# Comments on the Anomalous Thermoacoustic Properties of Methyl Heptanoate at 318 K

Sir:

In a recent article published in the June issue of this journal entitled: "Thermoacoustic Properties of Methyl Esters of *n*-Alkanoic Acids" by Cole *et al.* (1), a number of thermoacoustic parameters were calculated from the coefficients of volume expansion estimated from Liew *et al.*'s (2) density data, which were reported earlier. An anomalous, exceptionally high coefficient of volume expansion was reported by Cole *et al.* (1) for the $C_7$ methyl ester at 318 K. The thermoacoustic parameters calculated differ significantly from similar parameters for the same ester at other temperatures. The authors went on to speculate that the exceptionally low value of the Sharma constant obtained was due either to the transition of the mesogen from one mesophase to another or from a highly disordered low-density state to a more ordered, high-density state. This finding is interesting, but seems incredible, as the conclusion was drawn originally from very small changes in density around the temperature in question. Moreover, it is well known that the molar volumes of *n*-alkanoic acids (3), as well as their methyl esters (2), can be correlated linearly with temperature with good correlation coefficients within the temperature range studied, indicating no detectable abrupt changes in density and, hence, coefficient of volume expansion occur.

We thus recalculated the coefficient of volume expansion, as well as the other thermoacoustic parameters, for the methyl ester of the $C_7$ *n*-alkanoic acid using the original density and molar volume data reported previously (2), and the procedure described in the paper by Cole *et al.* (1). Some of the results are shown in Table 1. The calculated results differ slightly but insignificantly from those reported in Table 2 in the Cole *et al.* article (1) at all temperatures other than 318 K. The coefficient of volume expansion at 318 K is $0.0984 \times 10^{-2}$ compared to a value of $0.9852 \times 10^{-2}$, as reported, and the Sharma constant is 1.1173, compared to 0.2889, as reported. The insignificant differences between our values and the values reported at other temperatures may have arisen from small dif-

**TABLE 1**
**Thermoacoustic Parameters of Methyl Esters of $C_7$ and $C_6$ *n*-Alkanoic Acids[a]**

| Temperature | $\alpha \times 10^2$ | $-\left[\frac{d \ln \alpha}{d \ln T}\right]_V$ | $-\left[\frac{d \ln P_i}{d \ln T}\right]_V$ | $\beta$ | $\tilde{V}$ | $S_o$ | $S^*$ | $S_o^*$ | F |
|---|---|---|---|---|---|---|---|---|---|
| Methyester of $C_7$ *n*-alkanoic acid | | | | | | | | | |
| 283[b] | 0.1021 | 1.5779 | 0.5384 | 5.8610 | 1.2413 | 1.1188 | 1.3852 | 1.1390 | 1.1533 |
| 283[c] | 0.1017 | 1.5759 | 0.5396 | 5.8478 | 1.2406 | 1.1188 | 1.3839 | 1.1387 | 1.1550 |
| 298[b] | 0.1053 | 1.6276 | 0.5251 | 6.1990 | 1.2584 | 1.1172 | 1.4184 | 1.1475 | 1.1067 |
| 298[c] | 0.1056 | 1.6296 | 0.5245 | 6.2130 | 1.2590 | 1.1171 | 1.4197 | 1.1478 | 1.1048 |
| 318[b] | 0.0984 | 1.6258 | 0.5256 | 6.1868 | 1.2578 | 1.1173 | 1.4172 | 1.1472 | 1.1084 |
| 318[c] | 0.9852 | 7.2660 | 0.0372 | 390.2190 | 1.9657 | 0.2889 | 5.1773 | 1.4034 | 3.1401 |
| 348[b] | 0.1158 | 1.8100 | 0.4807 | 7.5135 | 1.3156 | 1.1085 | 1.5373 | 1.1748 | 0.9433 |
| 348[c] | 0.1164 | 1.8104 | 0.4796 | 7.5484 | 1.3169 | 1.1082 | 1.5402 | 1.1753 | 0.9393 |
| Methyl ester of $C_6$ *n*-alkanoic acid | | | | | | | | | |
| 283[b] | 0.1164 | 1.6588 | 0.5170 | 6.4175 | 1.2688 | 1.1160 | 1.4392 | 1.1526 | 1.0777 |
| 283[c] | 0.1170 | 1.6621 | 0.5161 | 6.4407 | 1.2699 | 1.1159 | 1.4414 | 1.1531 | 1.0747 |
| 298[b] | 0.1186 | 1.7068 | 0.5048 | 6.7630 | 1.2845 | 1.1139 | 1.4712 | 1.1602 | 1.0334 |
| 298[c] | 0.1189 | 1.7089 | 0.5042 | 6.7783 | 1.2851 | 1.1138 | 1.4726 | 1.1604 | 1.0316 |
| 318[b] | 0.1146 | 1.7288 | 0.4993 | 6.9252 | 1.2916 | 1.1128 | 1.4859 | 1.1635 | 1.0134 |
| 318[c] | 0.2081 | 2.3235 | 0.3756 | 12.3705 | 1.4534 | 1.0606 | 1.8823 | 1.2343 | 0.4933 |
| 348[b] | 0.1324 | 1.9215 | 0.4545 | 8.4555 | 1.3497 | 1.1006 | 1.6143 | 1.1903 | 0.8402 |
| 348[c] | 0.1332 | 1.9268 | 0.4533 | 8.b010 | 1.3512 | 1c1001 | 1.6179 | 1.1909 | 0.8354 |

[a]The symbols used in the headings are as defined in Reference 1. [b]Our calculation. [c]Reference 1.

ferences in the constants or truncation used. The differences in the data at 318 K could have been caused by misplacing the decimal point in the α value. There was no abrupt change in the coefficient of volume expansion and the Sharma constant at this temperature. We have to conclude that for the methyl ester of $C_7$ *n*-alkanoic acid, the alleged change in density state at 318 K is not indicated by the density data reported. This ester behaves in a similar way to the methyl esters of the other acids.

A number of other minor errors also were detected in the Cole *et al.* article (1). The α value at 318 K for the methyl ester of $C_6$ alkanoic acid reported in Table 2 of that article should be 0.1146 instead of 0.2081. Thus, the other thermoacoustic parameters at this temperature were also in error. Additionally there was a typographical error in Equation 7, which should be:

$$\tilde{V} = \left[1 + \frac{\alpha T}{3(1+\alpha T)}\right]^3 \qquad [7]$$

according to the original reference (4), from which Equation 6 should be rewritten as:

$$\alpha T = 3\left(\tilde{V}^{1/3} - 1\right)/\left(4 - 3\,\tilde{V}^{1/3}\right) \qquad [6]$$

## REFERENCES

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