THE PREPARATION AND PROPERTIES OF POLYAMIDE MICROCAPSULES CONTAINING PILOCARPINE IN SOLUTION

Evans, M.E., Richardson, N.E. and Norton, D.A., Pharmaceutics Department, School of Pharmacy & Pharmacology, University of Bath, Claverton Down, Bath, U.K.

As part of an investigation into the potential use of microcapsules for the delivery of drugs to the eye, we have studied the preparation of polyamide microcapsules containing pilocarpine in solution. Initial attempts to prepare nylon 6:10 microcapsules by interfacial polymerization in rapidly stirred two phase systems using reported methods (Chang et al 1966; Shiba et al 1970) proved difficult, only solid particles of polymer being formed. After varying several factors involved in the polymerization process, successful formation of spherical microcapsules was achieved by including a cross-linking agent, polyethyleneimine, in the aqueous phase. Harvesting of the capsules required centrifugation in conjunction with washings in cyclohexane, acetone and finally 5% Tween 20 solution. The capsules had a median volume diameter of about 20μm as determined using a Coulter Counter and electron scanning micrography showed them to be hollow with a thin polymeric membrane.

A typical batch process for nylon 6:10 capsules, where 7.5ml of water was available for encapsulation, gave only approximately 2g of microcapsule slurry. This was probably due to their fragility causing breakdown of the capsule walls on centrifuging. Consequently, stronger walled polyphthalamide microcapsules were prepared by the same method. The yield increased to 8g of slurry and harvesting could be achieved after only a cyclohexane wash. The median volume diameter of these capsules was 40μm. They could also be prepared in the form of a dry powder by freeze drying. The powdered microcapsules readily reconstituted on the addition of aqueous solutions.

Table 1 shows the encapsulating efficiency of the method for pilocarpine. Microcapsules were prepared containing 1% pilocarpine nitrate (Spiked with tritiated pilocarpine)in the aqueous phase. Samples of the continuous oil phase and the washings were then analysed for their pilocarpine content. For both types of microcapsule a large portion of the pilocarpine was lost to the continuous oil phase. The remainder of the drug was extracted by the acetone/Tween 20 washes. Polyphthalamide capsules prepared omitting the acetone/Tween 20 washing stages retained more than half of the drug in the capsule phase. All of their pilocarpine content however was released into water within twenty minutes, suggesting that the microcapsules are freely permeable to pilocarpine.

Table 1. The distribution of pilocarpine during the preparation of nylon 6:10 and polyphthalamide microcapsules

Solution sampled	Fraction of Initial Pilocarpine Found	
	Nylon 6:10	Polyphthalamide
Continuous oil phase	0.583	0.655
Cyclohexane wash	0 002	0.002
Acetone wash	0.274	0.253
5% Tween 20 wash	0.161	0.170

Chang, T.M.S., MacIntosh, F.C. & Mason, S.G. (1966) Canadian J. Phys. Pharm. 44:115-128.

Shiba, M., Tomioka, S., Koishi, M. & Kondo, T. (1970) Chem. Pharm. Bull. 18: 803-809.

0022-3573/81/120019P-01$02.50/0