

THE EFFECT OF TITANIUM DIOXIDE ON THE OXYGEN PERMEABILITY OF HYDROXYPROPYLMETHYL CELLULOSE (HPMC) FILMS

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The proposals of Chatfield (1962) have been used to explain the effect of titanium dioxide on the water vapour permeability of hydroxypropylmethyl cellulose films, which is first lowered then raised by increasing filler content, (Parker et al 1974; Porter 1980). The particles being impermeable to moisture, are considered to increase the effective diffusion pathway so decreasing permeability; above a critical pigment volume concentration (CPVC) of between 5-15%^{v/v}, there is insufficient polymer to bind all the particles together, creating voids and increasing permeability.

Theoretically, the Chatfield theory should be valid for all permeants, but we have observed this to be in error for the oxygen permeability of HPMC films formed from suspensions of titanium dioxide (Colorcon Ltd.) in 5%^{w/v} aqueous Pharmacoat 606 by casting on to glass or spraying on to glass or 25.4mm diameter calcium phosphate-lactose tablet cores under coating conditions designed to mimic those in a 24" Accela Cota (Prater et al 1980). The table shows mean oxygen permeability coefficients at 30° from at least three replicates determined by a mass spectrometry technique. With neither type of sprayed film does titanium dioxide concentration materially affect oxygen permeability. For the cast films permeability remains essentially constant until the CPVC, when it rises rapidly. The absence of the initial permeability minimum found with water vapour, can be attributed to the non plasticising nature of oxygen. The differences between cast and sprayed films at high filler content is probably due to sedimentation of filler as the solvent slowly evaporates during casting, which cannot occur under spraying conditions.

TiO ₂ Content (% v/v)	Oxygen Permeability Coefficient (m ² s ⁻¹ x 10 ¹³)		
	Glass (cast)	Glass (sprayed)	Tablet Core (sprayed)
nil	7.79 (0.83)	7.89 (0.73)	7.18 (0.02)
3.0	8.39 (0.87)	7.61 (0.73)	6.97 (0.33)
5.8	8.32 (0.14)	8.90 (0.49)	9.34 (0.34)
11.0	12.73 (2.49)	7.85 (0.42)	7.28 (0.12)
15.6	13.28 (0.44)	8.58 (0.74)	6.18 (1.04)

The Effect of Titanium Dioxide Content (%^{v/v} pigment:total solids ratio) on the Oxygen Permeability at 30° of HPMC Films formed on Glass and Calcium Phosphate-Lactose Tablet Core Substrates. (Figures in brackets are standard deviations)

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