.686	5.613	−0.9	−0.7	0.8421	0.1091	5.702	5.640	−0.8	−0.1
0.1954	0.0972	3.146	3.078	−2.5	−3.2	0.1982	0.0981	2.972	2.871	−2.8	−1.9
0.4365	0.1405	3.865	3.759	−8.2	−9.6	0.4420	0.1511	3.712	3.680	−9.0	−6.8
0.7521	0.1514	5.284	5.221	−2.5	−2.1	0.7425	0.1509	5.179	5.132	−2.7	−1.5
0.1425	0.2458	2.951	2.838	−4.9	−6.8	0.1478	0.2456	2.833	2.721	−5.2	−5.0
0.5255	0.3257	4.258	4.208	−6.3	−5.7	0.5328	0.3165	4.211	4.159	−6.7	−5.6
0.3463	0.4458	3.644	3.569	−7.0	−7.3	0.3425	0.4455	3.562	3.478	−7.3	−7.1
0.2357	0.5771	3.379	3.302	−5.6	−5.9	0.2450	0.5505	3.331	3.231	−6.2	−6.6
0.1027	0.6427	3.062	2.961	−3.9	−5.1	0.1015	0.6394	3.007	2.893	−3.9	−4.7
0.1457	0.7495	3.24	3.165	−3.4	−3.5	0.1471	0.7479	3.210	3.123	−3.8	−4.0
0.0985	0.8524	3.186	3.112	−2.0	−2.0	0.0992	0.8519	3.173	3.095	−2.2	−2.2
0.3779	0.0516	3.864	3.804	−2.0	−2.3	0.3801	0.0510	3.647	3.580	−2.4	−0.8

Table 9. Deviations in Experimental and Calculated Molar Polarizations, $\Delta\delta P_{m,123}$ for MMA (1) + 2-Butoxyethanol (2) + Dibutyl Ether (2) + Aromatic Hydrocarbons (3) at T = (298.15 and 308.15) K

