AN EFFECT OF PERMEABILITY ASYMMETRY IN SINGLE AND LAYERED FILMS

R.S. Okor and W. Anderson, Department of Pharmaceutics, University of Strathclyde, Glasgow G1 1XW

Films of certain polymers have a porous structure and differences in pore size distribution may arise during film formation resulting in porous asymmetry characterised by greater compactness of the upper or air-dried surface compared with the lower surface (in contact with substrate during formation). Differences in permeation rate may occur depending on which surface is placed upstream in permeation experiments - known as surfaces difference (Anderson & others, 1973) or permeability asymmetry. Single films, 40µm thick, were cast on PTFE from acetone solution (2.5% w/w) of polymer containing 0.5% w/w glyceryl triacetate plasticizer. Layered films were prepared by layering one film (20µm thick) upon another after 2 h exposure of the surface to acetone vapour followed by 2 h exposure of the layered film. Order of layering was LU-LU where L is lower surface and U is upper surface of a film. Permeation experiments, after Abdel-Aziz & others, 1975, were carried out (30°;5h). From two acrylate - methaerylate copolymers A and B, Eudragit ERL100 and ERS100 respectively, (Rohm Pharma, Darmstadt) containing quaternary ammonium groups in the ratio 2:1 films of intermediate quaternary ratios of 1.8, 1.6, 1.4, 1.2 were obtained by mixing appropriate quantities of ERL100 and ERS100, designated A1.8 - A1.2 respectively giving a series of films of decreasing hydrophilic character.

Table 1. Permeability differences in single and layered films.

Polymer	Permeation Rate, mg h^{-1} layered film	single film	Permeability ratios single:layered
A	291	388	1.33
A1.8	35	50	1.43
A1.6	13	20	1.54
A1.4	7	12	1.71
A1.2	3	5	1.67
B	0.6	0.6	1.0

Single films were consistently more permeable to urea than layered films of the same thickness due to layered films having in their structure an additional compact region. Decrease in hydrophilic character resulted in decrease in permeability for single and layered films although the ratios show that permeability for the layered film decreases more rapidly with decreasing hydrophilic character except for the two least hydrophilic polymers. Equal permeability for single and layered films of B suggest that resistance to entry of permeant at the fluid-film interface is the rate-limiting factor and conceals any film differences. Abdel-Aziz (1976) found that a less hydrophilic polymer showed greater film permeability asymmetry than a more hydrophilic polymer of the same type and the general nature of this finding is now seen in the greater rate of decrease in permeability in the layered film with decreasing hydrophilic character. These differences may be exploited in determining drug availability rate from a polymeric film.

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