**Study of Molecular Interactions of fossil fuels through Acoustic and Volumetric Data**

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**THEORY**

***Excess Properties***

The Table 2S*,* contains the investigated density, speed of sound for the binary mixtures of DEC with methyl phenols at 303.15 to 318.15 K, as well as excess properties like molar volume (), isentropic compressibility (), molar isentropic compressibility () and isobaric thermal expansion (αp) of pure and binary liquids at various temperatures. The following equation was used to get the molar volume:

 (1)

Excess molar volume is calculated by using the following relation:

 (2)

where *x*1 and *x*2 are the mole fractions, *M*1 and *M*2 are molar masses, and *ρ*1 and *ρ*2 are the densities of the pure liquid components 1 and 2, respectively.

 The isentropic compressibility, *κ*s, derived directly from the speed of sound and density measurements using the Newton-Laplace equation [28]:

 (3)

Molar isentropic compressibility can be calculated by the following relation

**  (4)

Excess isentropic compressibility and excess molar isentropic compressibility can be determined using the relations, [29]

 (5)

 (6)

where *κ*s is isentropic compression, is isentropic compression of the ideal mixture, and  is the molar isentropic compressibility of the ideal mixture. ,values for binary mixtures were computed according to Benson and Kiyohara [30] recommendations

 (7)

(8)

 , and are calculated using the following relations given in our previous paper [5]:

The values of *α*p are calculated from the temperature dependence of the density data of pure liquids and linear with temperature by using the relation,

 (9)

The expected uncertainty of is within ±0.003 kK-1.

The excess speed of sound, , was calculated using the relation

 (10)

The speed of sound in an ideal mixture can be determined by the equation

 (11)

where M = M1x1 + M1x2

***Excess isobaric thermal expansivity***

 Since the electrolytes are known as the “blood” of the batteries, the volume expansion property of mixture solvents is helping understand the stability of electrolyte systems in their application, especially in higher temperatures. Isobaric thermal expansions are estimated for every composition in order to gain a better understanding of the structural change that occurs during mixing.

 which have been often used the following equation:

 (12)

where, $V\_{m}$ is the molar volume of the mixture, *ϕi* is the volume fraction of component ‘i’ in the pre-mixing state, and $α\_{i}^{\*}$is the thermal expansion coefficient of the pure component ‘i’.

The values of  , , , andas functions of mole fraction, *x*1 of DEC, and temperature for binary systems are presented in Table 2S. The Redlich-Kister [31] polynomial equation was used to fit the excess values of the above parameters for the mixtures.

 (13)

where *Y*E is , , , *u*E, and. The equation coefficients, *A*i, obtained by the method of least squares with equal weights assigned to each point were calculated along with the standard deviation *σ* (*Y*E). The coefficients were adjustable parameters for a better fit of the excess functions.

The standard deviation *σ*(*Y*E) is calculated using,

 (14)

where *m* equal to the number of experimental points, *n* is the number of *Ai* coefficients considered (j + 1 in the present study). The optimal number of *Ai* coefficients has been determined statistically by performing F-test. The coefficients, *Ai* and corresponding standard deviations, σ fit of  , , , , Standard error (σ), and standard deviation was given in Table 3S. The variations of , , ,, and with mole fraction, *x*1 along with smoothed values from Eq. (13) at studied temperatures are shown graphically in Figures 1-5 respectively.

**Partial molar properties**

The partial molar quantities govern the changes in molecular configuration of the components in the non-ideal system. The partial molar properties  andof DEC and isomeric methyl phenols over the mole fraction range were investigated using the following relations:

$\overbar{Y}\_{m,1}=Y\_{m}^{E}+Y\_{m,1}^{\*}+x\_{2}(\frac{∂Y\_{m}^{E}}{∂x\_{1}})\_{T,p}$ (15)

$\overbar{Y}\_{m,2}=Y\_{m}^{E}+Y\_{m,2}^{\*}-x\_{1}(\frac{∂Y\_{m}^{E}}{∂x\_{1}})\_{T,p}$ (16)

where Y is V or whereand are the molar properties of pure DEC and isomeric methyl phenols. The derivative in Eqs. (15) and (16) could be measured by differentiation of R.K, and leads to the equations for &.

$\overbar{Y}\_{m,1}=\overbar{Y}\_{m,1}^{\*}+x\_{2}^{2}\sum\_{i=0}^{j}A\_{i}(2x\_{1}-1)^{i}-2x\_{1}x\_{2}^{2}\sum\_{i=0}^{j}iA\_{i}(2x\_{1}-1)^{i-1}$ (17)

$\overbar{Y}\_{m,2}=\overbar{Y}\_{m,2}^{\*}+x\_{1}^{2}\sum\_{i=0}^{j}A\_{i}(2x\_{1}-1)^{i}+2x\_{2}x\_{1}^{2}\sum\_{i=0}^{j}iA\_{i}(2x\_{1}-1)^{i-1}$ (18)

The excess partial molar properties were calculated by following relations:

$\overbar{Y}\_{m,i}^{E}=Y\_{m}^{E}+(1-x\_{i})(^{∂Y\_{m}^{E}}/\_{∂x\_{i}})$ (19)

To calculate the partial molar properties of DEC at infinite dilution (x1=0) in isomeric methyl phenols, and the partial molar properties of Isomeric methyl phenols at infinite dilution (x2=0) in DEC. Therefore, can be calculated by setting *x*1=0 which leads to

 (20)

Similarly setting *x*2=0, leads to

 (21)

hereand  represent the partial molar properties of DEC at infinite dilution in isomeric methyl phenols and the partial molar properties of Isomeric methyl phenols at infinite dilution in DEC, respectively.

