SORPTION OF DRUGS BY PLASTIC INFUSION BAGS

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Several recent studies have reported the loss of a number of drugs including diazepam, nitroglycerin, vitamin A, chlormethiazole and insulin from aqueous solutions stored in polyvinyl chloride (PVC) infusion bags for various periods of time (Moorhatch et al 1974; Cloyd et al 1980). This loss may result in reduced drug delivery to the patient and may have therapeutic implications.

In the present work the kinetics and mechanisms of the sorption of warfarin sodium, various benzodiazepines and other drugs or chemicals from aqueous solutions by PVC infusion bags were investigated.

Solutions of the drugs (110 ml) at various concentrations were stored in 100 ml size PVC Travenol infusion bags for 7 days at 22 °C. Samples were withdrawn at various intervals and the concentration of the drugs in the solutions was determined by UV-spectrophotometry. Sorption isotherms were derived and were found to be of the constant partition types (Giles et al 1974), indicating that the drugs were absorbed into the plastic. The results for warfarin sodium indicated that the plastic could be saturated by the drug at high solution concentrations. For the benzodiazepines there was a relationship between the initial rate of absorption and the n-hexane/water partition coefficients of the drugs (Table 1).

Analysis of the kinetics of uptake using the "closed two compartment kinetic" model and the "diffusion" model (Roberts et al 1980) indicated that the latter gave the best fit. The main physicochemical determinant controlling the rate of drug sorption appeared to be the plastic-water partition coefficient as expressed by the n-hexane/water partition coefficients.

The effect of pH on the uptake of warfarin has also been studied (fig. 1). The increased loss from solution with decreased pH showed that it was the nonionized form of the drug that was the partition species.

The sorption of the compounds by infusion bags made from polyethylene and polypropylene was evaluated and found to be much reduced as compared with the behaviour of PVC.

Table 1. Sorption and partition data for various benzodiazepines

Drug	Initial rate of sorption[a] (h^{-1})	Partition coefficient n-hexane/ water log P
Nitrazepam	$4.1 \cdot 10^{-2}$	-0.1
Oxazepam	$4.6 \cdot 10^{-2}$	-0.1
Diazepam	$26.8 \cdot 10^{-2}$	0.9
Medazepam	$50.8 \cdot 10^{-2}$	2.2

[a] As defined by $-d[A]/dt\ [A]_o$, where $[A]_o$ is the initial drug concentration and $-d[A]/dt$ is the initial decrease in concentration

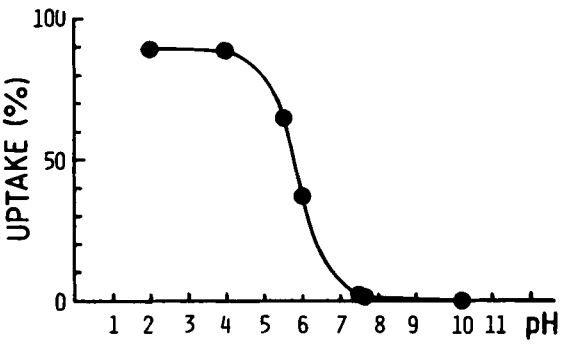

Fig. 1. The influence of pH on the amount of warfarin absorbed by PVC bags at equilibrium

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Cloyd, J.C. et al (1980) Ibid 37: 492-6
Giles, C.H., Smith, D. (1974) J.Colloid Interface Sci. 47: 755-778
Roberts, M.S. et al (1980) J.Pharm.Pharmacol 32: 237-244

0022-3573/81/120102P-01$02.50/0