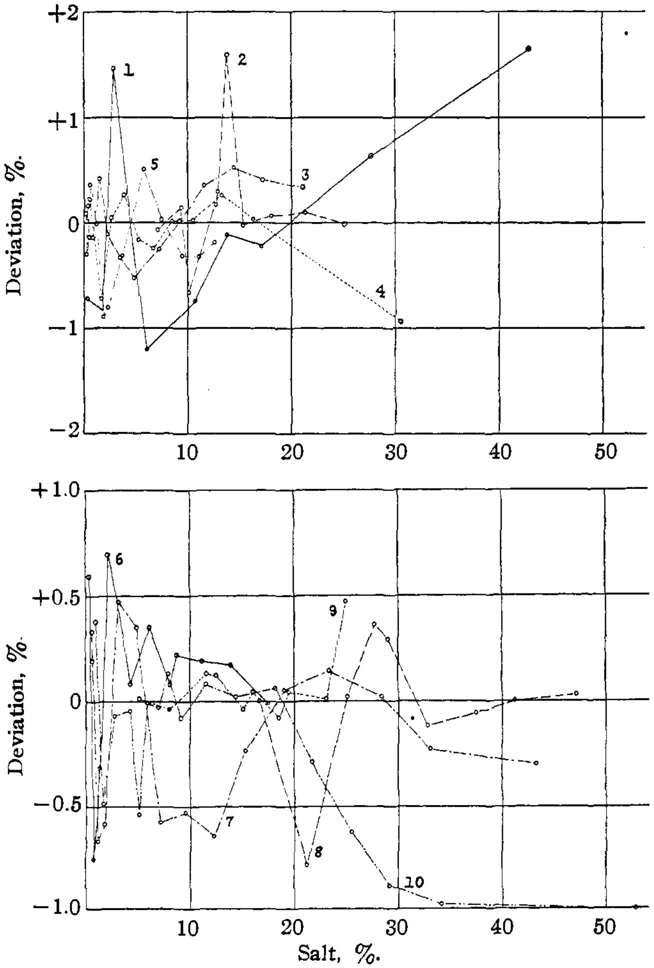
Notes

Ternary Systems: Water, Pyridine and Salts at 25°

By P. M. Ginnings, Bailey Webb and Emi Hinohara

In a previous study of the ternary systems water, aliphatic alcohols and salts,[1] empirical equations were obtained representing with reasonable accuracy the solubilities of the salts in aqueous alcoholic solutions. For purposes of comparison, we have now made similar measurements and have derived corresponding equations for systems in which pyridine is



Deviation charts of experimental values of weight per cent. of pyridine from values calculated using the empirical equations.

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[1] Ginnings, Herring and Webb, This Journal, **55**, 875–878 (1933).

employed instead of the aliphatic alcohols. Pyridine resembles the aliphatic alcohols (namely, isopropanol and tertiary butanol) in its complete miscibility with water, but is very unlike them in its chemical properties.

The methods and experimental procedure were essentially identical with those used previously (1) and if details are desired, reference should be made to the previous paper. The authors feel that the results obtained are not in error more than one per cent. in any case; and that the results can be reproduced with less deviation than this by a person experienced in this type of work. Plait points and percentage deviations are given in the following table and charts. C. P. pyridine, d_4^{20} 0.9812, was used throughout this investigation, without purification.

Empirical equations were derived to fit these data. It was found that the exponential equation

$$\text{(A)} \quad y = a + b(10)^{-cx}$$

where y = weight percentage of pyridine, x = weight percentage of salt, and a, b and c are arbitrary constants, gave the best fit in practically all cases. However, in the salt-rich solutions of ammonium sulfate and sodium chloride, the power equation

$$\text{(B)} \quad y = a + bx^{-c}$$

gave a better fit.

The values of the constants and the limiting values of x are given in the accompanying table.

TABLE I

Dev. curve	Salt	Eq.	Pyridine-rich section a	b	c	Limit for "x"	Eq.	Salt-rich section a	b	c	"x" at plait point
6	Na_2SO_4	A	17.2	43.5	0.1754	4.8	A	1.20	64.4	0.0975	4.97
9	KCl	A	−24.0	102.6	.0238	13.5	A	0	175.8	.0626	11.77
4	KF	A	9.8	57.45	.1402	4.4	A	1.17	88.1	.1332	4.11
5	$MgSO_4$	A	46.95	37.0	2.060	0.6	A	0	51.9	.0687	5.31
8	$NaNO_3$	A	−45.9	153.6	.01234	35.8	A	1.62	45960	.1047	29.93
3	Na_2CO_3	A	23.90	38.10	.3365	3.0	A	0.20	57.2	.1126	3.22
7	$Na_2S_2O_3$	A	22.65	48.35	.1527	6.1	A	.80	79.4	.0744	5.76
10	K_2CO_3	A	8.0	50.7	.0974	4.2	A	1.31	68.9	.0983	4.92
1	$(NH_4)_2SO_4$	A	22.8	47.15	.1682	5.9	B	−4.35	251.6	1.176	5.90
2	NaCl	A	17.1	104.7	.0722	12.5	B	0	96380	3.220	12.46

DEPARTMENT OF CHEMISTRY
GREENSBORO COLLEGE
GREENSBORO, NORTH CAROLINA

RECEIVED MAY 29, 1933
PUBLISHED DECEMBER 14, 1933

A New Relation between Viscosity, Vapor Pressure and Density

BY FRANK HOVORKA

In attempting to make some useful calculations between the viscosity and the vapor pressure of liquids, it was found that the empirical equation $S = \eta P^{1/4} d^{1/2}$, where η is the viscosity, P the vapor pressure, d the density, and S a constant characteristic of the substance under consideration, holds very closely for a great many organic liquids.