Excess partial molar properties at infinite dilution for each component in binary liquid mixtures were evaluated through relations

 (22)

(23)

**Table 1S.** Experimental values of density, speeds of sound, and AAD% of pure liquids along with corresponding values available at 303.15-318.15 K, at 0.1 MPa.

|  |  |  |  |
| --- | --- | --- | --- |
| Compound | T/K | *ρ*/kg m-3 | *u*/m s-1 |
| Expt. | Ref. | AAD% | Expt. | Ref. | AAD% |
| DEC | 303.15 | 963.5 | 963.65 [12] | 0.019 | 1156.9 | 1156.0 [13] | -0.083 |
|  |  | 963.40 [13] | -0.007 |  | 1156.3 [14] | -0.057 |
|  |  | 963.60 [14] | 0.013 |  | 1156.0 [16] | -0.083 |
|  |  | 963.70 [15] | 0.024 |  | 1156.6 [19] | -0.031 |
|  |  | 963.58 [16] | 0.011 |  |  |  |
|  |  | 963.00 [17] | -0.049 |  |  |  |
|  |  | 963.60 [18] | 0.013 |  |  |  |
|  |  | 963.70 [19] | 0.024 |  |  |  |
| 308.15 | 957.8 | 957.90 [10] | 0.009 | 1136.6 | 1135.7 [10] | -0.078 |
|  |  | 957.90 [11] | 0.009 |  | 1135.8 [14] | -0.072 |
|  |  | 957.92 [14] | 0.011 |  | 1136.0 [16] | -0.055 |
|  |  | 958.00 [15] | 0.020 |  | 1136.3 [19] | -0.028 |
|  |  | 957.93 [16] | 0.013 |  |  |  |
|  |  | 957.50 [17] | -0.032 |  |  |  |
|  |  | 957.98 [18] | 0.018 |  |  |  |
|  |  | 958.10 [19] | 0.030 |  |  |  |
| 313.15 | 952.1 | 952.31 [12] | 0.018 | 1116.5 | 1115.0 [13] | -0.130 |
|  |  | 952.20 [13] | 0.006 |  | 1116.0 [16] | -0.040 |
|  |  | 952.40 [15] | 0.027 |  | 1116.1 [19] | -0.031 |
|  |  | 952.26 [16] | 0.013 |  |  |  |
|  |  | 952.00 [17] | -0.015 |  |  |  |
|  |  | 952.40 [19] | 0.027 |  |  |  |
| 318.15 | 946.4 | 946.43 [10] | 0.000 | 1096.5 | 1096.2 [19] | -0.025 |
|  |  | 946.70 [15] | 0.029 |  |  |  |
|  |  | 947.67 [18] | 0.131 |  |  |  |
|  |  | 946.70 [19] | 0.029 |  |  |  |
| o-Cresol | 303.15 | 1037.1 | 1036.90 [20] | -0.019 | 1487.8 | 1487.00 [20] | -0.054 |
|   |   | 1036.20 [21] | -0.087 |   | 1485.26 [21] | -0.171 |
|   |   | 1037.05 [22] | -0.005 |   | 1488.19 [22] | 0.026 |
| 308.15 | 1032.6 | 1031.60 [20] | -0.097 | 1470.2 | 1470.00 [20] | -0.013 |
|   |   | 1031.00 [21] | -0.155 |   | 1466.84 [21] | -0.229 |
|   |   | 1032.64 [22] | 0.004 |   | 1470.21 [22] | 0.001 |
|   |   | 1032.73 [24] | 0.013 |   |  |   |
|   |   | 1032.73 [26] | 0.013 |   |  |   |
| 313.15 | 1028.1 | 1026.00 [21] | -0.205 | 1452.5 | 1452.11 [21] | -0.027 |
|   |   | 1028.25 [22] | 0.015 |   | 1452.65 [22] | 0.010 |
|   |   | 1028.10 [24] | 0.000 |  | 1453.35 [24] | 0.059 |
|   |   | 1026.00 [25] | -0.205 |  |  |   |
| 318.15 | 1023.6 | 1021.10 [21] | -0.245 | 1434.9 | 1437.06 [21] | 0.150 |
|   |   | 1023.82 [22] | 0.021 |   | 1435.18 [22] | 0.020 |
| m-cresol | 303.15 | 1025.7 | 1026.10 [20] | 0.039 | 1466.2 | 1465.00 [20] | -0.082 |
|  |  | 1025.80 [21] | 0.010 |  | 1464.21 [21] | -0.136 |
|  |  | 1025.96 [22] | 0.025 |  | 1466.16 [22] | -0.003 |
| 308.15 | 1022.0 | 1022.10 [20] | -0.352 | 1450.6 | 1450.00 [20] | -0.041 |
|  |  | 1021.50 [21] | -0.411 |  | 1449.27 [21] | -0.092 |
|  |  | 1021.99 [22] | -0.363 |  | 1450.55 [22] | -0.003 |
|  |  | 1021.64 [27] | -0.397 |  |  |  |
| 313.15 | 1017.9 | 1017.00 [21] | -0.855 | 1435.0 | 1436.32 [21] | 0.092 |
|  |  | 1017.99 [22] | -0.757 |  | 1434.97 [22] | -0.002 |
|  |  | 1018.00 [24] | -0.756 |  | 1434.20 [24] | -0.056 |
|  |  | 1016.00 [25] | -0.955 |  |  |  |
|  |  | 1017.63 [27] | -0.793 |  |  |  |
| 318.15 | 1013.8 | 1013.50 [21] | -1.204 | 1419.3 | 1424.21 [21] | 0.345 |
|  |  | 1013.99 [22] | -1.155 |  | 1419.45 [22] | 0.011 |
|  |  | 1013.60 [27] | -1.194 |  |  |   |
| p-cresol | 303.15 | 1026.7 | 1026.30 [20] | 0.058 | 1470.1 | 1471.00 [20] | 0.061 |
|  |  | 1026.50 [21] | 0.078 |  | 1468.43 [21] | -0.114 |
|  |  | 1026.39 [22] | 0.067 |  | 1471.38 [22] | 0.087 |
| 308.15 | 1022.5 | 1022.40 [20] | -0.323 | 1455.0 | 1455.00 [20] | 0.000 |
|  |  | 1022.00 [21] | -0.362 |  | 1455.79 [21] | 0.054 |
|  |  | 1022.50 [22] | -0.313 |  | 1455.63 [22] | 0.043 |
| 313.15 | 1018.4 | 1018.10 [21] | -0.746 | 1439.8 | 1443.68 [21] | 0.269 |
|  |  | 1018.59 [22] | -0.698 |  | 1439.97 [22] | 0.012 |
|  |  | 1018.80 [23] | -0.677 |  | 1439.56 [24] | -0.017 |
|  |  | 1018.50 [24] | -0.707 |  |  |   |
|  |  | 1016.80 [25] | -0.875 |  |  |   |
| 318.15 | 1014.3 | 1013.90 [21] | -1.164 | 1424.7 | 1432.73 [21] | 0.560 |
|  |  | 1014.66 [22] | -1.088 |  | 1424.29 [22] | -0.029 |

Standard uncertainties, *u*, are *u* (*T*) = ±0.02 K; *u* (*ρ*) = ±1 kg m-3; *u* (*u*) = ± 0.8 m s-1; u(p) = ±1 kPa.

