ISOBARIC VAPOUR LIQUID EQUILIBRIUM OF DI (iso) PROPYL ETHER–n. HEPTANE SYSTEM

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ABSTRACT

Vapour liquid equilibrium data for the system di (iso) propyl ether-n. heptane are reported. The system is found to be an ideal one.

Vapour liquid equilibrium data for the system di (iso) propyl ether-n. heptane are not available in the literature. Hence the system has been studied under isobaric conditions at 684 ± 2.5 mm of Hg.

EXPERIMENTAL

The equilibrium still used has been described earlier[1] and is a modified Ellis and Garbett[2] still. Since the system is a miscible one, the still is operated without stirrers for three hours to attain equilibrium and samples are drawn for analysis.

Di (iso) propyl ether of BDH laboratory reagent quality and n.heptane of Merck laboratory reagent grade are used. The density and refractive index of reagents used and also the literature values are given in table I. Samples are analysed by the determination of refractive index using Abbe's refractometer at a temperature of $25 \pm 0.1^{\circ}C$.

TABLE I

Properties of pure components

Compound	Density		Refractive Index	
	Exptl.	Lit.[3]	Exptl.	Lit.[3]
Di (iso) propyl ether	$0.7250^{20°C}$	$0.7258^{20°C}$	$1.3672^{23°C}$	$1.3678^{23°C}$
n.Heptane	.....	$0.68380^{20°C}$	$0.68376^{20°C}$	$1.3880^{20°C}$	$1.3876^{20°C}$

THERMODYNAMIC CONSISTENCY

The experimental vapour liquid equilibrium data are presented in table II. Liquid phase activity coefficients are calculated from the equation,

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

TABLE II

Vapour-liquid equilibrium data (Pressure : 684 ± 2.5 mm.)

No.	Temp.°C	Mole % of di (iso) propyl ether in		γ_1	γ_2	y_1 calculated
		liquid	vapour			
1	91.4	7.1	16.0	1.0076	1.0053	15.88
2	89.6	11.0	24.0	1.0260	1.0037	23.39
3	85.9	20.3	39.0	1.0038	1.0127	38.85
4	83.2	27.8	49.5	1.0010	1.0068	49.35
5	80.0	37.9	60.0	0.9765	1.0302	61.38
6	78.3	43.5	66.0	0.9836	1.0173	67.09
7	76.2	50.1	71.9	0.9929	1.0244	72.42
8	74.0	58.5	78.5	0.9903	1.0160	79.19
9	72.6	63.9	82.2	0.9890	1.0127	83.12
10	70.0	75.4	88.7	0.9801	1.0352	90.41
11	67.4	86.2	94.2	0.9859	1.0367	95.55
12	66.0	92.4	96 9	0.9882	1.0585	98.06

The vapour pressures at various temperatures for n.heptane are calculated using the following equation[3] :

$$\log_{10} P(mm) = 6.90319 - \frac{1268.586}{216.954 + t}$$

Since equation of Antoine type for calculating vapour pressure at different temperatures for di (iso) propyl ether is not available, the following equation has been formulated with the data available[3] :

$$\log_{10} P\,(mm) = -\frac{1581.0}{T} + 7.5218$$

The system does not form an azeotrope. The values of γ_1 and γ_2 are found to be nearly one, which indicates that it is an ideal system. The small deviations that are observed may be attributed to the experimental inaccuracies and do not show any definite trend. The calculated values of y_1 using Raoult's law ($y = x\,P/\pi$) are given in table II. The root-mean-square deviation of ($y_{experimental} - y_{calculated}$) is found to be 1.161. So, for all practical purposes, the system can be considered as an ideal one.

