*Supporting Materials*

# The Vaporization Enthalpy and Vapor Pressure of (±)-N-Ethylamphetamine at *T*/K = 298.15 by Correlation Gas Chromatography

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**Table S1. A:** Retention times of N-ethylamphetamine and compounds used as standards.

| Run 1 | *T*/K | 392.9 | 397.9 | 403 | 408.1 | 413.1 | 418.1 | 423.2 |
|---|---|---|---|---|---|---|---|---|
| Methanol | | 0.517 | 0.525 | 0.529 | 0.524 | 0.062 | 0.538 | 0.542 |
| N,N-Di-n-butylamine | | 1.261 | 1.172 | 1.095 | 1.020 | 0.500 | 0.928 | 0.887 |
| N,N-Di-n-pentylamine | | 2.879 | 2.518 | 2.223 | 1.967 | 1.300 | 1.611 | 1.470 |
| N-Ethylamphetamine | | 4.434 | 3.814 | 3.317 | 2.891 | 2.083 | 2.285 | 2.048 |
| N,N-Di-n-hexylamine | | 7.893 | 6.562 | 5.524 | 4.656 | 3.507 | 3.453 | 2.992 |
| 4-Benzylpiperidine | | 17.772 | 14.578 | 12.128 | 10.094 | 7.999 | 7.239 | 6.157 |
| N,N-Di-n-heptylamine | | 23.179 | 18.485 | 14.970 | 12.139 | 9.482 | 8.321 | 6.930 |

**Table S1. B:** Correlation between $\Delta_l^g H_m(298.15 \text{ K})$ and $\Delta H_{trn}(408\text{K})$ of the standards[1]

| Run 1 | -slope *T*/K | intercept | $\Delta H_{trn}(408\text{K})$ kJ·mol⁻¹ | $\Delta_l^g H_m(298.15 \text{ K})$/kJ·mol⁻¹ (lit)[2] | (calc) |
|---|---|---|---|---|---|
| N,N-Di-n-butylamine | 4197.2±20 | 10.984±0.05 | 34.89±0.16 | 50.1±0.6 | 50.4±3.4 |
| N,N-Di-n-pentylamine | 5121.3±23 | 12.181±0.06 | 42.58±0.19 | 61.3±2.1 | 61.0±3.7 |
| N-Ethylamphetamine | 5238.1±24 | 11.973±0.06 | 43.55±0.20 | | 62.4±3.8 |
| N,N-Di-n-hexylamine | 6037.1±24 | 13.374±0.06 | 50.19±0.20 | 70.7±3.4 | 71.5±4.0 |
| 4-Benzylpiperidine | 6149.2±27 | 12.810±0.07 | 51.12±0.22 | 74.2±1.0 | 72.8±4.1 |
| N,N-Di-n-heptylamine | 6937.5±36 | 14.546±0.09 | 57.68±0.30 | 81.3±4.9 | 81.8±4.3 |

$$\Delta_l^g H_m(298.15 \text{ } K)/\text{kJ·mol}^{-1} = (1.38\pm0.06)\Delta H_{trn}(408 \text{ } K) + (2.3\pm2.8) \qquad r^2 = 0.9947 \qquad (S1)$$

[1] All uncertainties represent one standard deviation.

[2] Vaporization enthalpies are average literature values; individual values and references are reported in Table 2.

**Table S2. A:** Retention times of N-ethylamphetamine and compounds used as standards.

| Run 2 | 392.9 | 398 | 403.1 | 408.2 t/min | 413.2 | 418.2 | 423.2 |
|---|---|---|---|---|---|---|---|
| Methanol | 0.541 | 0.536 | 0.551 | 0.545 | 0.549 | 0.557 | 0.559 |
| N,N-Di-n-butylamine | 1.315 | 1.211 | 1.142 | 1.049 | 1.006 | 0.960 | 0.919 |
| N,N-Di-n-pentylamine | 2.998 | 2.613 | 2.318 | 2.035 | 1.842 | 1.670 | 1.527 |
| N-Ethylamphetamine | 4.614 | 3.966 | 3.459 | 2.996 | 2.663 | 2.371 | 2.130 |
| N,N-Di-n-hexylamine | 18.524 | 15.237 | 12.648 | 10.488 | 8.871 | 7.495 | 6.405 |
| 4-Benzylpiperidine | 24.132 | 19.318 | 15.625 | 12.647 | 10.437 | 8.624 | 7.212 |
| N,N-Di-n-heptylamine | 24.132 | 19.318 | 15.625 | 12.647 | 10.437 | 8.624 | 7.212 |