Expt. – Experimental, Ref. – Reference

**Table 2S.** Densities, speeds of sound, excess molar volumes, , excess isentropic compressibilities, , excess molar isentropic compressibilities, $K\_{s,m}^{E}$, excess speed of sound, , excess coefficient of thermal expansion, αE, as a function of mole fraction DEC at 303.15 – 318.15 K at 0.1MPa.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| *x*1 | *ρ* (kg m-3) | *u* (m s-1) | (106) (m3 mol-1) | (1010)(m2 N−1) | (1014) (m5 N-1 mol-1) | (102) (m s-1) | *αE* (103)K-1 |
| DEC (1) + o-cresol (2)T = 303.15 K |
| 0.0000 | 1037.1 | 1487.8 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 0.1078 | 1029.1 | 1452.1 | -0.1261 | -0.2122 | -0.2313 | 0.3148 | -1.2594 |
| 0.1996 | 1022.4 | 1421.7 | -0.2109 | -0.3557 | -0.3941 | 0.4820 | -2.0455 |
| 0.2986 | 1015.1 | 1389.0 | -0.2784 | -0.4715 | -0.5317 | 0.5832 | -2.6185 |
| 0.4062 | 1007.2 | 1353.4 | -0.3232 | -0.5505 | -0.6325 | 0.6202 | -2.9392 |
| 0.5168 | 999.0 | 1316.7 | -0.3374 | -0.5788 | -0.6778 | 0.5955 | -2.9642 |
| 0.6166 | 991.7 | 1283.7 | -0.3218 | -0.5563 | -0.6627 | 0.5294 | -2.7408 |
| 0.6923 | 986.1 | 1258.7 | -0.2916 | -0.5075 | -0.6123 | 0.4560 | -2.4261 |
| 0.8224 | 976.5 | 1215.6 | -0.2020 | -0.3562 | -0.4392 | 0.2909 | -1.6138 |
| 0.9022 | 970.7 | 1189.2 | -0.1228 | -0.2185 | -0.2729 | 0.1685 | -0.9566 |
| 1.0000 | 963.5 | 1156.9 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| T = 308.15 K |
| 0.0000 | 1032.6 | 1470.2 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 0.1078 | 1024.5 | 1434.2 | -0.1305 | -0.2281 | -0.2497 | 0.3242 | -1.2950 |
| 0.1996 | 1017.6 | 1403.6 | -0.2182 | -0.3825 | -0.4257 | 0.4955 | -2.1046 |
| 0.2986 | 1010.2 | 1370.6 | -0.2882 | -0.5073 | -0.5747 | 0.5985 | -2.6954 |
| 0.4062 | 1002.2 | 1334.7 | -0.3345 | -0.5926 | -0.6841 | 0.6355 | -3.0266 |
| 0.5168 | 993.9 | 1297.7 | -0.3492 | -0.6234 | -0.7336 | 0.6094 | -3.0526 |
| 0.6166 | 986.5 | 1264.4 | -0.3330 | -0.5996 | -0.7178 | 0.5412 | -2.8223 |
| 0.6923 | 980.8 | 1239.2 | -0.3017 | -0.5473 | -0.6637 | 0.4658 | -2.4977 |
| 0.8224 | 971.1 | 1195.8 | -0.2088 | -0.3844 | -0.4765 | 0.2968 | -1.6604 |
| 0.9022 | 965.1 | 1169.1 | -0.1267 | -0.2359 | -0.2963 | 0.1718 | -0.9837 |
| 1.0000 | 957.8 | 1136.6 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| T = 313.15 K |
| 0.0000 | 1028.1 | 1452.5 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 0.1078 | 1019.9 | 1416.3 | -0.1352 | -0.2445 | -0.2688 | 0.3328 | -1.3369 |
| 0.1996 | 1012.9 | 1385.4 | -0.2261 | -0.4102 | -0.4586 | 0.5076 | -2.1721 |
| 0.2986 | 1005.4 | 1352.2 | -0.2986 | -0.5443 | -0.6194 | 0.6122 | -2.7810 |
| 0.4062 | 997.2 | 1316.0 | -0.3467 | -0.6360 | -0.7379 | 0.6490 | -3.1216 |
| 0.5168 | 988.8 | 1278.8 | -0.3619 | -0.6695 | -0.7919 | 0.6215 | -3.1474 |
| 0.6166 | 981.3 | 1245.3 | -0.3452 | -0.6443 | -0.7754 | 0.5513 | -2.9092 |
| 0.6923 | 975.5 | 1219.8 | -0.3128 | -0.5884 | -0.7174 | 0.4742 | -2.5740 |
| 0.8224 | 965.6 | 1176.1 | -0.2165 | -0.4138 | -0.5157 | 0.3018 | -1.7105 |
| 0.9022 | 959.6 | 1149.2 | -0.1314 | -0.2541 | -0.3209 | 0.1746 | -1.0132 |
| 1.0000 | 952.1 | 1116.5 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| T = 318.15 K |
| 0.0000 | 1023.6 | 1434.9 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 0.1078 | 1015.3 | 1398.4 | -0.1402 | -0.2626 | -0.2899 | 0.3420 | -1.3858 |
| 0.1996 | 1008.2 | 1367.4 | -0.2344 | -0.4407 | -0.4949 | 0.5208 | -2.2487 |
| 0.2986 | 1000.6 | 1333.8 | -0.3097 | -0.5850 | -0.6689 | 0.6269 | -2.8758 |
| 0.4062 | 992.3 | 1297.4 | -0.3596 | -0.6840 | -0.7974 | 0.6636 | -3.2246 |
| 0.5168 | 983.7 | 1260.0 | -0.3756 | -0.7204 | -0.8566 | 0.6346 | -3.2486 |
| 0.6166 | 976.0 | 1226.2 | -0.3584 | -0.6938 | -0.8394 | 0.5624 | -3.0011 |