		$\Delta\delta P_{m,123}$/cm^3·mol^{-1} at the following values of T/K								$\Delta\delta P_{m,123}$/cm^3·mol^{-1} at the following values of T/K					
		RK		TS		K				RK		TS		K	
x_1	x_2	298.15	308.15	298.15	308.15	298.15	308.15	x_1	x_2	298.15	308.15	298.15	308.15	298.15	308.15
MMA (1) + 2-Butoxyethanol (2) + Benzene (3)								MMA (1) + 2-Butoxyethanol (2) + Toluene (3)							
0.0420	0.1020	−0.5	−0.2	−0.7	−0.3	−0.6	−0.3	0.0465	0.1020	−0.8	−0.2	−1.1	−0.2	−0.9	−0.2
0.6349	0.1038	−7.0	−5.1	−9.3	−5.9	−7.4	−4.1	0.6432	0.0955	−6.1	−3.3	−9.1	−4.1	−6.5	−2.4
0.8413	0.1036	2.5	1.5	0.1	0.8	0.9	1.8	0.8320	0.0972	1.5	1.0	−1.6	0.5	0.0	1.4
0.1887	0.0986	−5.5	−4.4	−6.3	−4.7	−5.6	−4.2	0.1940	0.0962	−4.9	−2.7	−6.1	−3.0	−5.0	−2.6
0.4343	0.1509	−11.1	−8.9	−13.4	−9.7	−11.4	−7.9	0.4348	0.1401	−9.4	−5.5	−12.3	−6.3	−9.6	−4.7
0.7392	0.1554	5.9	3.4	2.6	2.5	4.0	4.1	0.7444	0.1514	4.7	2.6	0.4	1.9	2.8	3.3
0.1431	0.2378	−5.8	−3.2	−6.9	−3.6	−6.2	−3.2	0.1391	0.2469	−5.8	−1.7	−7.3	−2.0	−6.2	−1.7
0.5428	0.2771	18.6	10.2	14.5	9.0	16.4	11.1	0.5255	0.3257	30.6	13.3	24.0	12.3	27.0	13.8
0.3376	0.4522	35.3	18.3	31.2	17.0	32.6	18.5	0.3463	0.4459	33.2	14.8	26.8	13.9	29.3	14.9
0.2761	0.5270	35.8	18.2	31.9	17.0	33.0	18.1	0.2355	0.5771	30.2	13.1	24.2	12.3	26.0	12.9
0.0775	0.6619	5.6	3.3	4.2	2.7	4.5	3.1	0.1013	0.6437	7.5	4.1	4.4	3.6	5.3	3.9
0.1426	0.7539	14.2	7.2	11.4	6.6	11.8	7.0	0.1460	0.7495	14.0	6.1	9.6	5.6	10.5	5.9
0.0939	0.8598	3.8	2.0	1.7	1.7	1.9	1.9	0.0985	0.8499	4.2	1.9	1.4	1.7	1.8	1.8
0.4670	0.0439	−0.5	−4.1	−1.5	−4.6	−0.5	−3.6	0.3772	0.0516	−0.2	−2.5	−1.6	−2.9	−0.2	−2.1
MMA (1) + 2-Butoxyethanol (2) + *p*-Xylene (3)								MMA (1) + Dibutyl Ether (2) + Benzene (3)							
0.0446	0.1014	−0.7	−0.3	−0.7	−0.4	−0.8	−0.3	0.0410	0.1025	−0.9	−1.0	−0.9	−1.0	−0.8	−1.0
0.6448	0.0957	−6.0	−4.3	−6.5	−5.4	−6.8	−3.2	0.6421	0.1041	−6.1	−7.1	−6.2	−7.1	−7.0	−8.0
0.8400	0.1096	2.5	1.1	−0.1	0.6	0.4	1.6	0.8214	0.1030	−1.0	−1.0	−0.9	−0.9	−1.5	−1.5
0.1977	0.0987	−5.0	−4.0	−5.0	−4.5	−5.2	−3.9	0.1927	0.0986	−5.4	−6.2	−5.5	−6.3	−5.3	−6.2
0.4420	0.1511	−10.1	−7.6	−10.7	−8.6	−11.0	−6.5	0.4218	0.1509	−10.9	−12.5	−11.0	−12.5	−11.2	−13.0
0.7473	0.1509	4.6	2.2	1.6	1.4	2.1	3.2	0.7425	0.1550	−1.5	−1.5	−1.4	−1.2	−2.2	−2.2
0.1478	0.2456	−6.2	−3.2	−6.6	−3.7	−7.1	−3.1	0.1524	0.2378	−6.3	−7.3	−6.3	−7.2	−5.6	−6.8
0.5327	0.3172	27.5	11.8	21.7	10.9	22.8	12.9	0.5428	0.2775	−2.9	−2.5	−2.6	−2.0	−3.1	−2.8
0.3419	0.4450	30.4	13.3	24.4	12.4	25.3	13.7	0.3376	0.4522	−2.2	−0.9	−1.9	−0.3	−1.3	−0.1
0.2450	0.5505	28.1	12.2	22.3	11.4	23.0	12.2	0.2761	0.5275	−1.6	−0.2	−1.3	0.4	−0.6	0.7
0.1010	0.6399	6.9	3.4	3.8	3.0	4.1	3.3	0.0781	0.6619	−1.9	−1.9	−1.8	−1.7	−1.6	−1.6
0.1478	0.7479	13.5	5.8	9.0	5.3	9.6	5.6	0.1431	0.7545	−0.6	−0.1	−0.5	0.2	−0.2	0.4
0.0998	0.8513	3.9	1.7	1.0	1.5	1.3	1.7	0.0939	0.8598	−0.3	−0.1	−0.3	0.0	−0.2	0.0
0.3804	0.0510	−0.2	−3.9	−0.2	−4.5	−0.3	−3.5	0.1679	0.0445	−2.4	−2.8	−2.5	−2.9	−2.4	−2.9

Table 9. (Continued)