**Table S2. B:** Correlation between $\Delta_l^g H_m$(298.15 K) and $\Delta H_{trn}$(408K) of the standards [1]

| Run [2] | -slope $T/K$ | intercept | $\Delta H_{trn}$(408K) kJ·mol$^{-1}$ | $\Delta H_{vap}$(298 K) kJ·mol$^{-1}$ (lit) | $\Delta H_{vap}$(298 K) kJ·mol$^{-1}$ (calc) |
|---|---|---|---|---|---|
| N,N-Di-n-butylamine | 4214.4±74 | 10.987±0.18 | 35.04±0.62 | 50.1±0.6 | 50.2±4.5 |
| N,N-Di-n-pentylamine | 5120.2±31 | 12.137±0.07 | 42.57±0.25 | 61.3±2.1 | 60.9±4.9 |
| N-Ethylamphetamine | 5236.5±22 | 11.927±0.05 | 43.53±0.18 | | 62.3±4.9 |
| N,N-Di-n-hexylamine | 6041.9±25 | 13.342±0.06 | 50.23±0.21 | 70.7±3.4 | 71.8±5.3 |
| 4-Benzylpiperidine | 6171.3±13 | 12.844±0.03 | 51.31±0.11 | 74.2±1.0 | 73.3±5.4 |
| N,N-Di-n-heptylamine | 6950.4±12 | 14.533±0.03 | 57.78±0.10 | 81.3±4.9 | 82.5±5.8 |

$\Delta H_{vap}$(298.15 K)/kJ·mol$^{-1}$ = (1.42±0.08)$\Delta H_{trn}$(408 K) + (0.46±3.56)     r$^2$ = 0.9939     S2)

[1] All uncertainties represent one standard deviation.

[2] Vaporization enthalpies are average literature values; individual values and references are reported in Table 2.

**Table S3.** A comparison of the vapor pressures of (S) (+)-methamphetamine to N-ethylamphetamine as a function of temperature [1].

| (S) (+)-Methamphetamine $T/K$ | | N-Ethylamphetamine $p/Pa$[2] | (S) (+)-Methamphetamine $T/K$ | | N-Ethylamphetamine $p/Pa$[2] |
|---|---|---|---|---|---|
| 298.15 | *39* | 19±11    (8.2) [S1] | 390 | *5600* | 3900±870 |
| 310 | *91* | 48±24 | 400 | *8200* | **5700**±1200 |
| 320 | *180* | 98±45 | 410 | *12000* | 8300±1500 |
| 330 | *320* | 190±77 | 420 | *16000* | 12000±1900 |
| 340 | *570* | 340±130 | 430 | *22000* | 16000±2400 |
| 350 | *960* | 590±200 | 440 | *29000* | 22000±2900 |
| 360 | *1600* | 1000±310 | 450 | *39000* | 30000±3400 |
| 368.2 | | 1500±410    (800)[S2] | 460 | *50000* | 39000 |
| 370 | *2500* | 1600±450 | 470 | *64000* | 51000 |
| 372.2 | | 1800±480    (2700 ) [S3] | 480 | *81000* | 65000 |
| 376.2 | | 2100±560    (3300) [S4] | 490 | *101300* | 82000 |
| 378.2 | | 2300±600    (1900) [S5] | 500 | | 101300 |
| 380 | *3800* | 2500±630 | 507.7 | | 120000 (101325) [S1] |

[1] N-Methylamphetamine: vapor pressures evaluated using Eq. (S1);

$\ln(p/p^o) = 7.592 - 2119.6(T/K) - 849{,}290(T/K)^2 - 31{,}824{,}000(T/K)^3$ ;   $p^o = 101{,}325$ Pa     (S3)

N-ethylamphetamine: vapor pressure from $T$ = (298.15 to 450) K evaluated by correlation;

from $T$ = (460 to 500) K: $\ln(p/p^o) = (8.347\pm0.01) - (2{,}872.4\pm3.7)(T/K) - (646{,}650\pm665)(T/K)^2$     (S4)

[2] Uncertainties are a measure of the quality of the correlation; actual uncertainties may differ.

**References**

[S1] Estimate, EPI Suite version 4.11 (Estimation Programs Interface), The EPI Suite can be downloaded at http://www.epa.gov/oppt/exposure/pubs/episuitedl.htm; accessed 4/08/21.

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S3 Shiho, D.; Kanayama, K.; A new process of alkylation of amines. II. Nippon Kagaku Kaishi 1944, 65, 237-239.

S4 Temmler, T. H.; Keil, F.; Dobke, W. β-Aralkylamines. DE 767263 **1952.**

S5 Leonard, N. J.; Adamcik, J. A.; Djerassi, C.; Halpern, O. Cyclic amino acyloins and amino ketones. X. Trans-annular nitrogen-carbonyl interaction in cyclic aminoketones and optical rotatory dispersión. *J. Am. Chem. Soc*. **1958**, *80*, 4858-4862.