| 0.6923 | 970.2 | 1200.6 | -0.3249 | -0.6339 | -0.7771 | 0.4834 | -2.6547 |
| 0.8224 | 960.1 | 1156.5 | -0.2252 | -0.4462 | -0.5592 | 0.3073 | -1.7638 |
| 0.9022 | 954.0 | 1129.5 | -0.1370 | -0.2742 | -0.3483 | 0.1777 | -1.0449 |
| 1.0000 | 946.4 | 1096.5 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| DEC (1) + m-cresol (2)T = 303.15K |
| 0.0000 | 1025.7 | 1466.2 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.000 |
| 0.0986 | 1019.9 | 1435.3 | -0.1247 | -0.1928 | -0.2124 | 0.2739 | -1.071 |
| 0.1956 | 1013.8 | 1405.6 | -0.1982 | -0.3472 | -0.3876 | 0.4523 | -1.853 |
| 0.3076 | 1006.9 | 1370.5 | -0.2592 | -0.4704 | -0.5345 | 0.5564 | -2.441 |
| 0.3958 | 1001.4 | 1343.8 | -0.2890 | -0.5372 | -0.6189 | 0.5921 | -2.683 |
| 0.4978 | 995.0 | 1311.5 | -0.3031 | -0.5612 | -0.6574 | 0.5712 | -2.737 |
| 0.6102 | 988.0 | 1277.0 | -0.2927 | -0.5426 | -0.6471 | 0.5086 | -2.534 |
| 0.6982 | 982.6 | 1249.7 | -0.2652 | -0.4848 | -0.5865 | 0.4267 | -2.197 |
| 0.7934 | 976.6 | 1220.4 | -0.2161 | -0.3826 | -0.4704 | 0.3152 | -1.670 |
| 0.9036 | 969.8 | 1186.3 | -0.1335 | -0.2054 | -0.2582 | 0.1564 | -0.864 |
| 1.0000 | 963.5  | 1156.9 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.000 |
| T = 308.15 K |
| 0.0000 | 1022.0 | 1450.6 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.000 |
| 0.0986 | 1016.0 | 1419.2 | -0.1301 | -0.2034 | -0.2251 | 0.2780 | -1.121 |
| 0.1956 | 1009.7 | 1389.1 | -0.2076 | -0.3666 | -0.4112 | 0.4582 | -1.938 |
| 0.3076 | 1002.5 | 1353.4 | -0.2721 | -0.4975 | -0.5681 | 0.5630 | -2.553 |
| 0.3958 | 996.9 | 1326.3 | -0.3036 | -0.5687 | -0.6585 | 0.5986 | -2.805 |
| 0.4978 | 990.3 | 1293.5 | -0.3185 | -0.5950 | -0.7007 | 0.5769 | -2.859 |
| 0.6102 | 983.1 | 1258.5 | -0.3075 | -0.5761 | -0.6909 | 0.5131 | -2.646 |
| 0.6982 | 977.5 | 1230.8 | -0.2786 | -0.5154 | -0.6272 | 0.4303 | -2.294 |
| 0.7934 | 971.4 | 1201.0 | -0.2267 | -0.4073 | -0.5038 | 0.3176 | -1.743 |
| 0.9036 | 964.3 | 1166.4 | -0.1394 | -0.2191 | -0.2771 | 0.1575 | -0.901 |
| 1.0000 | 957.8 | 1136.6 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.000 |
| T = 313.15 K |
| 0.0000 | 1017.9 | 1435.0 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.000 |
| 0.0986 | 1011.7 | 1403.1 | -0.1350 | -0.2139 | -0.2377 | 0.2810 | -1.165 |
| 0.1956 | 1005.3 | 1372.6 | -0.2162 | -0.3859 | -0.4348 | 0.4626 | -2.014 |
| 0.3076 | 998.0 | 1336.4 | -0.2838 | -0.5244 | -0.6018 | 0.5677 | -2.651 |
| 0.3958 | 992.2 | 1308.9 | -0.3169 | -0.6000 | -0.6985 | 0.6030 | -2.912 |
| 0.4978 | 985.5 | 1275.7 | -0.3325 | -0.6287 | -0.7444 | 0.5806 | -2.968 |
| 0.6102 | 978.1 | 1240.1 | -0.3211 | -0.6096 | -0.7353 | 0.5160 | -2.745 |
| 0.6982 | 972.3 | 1212.0 | -0.2907 | -0.5461 | -0.6685 | 0.4324 | -2.379 |
| 0.7934 | 966.0 | 1181.9 | -0.2364 | -0.4322 | -0.5378 | 0.3189 | -1.807 |
| 0.9036 | 958.8 | 1146.8 | -0.1448 | -0.2328 | -0.2964 | 0.1580 | -0.934 |
| 1.0000 | 952.1 | 1116.5 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.000 |
| T = 318.15 K |
| 0.0000 | 1013.8 | 1419.3 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.000 |
| 0.0986 | 1007.4 | 1387.1 | -0.1401 | -0.2253 | -0.2516 | 0.2846 | -1.211 |
| 0.1956 | 1000.9 | 1356.2 | -0.2252 | -0.4070 | -0.4608 | 0.4678 | -2.092 |
| 0.3076 | 993.4 | 1319.6 | -0.2960 | -0.5538 | -0.6388 | 0.5734 | -2.753 |
| 0.3958 | 987.4 | 1291.8 | -0.3306 | -0.6343 | -0.7422 | 0.6084 | -3.023 |
| 0.4978 | 980.6 | 1258.2 | -0.3471 | -0.6654 | -0.7923 | 0.5855 | -3.080 |
| 0.6102 | 973.0 | 1222.2 | -0.3351 | -0.6462 | -0.7839 | 0.5198 | -2.848 |
| 0.6982 | 967.1 | 1193.8 | -0.3034 | -0.5795 | -0.7136 | 0.4353 | -2.467 |
| 0.7934 | 960.6 | 1163.3 | -0.2464 | -0.4593 | -0.5750 | 0.3209 | -1.873 |