		$\Delta\delta P_{m,123}$/cm^3·mol^{-1} at the following values of T/K								$\Delta\delta P_{m,123}$/cm^3·mol^{-1} at the following values of T/K					
		RK		TS		K				RK		TS		K	
x_1	x_2	298.15	308.15	298.15	308.15	298.15	308.15	x_1	x_2	298.15	308.15	298.15	308.15	298.15	308.15
MMA (1) + Dibutyl Ether (2) + Toluene (3)								MMA (1) + Dibutyl Ether (2) + *p*-Xylene (3)							
0.0457	0.1020	−1.0	−1.2	−1.0	−1.2	−0.9	−1.1	0.0447	0.1010	−0.9	−0.8	−0.9	−0.7	−0.8	−0.7
0.6428	0.0995	−5.5	−6.6	−5.3	−6.1	−6.7	−7.6	0.6448	0.0952	−5.7	−5.2	−5.5	−4.6	−6.9	−6.1
0.8287	0.0978	−1.0	−1.3	−0.8	−0.9	−1.5	−1.8	0.8421	0.1091	−0.6	−0.6	−0.4	−0.3	−1.0	−0.9
0.1954	0.0972	−4.9	−5.7	−4.9	−5.6	−4.8	−5.7	0.1982	0.0981	−5.4	−4.9	−5.3	−4.6	−5.4	−4.9
0.4365	0.1405	−9.5	−11.2	−9.3	−10.7	−10.2	−11.9	0.4420	0.1511	−10.2	−9.2	−9.9	−8.5	−11.0	−9.9
0.7521	0.1514	−1.5	−1.9	−1.3	−1.5	−2.3	−2.7	0.7425	0.1509	−1.8	−1.7	−1.5	−1.1	−2.7	−2.3
0.1425	0.2458	−5.7	−7.0	−5.5	−6.6	−5.2	−6.5	0.1478	0.2456	−5.8	−5.1	−5.7	−4.7	−5.4	−4.8
0.5255	0.3257	−2.0	−2.5	−1.7	−2.2	−2.4	−3.1	0.5328	0.3165	−2.6	−3.0	−2.3	−2.4	−3.1	−3.4
0.3463	0.4458	−2.9	−3.7	−2.6	−3.5	−2.6	−3.7	0.3425	0.4455	−3.4	−3.9	−3.1	−3.5	−3.0	−3.7
0.2357	0.5771	−2.0	−2.5	−2.0	−2.7	−1.7	−2.5	0.2450	0.5505	−2.8	−3.3	−2.6	−3.1	−2.2	−3.1
0.1027	0.6427	−2.4	−3.1	−2.4	−3.2	−2.3	−3.1	0.1015	0.6394	−2.4	−2.4	−2.2	−2.3	−2.1	−2.3
0.1457	0.7495	−0.9	−1.1	−1.0	−1.5	−0.9	−1.3	0.1471	0.7479	−1.2	−1.4	−1.0	−1.5	−0.8	−1.4
0.0985	0.8524	−0.4	−0.5	−0.5	−0.7	−0.4	−0.6	0.0992	0.8519	−0.4	−0.5	−0.3	−0.6	−0.3	−0.5
0.3779	0.0516	−5.4	−6.0	−5.4	−6.0	−5.9	−6.5	0.3801	0.0510	−6.4	−6.0	−6.3	−5.8	−6.9	−6.5

in Table 8. The molar polarizations for the pure and mixture components were calculated from $P_{m,i} = \{(\epsilon_{r,i} - 1)(2\epsilon_{r,i} + 1)V_{m,i}/9\epsilon_{r,i}\}$ and $P_{m,123} = \{(\epsilon_{r,123} - 1)(2\epsilon_{r,123} + 1)/9\epsilon_{r,123}\}\{(x_1M_1 + x_2M_2)/\rho_{12}\}$.[40] $\delta P_{m,123}$ values were also calculated by employing RK, TS, and K equations using the data of the constituent binary pairs (as obtained through the coefficients, a_i, given in Table 4 and eq 4). The differences between the experimental and calculated deviations in molar polarizations, $\Delta\delta P_{m,123} = \delta P_{m,123}(\text{exp}) - \delta P_{m,123}(\text{cal})$ are listed in Table 9. The $\Delta\delta P_{m,123}$ values for methyl methacrylate + 2-butoxyethanol + benzene, toluene, or *p*-xylene at $T = 298.15$ K are mostly found to be very large and positive while the same are mostly negative but considerable for methyl methacrylate + dibutyl ether + benzene, toluene, or *p*-xylene mixtures. This indicates that the three equations give only very approximate $\delta P_{m,123}$ values in the six ternary mixtures studied. A perusal of $\delta P_{m,123}$ values from Table 9 reveals that they are large and positive in methyl methacrylate + 2-butoxyethanol + aromatics while they become small and negative in methyl methacrylate + dibutyl ether + aromatics.

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