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RECEIVED for review August 16, 1965. Accepted June 30, 1966.

Latent Heat of Vaporization

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IN A PREVIOUS PAPER (*3*), a correlation was presented for calculating latent heats of vaporization at the normal boiling point. The authors at that time missed the excellent papers by Fishtine (*1*). It is the purpose of the present work to show that the correlation presented earlier is comparable to the modified Kistiakowsky relation proposed by Fishtine.

The equation proposed earlier (*3*) is

$$\lambda_b = \frac{4.7\,T_c\,(1.0 - Pr_b)^{0.69} \log Pr_b}{(1 - 1/Tr_b)} \qquad (1)$$

Earlier, this equation was used to predict λ_b for about 90 substances with an average deviation of about 1.8%. Equation 1 is used to predict λ_b values for substances considered by Fishtine and the results are shown in Table I. The input data used are those listed by Fishtine. In Table I, the first values after each substance give the calculated value of λ_b, and the second give per cent deviation defined as $(\lambda_F - \lambda_b)\ 100/\ \lambda_F$ where λ_F is the value given by Fishtine in his final paper under the column "Author's Choice".

In a recent paper (*2*), Fishtine has compared the different methods of predicting latent heat at the normal boiling point, but the author has not used the present method—Equation 1—in such a comparison. From Table I of the previous paper (*3*), the following table is prepared. In the case of a total of 143 substances tested, the present method gives an average deviation of 1.75%.

Table I. Comparison of Calculated λ_b Values

Compound	λ_b Calcd., Cal./G.	% Dev.
Acetaldehyde	145.5	−0.20
Acetic anhydride	94.5	−1.40
Benzaldehyde	96.0	−1.16
Benzyl alcohol	115.2	−2.58
Bromobenzene	58.0	−0.70
iso-Butyl *iso*-butyrate	62.8	0.80
iso-Butyl *n*-butyrate	65.3	−1.24
Carvacrol	82.0	0.61
Chlorobenzene	77.0	0.80
o-Chlorotoluene	73.0	−0.55
p-Chlorotoluene	73.5	−0.50
Di-*iso*-butylamine	71.0	−2.60
Diethyloxalate	73.7	0.0
Dimethylamine	137.2	2.14
Dimethylaniline	85.3	−1.91
Dimethyloxalate	85.6	1.39
Diphenylsulfide	67.5	−1.51
Ethyl phenyl ether	80.5	0.88
Furfural	106.0	1.4
1-Heptanol	101.0	3.71
Hydroquinone	140.0	3.09
Methylamine	198.0	0.25
Methylmercaptan	121.0	0.82
Methyl sulfide	104.5	−0.87
Napthalene	80.5	0.38
o-Nitrobenzaldehyde	89.5	4.20
Nitrobenzene	90.2	−1.80
Nitromethane	141.0	−4.50
o-Nitrophenol	83.2	−2.60
1-Octanol	94.0	−3.60
Phenylacetonitrile	98.6	−0.61
Phthalic anhydride	89.2	−1.02
α-Picolene	91.5	1.92
Piperdine	96.5	−1.47
Pipernol	86.0	−2.74
Pyridine	104.5	2.60
Salicylaldehyde	89.2	3.24
2,3,4,6 Tetrachlorophenol	58.0	−0.20
1,2,3 Trichlorobenzene	59.2	−1.71
1,3,5 Trichlorobenzene	58.0	−3.57
2,3,5 Trimethylacetophenone	74.5	2.10
Trimethylamine	95.0	−2.48
2,4 Xyaldehyde	83.2	−1.58

Average deviation of the 43 compounds = 1.7%.

Table II. Comparison of Latent Heat Correlations at T_b

Compound Group	No. of Substances Tested	Present Method	Riedel's Method	Giacolone's Method
Inorganic	8	1.45	2.20	2.00
Hydrocarbons	18	2.45	1.92	2.44
All substances	51	1.70	2.27	2.20

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RECEIVED for review January 5, 1966. Accepted June 30, 1966.