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Vapor-Liquid Equilibrium Data for the Systems Diisopropyl Ether–n-Heptane and Diisopropyl Ether–Carbon Tetrachloride at Medium Pressures

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Vapor-liquid equilibrium data for the systems diisopropyl ether–*n*-heptane and diisopropyl ether–carbon tetrachloride have been reported at pressures of 760, 1520, and 2280 mm. of Hg. The systems form ideal mixtures under the pressure range studied.

VAPOR-LIQUID equilibrium data for the systems diisopropyl ether–*n*-heptane (*3*) and diisopropyl ether–carbon tetrachloride (*4*) are reported in the literature only at 685 mm. of Hg pressure. In the present work the systems have been studied at 760, 1520, and 2280 mm. of Hg.

EXPERIMENTAL

The equilibrium still and experimental procedure have been described earlier (*2*). The properties of reagents used are given in Table I. The samples were analyzed by the refractive index using Abbe's refractometer at 25 ± 0.1° C. The refractive index values are reproducible within ±0.0001. The pressure in the still was measured by a bourdon gage with an accuracy of 0.5 lb./sq. in., the temperature by a thermometer of 0.1° C. accuracy.

THERMODYNAMIC CONSISTENCY

The experimental vapor-liquid equilibrium data are given in Tables II and III and Figures 1 and 2.

Table I. Properties of Pure Components

	Density		Refractive Index	
Compound	Exptl.	Lit. (*1*)	Exptl.	Lit. (*1*)
Diisopropyl ether	0.7250[a]	0.7258[a]	1.3672[b]	1.3678[b]
n-Heptane	0.6838[a]	0.68376[a]	1.3880[a]	1.3876[a]
Carbon tetrachloride	1.5840[a]	1.5845[a]	1.4606[a]	1.4607[a]

[a] At 20° C.
[b] At 23° C.

Liquid phase activity coefficients are calculated from the equation,

$$\gamma_i = \frac{y_i \pi}{x_i P_i}$$

Table II. System. Diisopropyl Ether (1)–*n*-Heptane (2)

Temp., ° C.	x_1	y_1	γ_1	γ_2	$y_{1\text{calcd.}}$
		760 mm.			
90.3	18.7	36.0	0.984	1.006	36.6
85.8	30.3	51.0	0.975	1.035	52.3
84.3	35.4	56.7	0.968	1.035	58.6
82.2	41.6	63.2	0.975	1.042	64.8
79.7	49.8	71.0	0.984	1.036	72.1
78.4	54.5	74.9	0.986	1.050	75.9
76.2	63.4	81.2	0.980	1.037	82.8
74.2	71.3	85.9	0.979	1.062	87.7
71.0	85.4	93.2	0.978	1.125	95.3
69.2	93.2	97.2	0.988	1.050	98.4
		1520 mm.			
115.7	20.5	38.0	0.985	0.965	38.6
111.0	32.0	52.5	0.975	0.981	53.9
108.2	39.8	60.7	0.974	0.988	62.3
106.8	43.2	64.1	0.982	1.001	65.3
105.1	48.9	69.5	0.973	0.986	71.2
103.2	54.4	74.2	0.989	0.986	75.0
101.4	60.1	78.7	0.995	0.979	79.1
98.0	75.2	88.0	0.972	1.009	90.6
		2280 mm.			
134.0	19.3	34.7	0.941	0.968	36.9
130.7	25.4	42.5	0.942	0.978	45.0
125.8	38.3	57.3	0.941	0.991	60.9
122.7	46.5	65.2	0.947	1.006	68.9
120.3	53.7	72.1	0.959	0.991	75.2
116.8	64.2	80.1	0.969	1.000	82.7
113.8	72.8	85.2	0.977	1.061	87.2
111.9	80.1	90.1	0.973	1.021	92.6