| 0.9036 | 953.2 | 1127.7 | -0.1505 | -0.2478 | -0.3174 | 0.1589 | -0.968 |
| 1.0000 | 946.4 | 1096.5 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.000 |
| DEC + p-cresol |
| T = 303.15 K |
| 0.0000 | 1026.7 | 1470.1 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 0.1078 | 1019.8 | 1436.4 | -0.1029 | -0.1997 | -0.2190 | 0.2858 | -1.0091 |
| 0.1907 | 1014.6 | 1410.4 | -0.1660 | -0.3228 | -0.3588 | 0.4276 | -1.5904 |
| 0.3163 | 1006.7 | 1371.0 | -0.2345 | -0.4578 | -0.5196 | 0.5439 | -2.1689 |
| 0.3954 | 1001.7 | 1346.3 | -0.2605 | -0.5104 | -0.5869 | 0.5685 | -2.3571 |
| 0.5187 | 993.9 | 1307.6 | -0.2742 | -0.5409 | -0.6344 | 0.5475 | -2.3968 |
| 0.6086 | 988.2 | 1279.5 | -0.2631 | -0.5223 | -0.6213 | 0.4946 | -2.2430 |
| 0.7012 | 982.3 | 1250.5 | -0.2328 | -0.4655 | -0.5619 | 0.4124 | -1.9338 |
| 0.8096 | 975.5 | 1216.5 | -0.1725 | -0.3483 | -0.4276 | 0.2862 | -1.3898 |
| 0.9077 | 969.3 | 1185.8 | -0.0943 | -0.1925 | -0.2398 | 0.1480 | -0.7395 |
| 1.0000 | 963.5 | 1156.9 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| T = 308.15 K |
| 0.0000 | 1022.5 | 1455.0 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 0.1078 | 1015.5 | 1420.7 | -0.1077 | -0.2169 | -0.2387 | 0.2986 | -1.0530 |
| 0.1907 | 1010.2 | 1394.3 | -0.1738 | -0.3506 | -0.3914 | 0.4458 | -1.6592 |
| 0.3163 | 1002.1 | 1354.3 | -0.2454 | -0.4977 | -0.5674 | 0.5656 | -2.2616 |
| 0.3954 | 996.9 | 1329.1 | -0.2727 | -0.5552 | -0.6413 | 0.5903 | -2.4570 |
| 0.5187 | 989.0 | 1289.8 | -0.2871 | -0.5890 | -0.6940 | 0.5675 | -2.4973 |
| 0.6086 | 983.1 | 1261.2 | -0.2756 | -0.5691 | -0.6804 | 0.5120 | -2.3362 |
| 0.7012 | 977.1 | 1231.7 | -0.2439 | -0.5076 | -0.6159 | 0.4265 | -2.0134 |
| 0.8096 | 970.1 | 1197.2 | -0.1807 | -0.3802 | -0.4692 | 0.2956 | -1.4464 |
| 0.9077 | 963.8 | 1165.9 | -0.0989 | -0.2103 | -0.2635 | 0.1527 | -0.7693 |
| 1.0000 | 957.8 | 1136.6 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| T = 313.15 K |
| 0.0000 | 1018.4 | 1439.8 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 0.1078 | 1011.2 | 1405.0 | -0.1127 | -0.2346 | -0.2593 | 0.3107 | -1.0983 |
| 0.1907 | 1005.7 | 1378.1 | -0.1818 | -0.3796 | -0.4255 | 0.4629 | -1.7300 |
| 0.3163 | 997.4 | 1337.5 | -0.2568 | -0.5392 | -0.6175 | 0.5858 | -2.3571 |
| 0.3954 | 992.2 | 1311.9 | -0.2854 | -0.6018 | -0.6984 | 0.6105 | -2.5600 |
| 0.5187 | 984.0 | 1272.0 | -0.3005 | -0.6390 | -0.7567 | 0.5858 | -2.6008 |
| 0.6086 | 978.1 | 1243.0 | -0.2885 | -0.6179 | -0.7424 | 0.5279 | -2.4321 |
| 0.7012 | 971.9 | 1213.0 | -0.2554 | -0.5516 | -0.6727 | 0.4393 | -2.0953 |
| 0.8096 | 964.7 | 1178.0 | -0.1893 | -0.4136 | -0.5132 | 0.3041 | -1.5046 |
| 0.9077 | 958.2 | 1146.2 | -0.1036 | -0.2290 | -0.2886 | 0.1570 | -0.8000 |
| 1.0000 | 952.1 | 1116.5 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| T = 318.15 K |
| 0.0000 | 1014.3 | 1424.7 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 0.1078 | 1006.9 | 1389.3 | -0.1179 | -0.2543 | -0.2822 | 0.3238 | -1.1459 |
| 0.1907 | 1001.3 | 1362.1 | -0.1902 | -0.4116 | -0.4634 | 0.4813 | -1.8045 |
| 0.3163 | 992.8 | 1320.8 | -0.2689 | -0.5852 | -0.6732 | 0.6074 | -2.4575 |
| 0.3954 | 987.4 | 1294.9 | -0.2988 | -0.6535 | -0.7619 | 0.6322 | -2.6684 |
| 0.5187 | 979.1 | 1254.4 | -0.3147 | -0.6945 | -0.8265 | 0.6054 | -2.7097 |
| 0.6086 | 973.0 | 1224.9 | -0.3022 | -0.6721 | -0.8117 | 0.5449 | -2.5332 |
| 0.7012 | 966.7 | 1194.5 | -0.2675 | -0.6004 | -0.7362 | 0.4530 | -2.1817 |
| 0.8096 | 959.3 | 1158.9 | -0.1983 | -0.4507 | -0.5623 | 0.3133 | -1.5660 |
| 0.9077 | 952.7 | 1126.7 | -0.1085 | -0.2498 | -0.3166 | 0.1615 | -0.8323 |
| 1.0000 | 946.4 | 1096.5 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |

