THE EFFECT OF PLASTICIZERS ON THE INTERACTION OF PVC WITH BENZOCAINE

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In a previous report, we described the permeability and sorption characteristics associated with the interaction between benzocaine and polyvinyl chloride (PVC) plasticized with di-2-ethylhexylphthalate (DEHP) at 50° (Bray and Meakin, 1975). Studies of drug-plastics interactions, using this model have now been extended, and the influence of DEHP and acetyl tri-n-butyl citrate (ATBC) both of which have been used in the formulation of PVC for intravenous infusion bags, have been studied over a range of temperatures and concentrations. Representative interaction constants are given in the table, which show that drug permeability increases with plasticizer concentration and temperature, whilst sorption increases with plasticizer concentration and decreases with temperature. The effect of ATBC is more pronounced than that of DEHP for both sorption and permeation processes.

The sorption process is capable of being described by a mathematical model which assumes that in plasticized PVC, the drug partitions separately into the plasticizer and unplasticized compound and that the total extent of sorption is obtained from the summation of these two processes (equation 1)

$$K_{obs} = K_p F_p + K_R F_R \quad \text{---------- (1)}$$

(K_{obs} & K_R) are the sorption constants for plasticized and unplasticized compound respectively; K_p is the plasticizer-water partition coefficient; F_p and F_R are the weight fractions of plasticizer and unplasticized compound) Re-arrangement of equation 1 leads to equation 2 which is consistent with the linear relationship between K_{obs} and F_p found experimentally.

$$K_{obs} = \left[K_p - K_R\right] F_p + K_R \quad \text{-------- (2)}$$

Summation of slope and intercept gives an estimate of K_p which correlates well with the experimentally determined partition coefficients.

The permeation behaviour cannot be fitted to such a simple additive model.

DEHP % w/w	Temp °C	K_{obs} litre kg^{-1}	P m^2s^{-1} x 10^{11}	ATBC % w/w	Temp °C	K_{obs} litre kg^{-1}	P m^2s^{-1} x 10^{11}
16.0	30	32.7	-	16.0	30	40.5	-
23.2	30	36.5	-	27.7	30	51.8	-
34.2	30	39.4	-	36.6	30	62.1	-
16.0	40	29.9	-	16.0	40	35.2	-
21.5	40	32.8	-	21.9	40	41.4	-
37.8	40	36.3	-	31.9	40	49.5	-
21.5	45	-	0.48	21.9	45	-	0.59
34.2	45	-	2.18	31.9	45	-	3.48
37.8	45	-	3.31	36.6	45	-	5.93
16.0	50	26.5	0.15	16.0	50	32.3	0.19
23.2	50	29.4	0.98	21.9	50	36.3	2.60
37.8	50	32.5	4.72	36.6	50	48.2	8.88
21.5	60	-	1.67	21.9	60	-	2.39
23.2	60	-	1.82	27.7	60	-	4.91
37.8	60	-	7.42	36.6	60	-	14.90

(P = Permeability Coefficient)

Bray, C.S. and Meakin, B.J. (1975), J. Pharm. Pharmac., 27, 68P