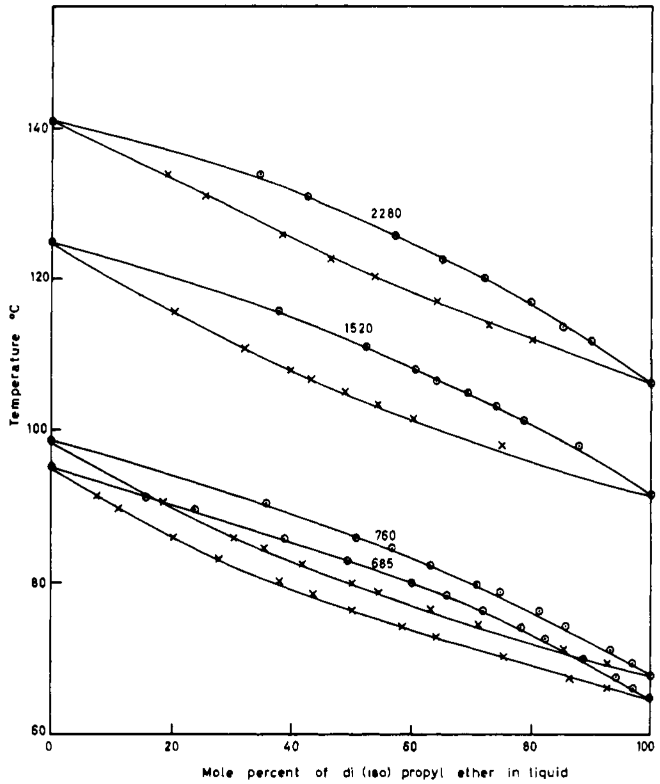

Figure 1. $t - x - y$ data, diisopropyl ether–*n*-heptane

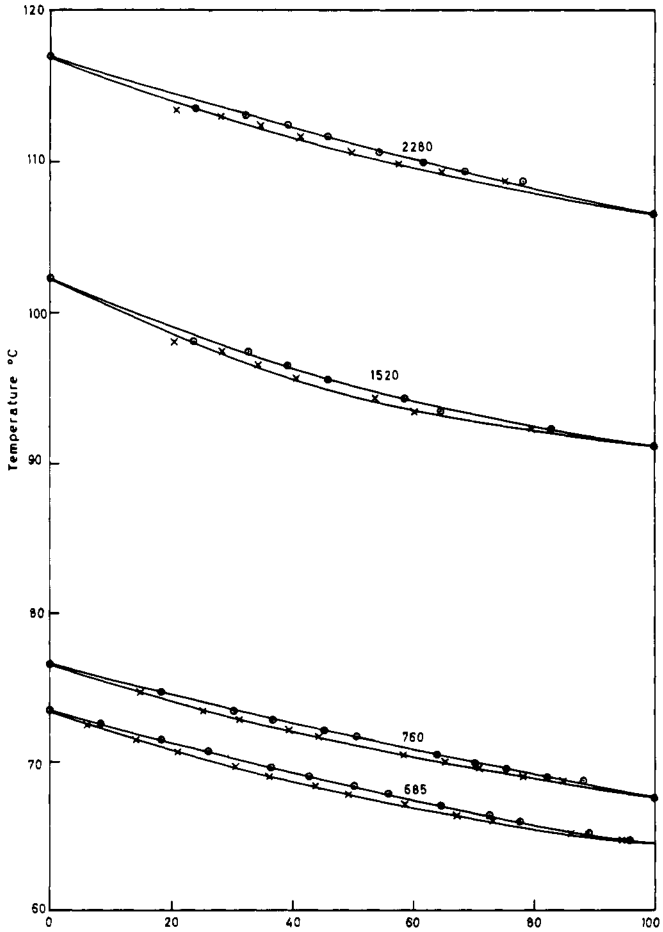

Figure 2. $t - x - y$ data, diisopropyl ether–carbon tetrachloride

Table III. System: Diisopropyl Ether(1)–Carbon Tetrachloride (2)

Temp., ° C.	x_1	y_1	γ_1	γ_2	$y_{1\text{calcd.}}$
		760 mm.			
74.7	14.8	18.3	0.990	1.016	18.5
73.4	25.2	30.4	1.005	1.027	30.3
72.8	31.3	36.8	0.997	1.034	36.9
72.1	39.4	65.5	1.000	1.034	45.5
71.6	44.4	50.7	1.004	1.036	50.5
70.4	58.3	64.1	1.003	1.045	63.9
69.9	65.2	70.4	1.001	1.049	70.4
69.5	70.8	75.5	1.007	1.055	75.0
68.9	78.4	82.3	1.004	1.044	82.0
68.6	85.3	88.2	0.998	1.033	88.4
		1520 mm			
98.1	20.2	23.7	0.972	1.021	24.4
97.4	28.3	32.8	0.978	1.020	33.6
96.5	34.3	39.4	0.992	1.029	39.7
95.6	40.7	46.0	1.000	1.042	46.0
95.2	45.4	50.9	1.003	1.040	50.8
94.3	53.6	58.7	1.003	1.055	58.5
93.4	60.3	64.9	1.002	1.063	64.8
92.3	79.8	82.9	1.005	1.062	82.5
		2280 mm.			
113.4	20.7	24.0	0.977	1.024	24.6
113.0	28.3	32.4	0.974	1.018	33.3
112.4	34.8	39.2	0.973	1.023	40.3
111.7	41.3	46.0	0.979	1.023	47.0
110.6	49.8	54.5	0.988	1.041	55.2
109.8	57.7	61.9	0.988	1.056	62.7
109.3	64.8	68.7	0.988	1.055	69.5
108.6	75.4	78.2	0.984	1.071	79.5

Vapor pressure data for *n*-heptane and carbon tetrachloride were taken from the Handbook (*1*), and for diisopropyl ether from the literature (*3*).

An inspection of the tables shows that the systems are ideal at the pressure ranges studied, and within the limits of experimental error, the systems obey Raoult's law. The calculated values of y, using Raoult's law also are given in Tables II and III.

NOMENCLATURE

P = vapor pressure of pure component
x = mole fraction in liquid phase
y = mole fraction in vapor phase
γ = activity coefficient
π = total pressure, mm. of Hg

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