Standard uncertainties, *u*, are u(x) = 0.0001; *u* (*T*) = ±0.02 K; *u* (*ρ*) = ±1 kg m-3; *u* (*u*) = ± 0.8 m s-1; u(*p*) = ±1 kPa, *u*() = ±0.022∙106 m3 mol-1, *u*() = ±0.09∙1010 m2∙N-1,and *u* () = ±0.008∙1014 m5 N-1 mol-1, *u*()=±0.6∙ 102 m s-1, *u*() =± 0.006 kK-1

**Table 3S.** Coefficients Aj of equation (13) along with standard deviations σ of binary mixture properties.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | T/K | a | b | c | σ |
| DEC + o-cresol  |
| 106x/m3$∙$mol-1 | 303.15 | -1.349 | -0.050 | -0.003 | 0.00003 |
| 308.15 | -1.397 | -0.051 | 0.001 | 0.00005 |
| 313.15 | -1.448 | -0.054 | 0.000 | 0.00005 |
| 318.15 | -1.502 | -0.060 | -0.004 | 0.00003 |
| 1010x/m2.N-1 | 303.15 | -2.312 | -0.168 | -0.044 | 0.0001 |
| 308.15 | -2.490 | -0.188 | -0.048 | 0.0001 |
| 313.15 | -2.674 | -0.210 | -0.056 | 0.0001 |
| 318.15 | -2.877 | -0.235 | -0.063 | 0.0001 |
| 1014x/m5.N-1.mol-1 | 303.15 | -2.700 | -0.430 | -0.071 | 0.0001 |
| 308.15 | -2.922 | -0.475 | -0.080 | 0.0002 |
| 313.15 | -3.153 | -0.525 | -0.091 | 0.0002 |
| 318.15 | -3.410 | -0.581 | -0.102 | 0.0002 |
| 102xuE/m$∙$s-1 | 303.15 | 2.411 | -0.832 | 0.294 | 0.0017 |
| 308.15 | 2.468 | -0.868 | 0.311 | 0.0018 |
| 313.15 | 2.517 | -0.902 | 0.328 | 0.0019 |
| 318.15 | 2.571 | -0.938 | 0.347 | 0.0021 |
| 103x/K-1 | 303.15 | -11.932 | 1.413 |  | 0.0034 |
| 308.15 | -12.284 | 1.455 |  | 0.0024 |
| 313.15 | -12.667 | 1.518 |  | 0.0027 |
| 318.15 | -13.082 | 1.613 |  | 0.0040 |
| DEC + m-cresol |
| 106x/m3$∙$mol-1 | 303.15 | -1.245 | -0.057 |  | 0.0106 |
| 308.15 | -1.307 | -0.061 |  | 0.0108 |
| 313.15 | -1.364 | -0.064 |  | 0.0109 |
| 318.15 | -1.422 | -0.068 |  | 0.0110 |
| 1010x/m2.N-1 | 303.15 | -2.259 | -0.110 |  | 0.0018 |
| 308.15 | -2.395 | -0.133 |  | 0.0019 |
| 313.15 | -2.531 | -0.157 |  | 0.0021 |
| 318.15 | -2.679 | -0.183 |  | 0.0023 |
| 1014x/m5.N-1.mol-1 | 303.15 | -2.650 | -0.343 |  | 0.0017 |
| 308.15 | -2.825 | -0.389 |  | 0.0020 |
| 313.15 | -3.002 | -0.437 |  | 0.0023 |
| 318.15 | -3.196 | -0.488 |  | 0.0026 |
| 102xuE/m$∙$s-1 | 303.15 | 2.327 | -0.782 |  | 0.0080 |
| 308.15 | 2.351 | -0.802 |  | 0.0083 |
| 313.15 | 2.367 | -0.818 |  | 0.0086 |
| 318.15 | 2.388 | -0.835 |  | 0.0089 |
| 103x/K-1 | 303.15 | -10.952 | 1.325 |  | 0.0022 |
| 308.15 | -11.443 | 1.409 |  | 0.0025 |
| 313.15 | -11.877 | 1.483 |  | 0.0026 |
| 318.15 | -12.325 | 1.561 |  | 0.0028 |
| DEC + p-cresol |
| 106x/m3$∙$mol-1 | 303.15 | -1.0971 | -0.0349 |  | 0.0000 |
| 308.15 | -1.1488 | -0.0377 |  | 0.0001 |
| 313.15 | -1.2025 | -0.0406 |  | 0.0001 |
| 318.15 | -1.2592 | -0.0435 |  | 0.0000 |
| 1010x/m2.N-1 | 303.15 | -2.1668 | -0.1355 |  | 0.0012 |
| 308.15 | -2.3592 | -0.1567 |  | 0.0013 |
| 313.15 | -2.5596 | -0.1802 |  | 0.0015 |
| 318.15 | -2.7820 | -0.2067 |  | 0.0018 |
| 1014x/m5.N-1.mol-1 | 303.15 | -2.5357 | -0.3617 |  | 0.0018 |
| 308.15 | -2.7741 | -0.4093 |  | 0.0021 |
| 313.15 | -3.0246 | -0.4610 |  | 0.0024 |
| 318.15 | -3.3038 | -0.5200 |  | 0.0028 |
| 102xuE/m$∙$s-1 | 303.15 | 2.2185 | -0.7347 | 0.2517 | 0.0013 |
| 308.15 | 2.3000 | -0.7803 | 0.2731 | 0.0015 |
| 313.15 | 2.3747 | -0.8248 | 0.2953 | 0.0017 |
| 318.15 | 2.4548 | -0.8729 | 0.3199 | 0.0018 |
| 103x/K-1 | 303.15 | -9.648 | 1.0394 |  | 0.0020 |
| 308.15 | -10.052 | 1.1075 |  | 0.0020 |
| 313.15 | -10.470 | 1.1700 |  | 0.0022 |
| 318.15 | -10.910 | 1.2406 |  | 0.0021 |

**Table 4S.** The values of  for DEC + cresol mixtures at 303.15-318.15 K from Redlich-Kister equation.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| T/K |  |  |  |  |  |  |
| DEC + o-cresol |
| 303.15 | 121.31 | 122.61 | -1.30 | 102.87 | 104.28 | -1.40 |
| 308.15 | 121.99 | 123.33 | -1.35 | 103.28 | 104.73 | -1.45 |
| 313.15 | 122.68 | 124.07 | -1.39 | 103.69 | 105.19 | -1.50 |
| 318.15 | 123.37 | 124.82 | -1.45 | 104.08 | 105.65 | -1.57 |
| DEC + m-cresol |
| 303.15 | 121.42 | 122.61 | -1.19 | 104.13 | 105.43 | -1.30 |
| 308.15 | 122.09 | 123.33 | -1.25 | 104.45 | 105.81 | -1.37 |
| 313.15 | 122.77 | 124.07 | -1.30 | 104.81 | 106.24 | -1.43 |
| 318.15 | 123.46 | 124.82 | -1.35 | 105.18 | 106.67 | -1.49 |
| DEC + p-cresol |
| 303.15 | 121.55 | 122.61 | -1.06 | 104.20 | 105.33 | -1.13 |
| 308.15 | 122.22 | 123.33 | -1.11 | 104.57 | 105.76 | -1.19 |
| 313.15 | 122.91 | 124.07 | -1.16 | 104.95 | 106.19 | -1.24 |
| 318.15 | 123.60 | 124.82 | -1.22 | 105.32 | 106.62 | -1.30 |

**Table 5S.** The values of  for DEC + isomeric cresols at 303.15-318.15 K.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| T/K |  |  |  |  |  |  |
| DEC + o-cresol |
| 303.15 | 7.168 | 9.509 | -2.341 | 1.342 | 4.543 | -3.200 |
| 308.15 | 7.442 | 9.969 | -2.527 | 1.215 | 4.693 | -3.477 |
| 313.15 | 7.736 | 10.456 | -2.719 | 1.080 | 4.849 | -3.769 |
| 318.15 | 8.040 | 10.971 | -2.931 | 0.919 | 5.013 | -4.094 |
| DEC + -m-cresol |
| 303.15 | 7.202 | 9.509 | -2.307 | 1.787 | 4.781 | -2.993 |
| 308.15 | 7.533 | 9.970 | -2.437 | 1.707 | 4.920 | -3.214 |
| 313.15 | 7.889 | 10.454 | -2.566 | 1.630 | 5.069 | -3.439 |
| 318.15 | 8.251 | 10.958 | -2.708 | 1.538 | 5.223 | -3.685 |
| DEC + p-cresol |
| 303.15 | 7.478 | 9.509 | -2.031 | 2.445 | 4.747 | -2.302 |
| 308.15 | 7.766 | 9.969 | -2.202 | 2.370 | 4.886 | -2.516 |
| 313.15 | 8.076 | 10.456 | -2.379 | 2.290 | 5.030 | -2.740 |
| 318.15 | 8.396 | 10.971 | -2.575 | 2.191 | 5.179 | -2.989 |

