AN EQUATION FOR THE CALCULATION OF THE SATURATED VAPOUR PRESSURE OF METHOXYFLURANE (PENTHRANE®)*

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THE RATIONAL CLINICAL use of methoxyflurane (Penthrane, 2, 2-dichloro-1,1-difluorethyl methyl ether) as an inhalation anaesthetic requires accurate information about its vapour pressure. Likewise, to prepare precise concentrations of methoxyflurane to calibrate measuring equipment, such as an interferometer and a gas chromatograph, precise knowledge of the saturated vapour pressure is required. At present the only data available on methoxyflurane saturated vapour pressure is that provided by the publication of Abbott Laboratories as described in Table I: "experimental data." The purposes of this paper are (a) to provide an equation for the precise calculation of saturated vapour pressure of methoxyflurane at any temperature, and (b) to provide a graph for easy estimation of methoxyflurane vapour pressure.

The Antoine semi-empiric equation¹ has proved to be the best expression of the relationship of saturated vapour pressure and temperature,² and has been used recently for calculation of the vapour pressures of various anaesthetic agents.³ The Antoine equation is:

$$\log_{10} P = A - \frac{B}{(t + C)} \quad (1)$$

where P is the vapour pressure in mm Hg, A , B , and C are constants, and t is the temperature in degrees centigrade.

Using the known data for the saturated vapour pressure of methoxyflurane,⁴ the values for the constants A , B , and C were calculated by computer using an iterative procedure, and substituted into equation (1):

$$\log_{10} P = 7.08798 - \frac{1339.471}{(t + 213.746)} \quad (2)$$

Vapour pressure calculated from equation (2) for the temperatures in Table I are compared with the experimental figures given in that table. Calculated data correspond closely.

Using equation (2), the saturated vapour pressures of methoxyflurane at a variety of temperatures were calculated (Table II). This calculated data is plotted graphically (Fig. 1) and demonstrates the curvilinear relationship of the saturated vapour pressure of methoxyflurane with temperature.

Thus for clinical purposes the vapour pressure of methoxyflurane can be

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quickly estimated from the graph. For more accurate vapour pressure estimation the modified Antoine equation (2) should be used.

FIGURE 1. Methoxyflurane: the variation of saturated vapour pressure with temperature.

TABLE I
COMPARISON OF EXPERIMENTAL AND CALCULATED DATA

Experimental data for methoxyflurane		Calculated vapour pressure according to equation (2) (mm Hg)	Difference (%)
Temperature (°C)	Saturated vapour pressure (mm Hg)		
6.27	10	9.998	-0.02
17.72	20	20.00	±0.00
30.42	40	40.00	±0.00
38.51	60	59.98	-0.03
49.51	100	99.97	-0.03
104.65	760	760.40	-0.05

TABLE II
CALCULATED VAPOUR PRESSURE OF
METHOXYFLURANE FROM EQUATION (2)

Temperature (°C)	Vapour pressure (mm Hg)
-20	1.49
-10	3.26
0	6.62
10	12.63
20	22.78
30	39.14
40	64.45
50	102.2
60	156.6
70	233.0
80	337.3
90	476.6
100	658.7

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