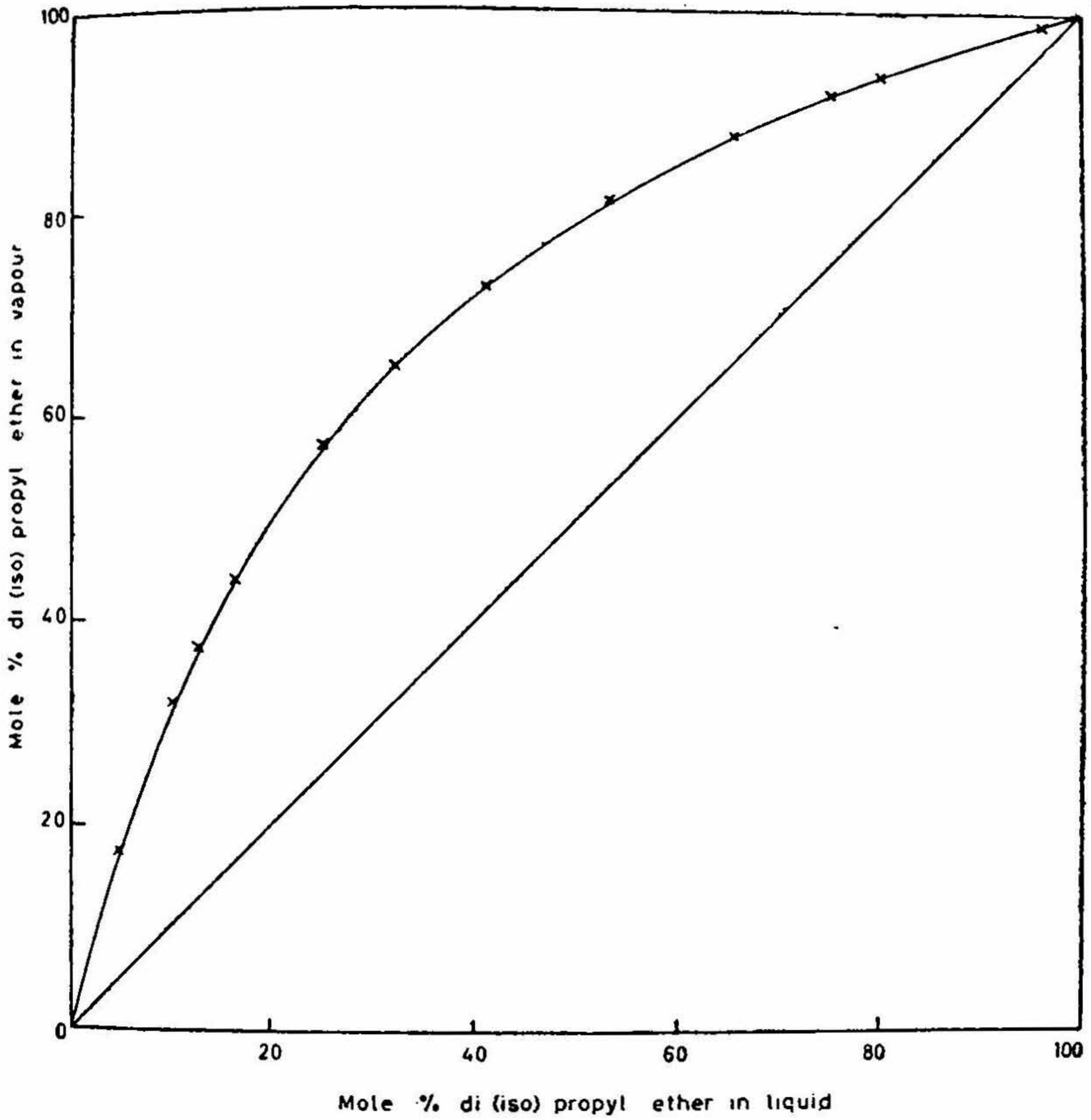

FIG. I

Di (iso) Propyl Ether—*n*—Heptane

x—*y*

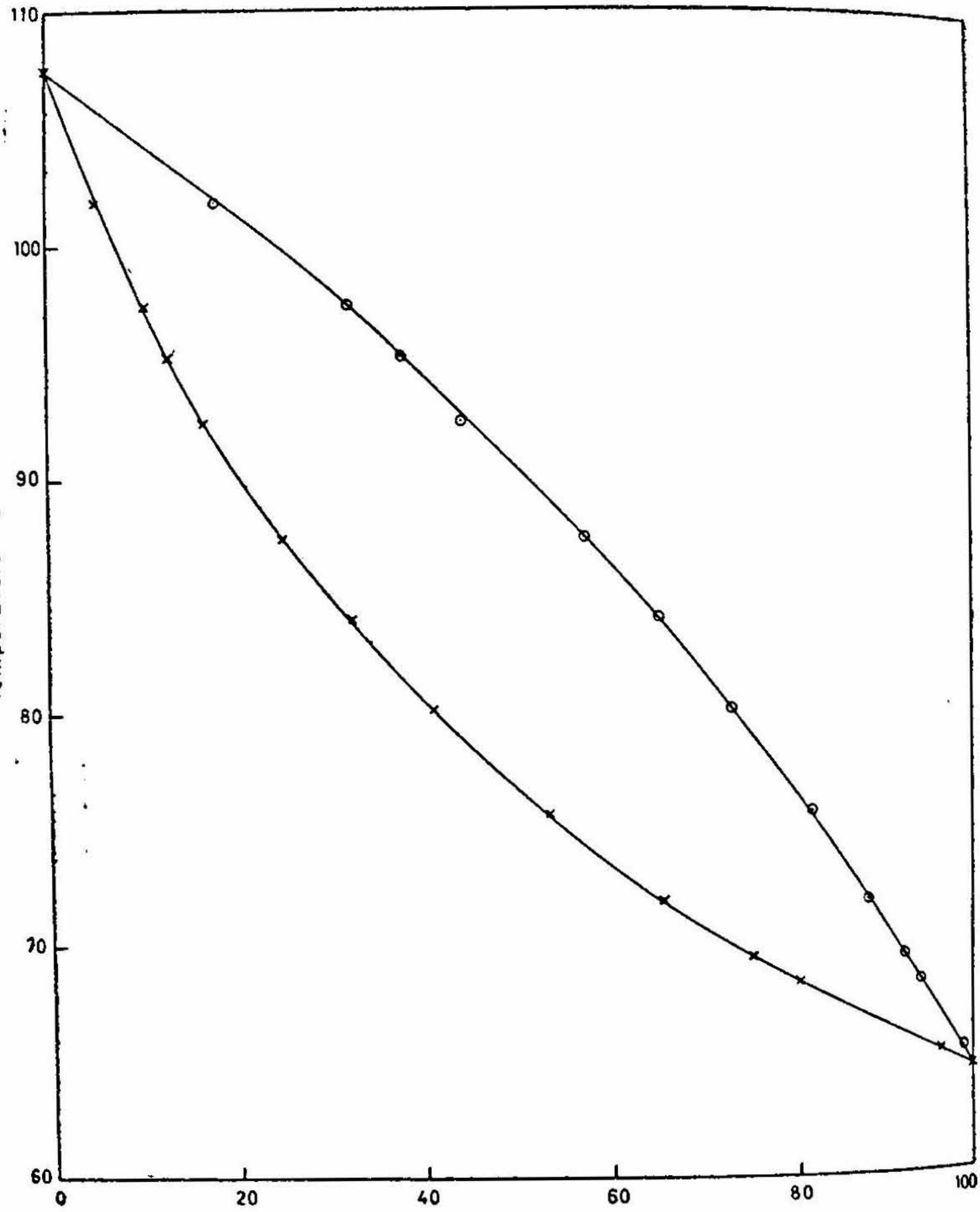

FIG. II

Di (iso) Propyl Ether—*n*-Heptane

t—*x*—*y*

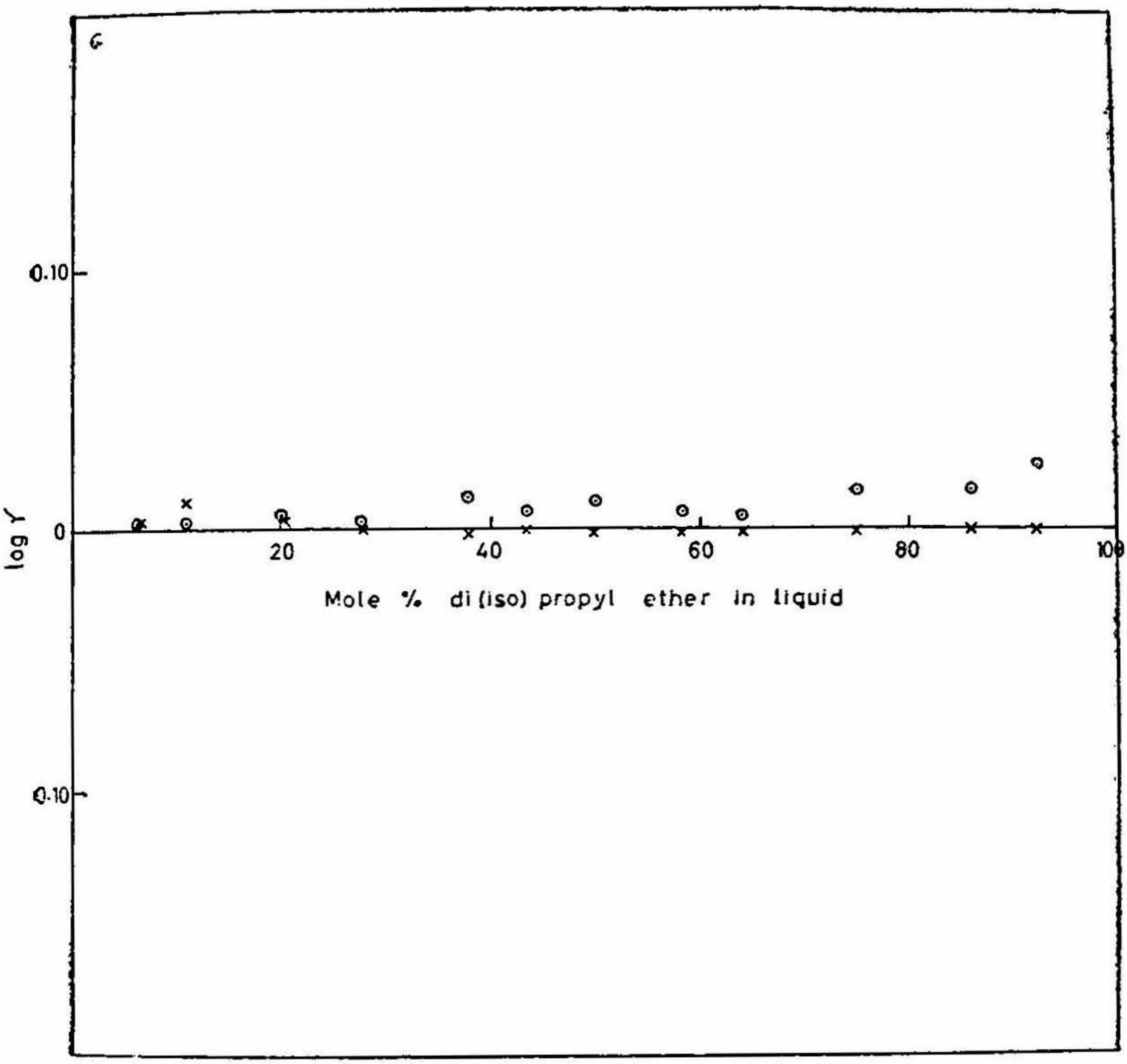

FIG. III

Di (iso) Propyl Ether—*n*-Heptane
logarithm of activity of coefficient *vs.* composition

NOMENCLATURE

P = Vapour pressure of pure component
x = Mole fraction in liquid phase
y = Mole fraction in vapour phase
γ = Activity coefficient
π = Total pressure,
t = temperature, °C

Subscripts

1 = Di (iso) propyl ether
2 = n.Heptane

LITERATURE CITED

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2. Ellis, S. R. M., and Garbett, R. D. . . — *Ind. Eng. Chem.*, 1960, 52, 383.
3. Handbook of Chemistry and Physics . . — Edited by Charles D. Hodgman, 44th Edition, Chemical Rubber Publishing Co. (1962-63).