**Table 6S.** Excess partial molar volumes (and) as functions of mole fractions *x*1 of DEC with cresols at T= (303.15-318.15) K

|  |
| --- |
| *DEC +o-Cresol* |
| *Excess partial molar Volume of component I* |
| x1 | 303.15 K | 308.15 K | 313.15 K | 318.15 K |
| 0.0000 | -1.301 | -1.345 | -1.393 | -1.446 |
| 0.0778 | -1.035 | -1.071 | -1.109 | -1.150 |
| 0.1596 | -0.833 | -0.862 | -0.893 | -0.925 |
| 0.2456 | -0.640 | -0.662 | -0.686 | -0.710 |
| 0.3362 | -0.458 | -0.475 | -0.492 | -0.509 |
| 0.4317 | -0.303 | -0.314 | -0.325 | -0.337 |
| 0.5326 | -0.191 | -0.198 | -0.205 | -0.212 |
| 0.6393 | -0.123 | -0.127 | -0.132 | -0.136 |
| 0.7524 | -0.041 | -0.042 | -0.044 | -0.045 |
| 0.8724 | -0.012 | -0.013 | -0.013 | -0.014 |
| 1.0000 | 0.000 | 0.000 | 0.000 | 0.000 |
| *Excess partial molar Volume of component II* |
| 0.0000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 0.0778 | -0.016 | -0.017 | -0.017 | -0.018 |
| 0.1596 | -0.056 | -0.058 | -0.060 | -0.062 |
| 0.2456 | -0.125 | -0.129 | -0.134 | -0.139 |
| 0.3362 | -0.231 | -0.239 | -0.248 | -0.257 |
| 0.4317 | -0.374 | -0.387 | -0.401 | -0.417 |
| 0.5326 | -0.532 | -0.550 | -0.571 | -0.594 |
| 0.6393 | -0.671 | -0.694 | -0.719 | -0.749 |
| 0.7524 | -0.948 | -0.979 | -1.015 | -1.058 |
| 0.8724 | -1.141 | -1.178 | -1.222 | -1.273 |
| 1.0000 | -1.402 | -1.447 | -1.501 | -1.565 |
| *DEC +p-Cresol* |
| *Excess partial molar Volume of component I* |
| x1 | 303.15 K | 308.15 K | 313.15 K | 318.15 K |
| 0.0000 | -1.062 | -1.111 | -1.162 | -1.216 |
| 0.0785 | -0.846 | -0.884 | -0.925 | -0.968 |
| 0.1609 | -0.696 | -0.728 | -0.761 | -0.796 |
| 0.2474 | -0.497 | -0.519 | -0.543 | -0.568 |
| 0.3383 | -0.388 | -0.406 | -0.425 | -0.444 |
| 0.4341 | -0.246 | -0.257 | -0.269 | -0.282 |
| 0.5350 | -0.163 | -0.170 | -0.178 | -0.186 |
| 0.6415 | -0.095 | -0.099 | -0.104 | -0.109 |
| 0.7542 | -0.039 | -0.040 | -0.042 | -0.044 |
| 0.8735 | -0.009 | -0.009 | -0.010 | -0.010 |
| 1.0000 | 0.000 | 0.000 | 0.000 | 0.000 |

|  |
| --- |
| *Excess partial molar Volume of component II* |
| x1 | 303.15 K | 308.15 K | 313.15 K | 318.15 K |
| 0.0000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 0.0785 | -0.013 | -0.014 | -0.014 | -0.015 |
| 0.1609 | -0.041 | -0.043 | -0.045 | -0.047 |
| 0.2474 | -0.113 | -0.119 | -0.124 | -0.130 |
| 0.3383 | -0.177 | -0.186 | -0.194 | -0.204 |
| 0.4341 | -0.305 | -0.319 | -0.334 | -0.350 |
| 0.5350 | -0.419 | -0.439 | -0.460 | -0.482 |
| 0.6415 | -0.557 | -0.583 | -0.611 | -0.640 |
| 0.7542 | -0.742 | -0.778 | -0.815 | -0.854 |
| 0.8735 | -0.933 | -0.978 | -1.024 | -1.073 |
| 1.0000 | -1.132 | -1.187 | -1.243 | -1.303 |
| *DEC +m-Cresol* |
| *Excess partial molar Volume of component I* |
| 0.0000 | -1.189 | -1.247 | -1.299 | -1.354 |
| 0.0786 | -0.966 | -1.013 | -1.056 | -1.100 |
| 0.1610 | -0.769 | -0.807 | -0.841 | -0.876 |
| 0.2475 | -0.570 | -0.598 | -0.623 | -0.649 |
| 0.3385 | -0.434 | -0.455 | -0.474 | -0.494 |
| 0.4343 | -0.300 | -0.314 | -0.328 | -0.342 |
| 0.5352 | -0.181 | -0.189 | -0.197 | -0.206 |
| 0.6417 | -0.108 | -0.114 | -0.118 | -0.123 |
| 0.7543 | -0.051 | -0.053 | -0.055 | -0.058 |
| 0.8736 | -0.011 | -0.012 | -0.012 | -0.013 |
| 1.0000 | 0.000 | 0.000 | 0.000 | 0.000 |
| *Excess partial molar Volume of component II* |
| x1 | 303.15 K | 308.15 K | 313.15 K | 318.15 K |
| 0.0000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 0.0786 | -0.013 | -0.013 | -0.014 | -0.014 |
| 0.1610 | -0.050 | -0.052 | -0.055 | -0.057 |
| 0.2475 | -0.123 | -0.129 | -0.135 | -0.141 |
| 0.3385 | -0.204 | -0.214 | -0.224 | -0.234 |
| 0.4343 | -0.323 | -0.339 | -0.354 | -0.369 |
| 0.5352 | -0.485 | -0.509 | -0.532 | -0.555 |
| 0.6417 | -0.635 | -0.667 | -0.696 | -0.727 |
| 0.7543 | -0.819 | -0.861 | -0.899 | -0.938 |
| 0.8736 | -1.063 | -1.117 | -1.166 | -1.217 |
| 1.0000 | -1.302 | -1.368 | -1.428 | -1.490 |

**Table 7S.** Excess partial molar compressibility (and) as functions of mole fractions *x*1 of DEC with cresols at T= (303.15-318.15) K

|  |
| --- |
| *DEC +o-Cresol* |
| *Excess partial molar compressibility of component I* |
| X1 | 303.15 K | 308.15 K | 313.15 K | 318.15 K |
| 0.0000 | -2.341 | -2.527 | -2.719 | -2.931 |
| 0.0778 | -1.851 | -1.997 | -2.149 | -2.316 |
| 0.1596 | -1.482 | -1.598 | -1.719 | -1.852 |
| 0.2456 | -1.131 | -1.219 | -1.311 | -1.412 |
| 0.3362 | -0.805 | -0.868 | -0.933 | -1.004 |
| 0.4317 | -0.529 | -0.571 | -0.613 | -0.660 |
| 0.5326 | -0.331 | -0.357 | -0.383 | -0.412 |
| 0.6393 | -0.212 | -0.229 | -0.246 | -0.264 |
| 0.7524 | -0.070 | -0.076 | -0.081 | -0.087 |
| 0.8724 | -0.021 | -0.023 | -0.024 | -0.026 |
| 1.0000 | 0.000 | 0.000 | 0.000 | 0.000 |
| *Excess partial molar compressibility of component II* |
| 0.0000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 0.0778 | -0.036 | -0.039 | -0.042 | -0.045 |
| 0.1596 | -0.123 | -0.133 | -0.144 | -0.157 |
| 0.2456 | -0.276 | -0.300 | -0.325 | -0.352 |
| 0.3362 | -0.514 | -0.558 | -0.604 | -0.655 |
| 0.4317 | -0.836 | -0.908 | -0.983 | -1.067 |
| 0.5326 | -1.196 | -1.299 | -1.407 | -1.527 |
| 0.6393 | -1.513 | -1.643 | -1.780 | -1.932 |
| 0.7524 | -2.147 | -2.333 | -2.527 | -2.744 |
| 0.8724 | -2.594 | -2.818 | -3.054 | -3.316 |
| 1.0000 | -3.200 | -3.477 | -3.769 | -4.094 |
| *DEC +p-Cresol* |
| *Excess partial molar compressibility of component I* |
| X1 | 298.15 K | 303.15 K | 308.15 K | 313.15 K |
| 0.0000 | -2.031 | -2.202 | -2.379 | -2.575 |
| 0.0785 | -1.617 | -1.753 | -1.894 | -2.050 |
| 0.1609 | -1.330 | -1.443 | -1.558 | -1.687 |
| 0.2474 | -0.950 | -1.030 | -1.112 | -1.204 |
| 0.3383 | -0.743 | -0.805 | -0.870 | -0.941 |
| 0.4341 | -0.471 | -0.510 | -0.551 | -0.597 |
| 0.5350 | -0.311 | -0.337 | -0.365 | -0.395 |
| 0.6415 | -0.181 | -0.197 | -0.212 | -0.230 |
| 0.7542 | -0.074 | -0.080 | -0.086 | -0.093 |
| 0.8735 | -0.017 | -0.019 | -0.020 | -0.022 |
| 1.0000 | 0.000 | 0.000 | 0.000 | 0.000 |

|  |
| --- |
| *Excess partial molar compressibility of component II* |
| x1 | 303.15 K | 308.15 K | 313.15 K | 318.15 K |
| 0.0000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 0.0785 | -0.027 | -0.029 | -0.032 | -0.035 |
| 0.1609 | -0.084 | -0.091 | -0.100 | -0.109 |
| 0.2474 | -0.230 | -0.252 | -0.274 | -0.299 |
| 0.3383 | -0.360 | -0.393 | -0.428 | -0.467 |
| 0.4341 | -0.619 | -0.677 | -0.737 | -0.804 |
| 0.5350 | -0.853 | -0.932 | -1.015 | -1.107 |
| 0.6415 | -1.132 | -1.237 | -1.347 | -1.470 |
| 0.7542 | -1.509 | -1.649 | -1.796 | -1.959 |
| 0.8735 | -1.897 | -2.073 | -2.257 | -2.462 |
| 1.0000 | -2.302 | -2.516 | -2.740 | -2.989 |
| *DEC +m-Cresol* |
| *Excess partial molar compressibility of component I* |
| 0.0000 | -2.307 | -2.437 | -2.566 | -2.708 |
| 0.0786 | -1.874 | -1.980 | -2.085 | -2.200 |
| 0.1610 | -1.493 | -1.577 | -1.660 | -1.752 |
| 0.2475 | -1.106 | -1.168 | -1.230 | -1.298 |
| 0.3385 | -0.842 | -0.890 | -0.937 | -0.989 |
| 0.4343 | -0.582 | -0.615 | -0.647 | -0.683 |
| 0.5352 | -0.350 | -0.370 | -0.390 | -0.411 |
| 0.6417 | -0.210 | -0.222 | -0.234 | -0.247 |
| 0.7543 | -0.098 | -0.104 | -0.110 | -0.116 |
| 0.8736 | -0.021 | -0.023 | -0.024 | -0.025 |
| 1.0000 | 0.000 | 0.000 | 0.000 | 0.000 |
| *Excess partial molar compressibility of component II* |
| x1 | 303.15 K | 308.15 K | 313.15 K | 318.15 K |
| 0.0000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 0.0786 | -0.029 | -0.031 | -0.033 | -0.036 |
| 0.1610 | -0.115 | -0.123 | -0.132 | -0.141 |
| 0.2475 | -0.283 | -0.304 | -0.325 | -0.349 |
| 0.3385 | -0.469 | -0.503 | -0.539 | -0.577 |
| 0.4343 | -0.742 | -0.796 | -0.852 | -0.913 |
| 0.5352 | -1.115 | -1.197 | -1.280 | -1.372 |
| 0.6417 | -1.459 | -1.567 | -1.676 | -1.796 |
| 0.7543 | -1.884 | -2.023 | -2.165 | -2.319 |
| 0.8736 | -2.444 | -2.624 | -2.808 | -3.008 |
| 1.0000 | -2.993 | -3.214 | -3.439 | -3.685 |

**Figure 1S.** Graphical comparison of density of p-cresol with our new and old values [Ref 5]



**Figure 2S**. Graphical comparison of speed of sound of p-cresol with our new and old values [Ref 5]

**Figure 3S.** Graphical comparison of density of o-cresol with our new and old values [Ref 5]

**Figure 4S**. Graphical comparison of speed of sound of o-cresol with our new and old values [Ref 5]

**Figure 5S.** Graphical comparison of density of m-cresol with our new and old values [Ref 5]

**Figure 6S**. Graphical comparison of speed of sound of m-cresol with our new and old values [Ref 5]