HYDRATION OF A HYDROCOLLOID CONTAINING DERMATOLOGICAL PATCH AND ITS EFFECTS ON RHEOLOGICAL CHARACTERISTICS

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Occlusion enhances percutaneous absorption of drugs and has been used clinically to promote topical bioavailability. It has been effected using plastic films, but more recently a hydrocolloid containing dermatological patch has been employed. The latter consists of a dispersion of hydrocolloids in a hydrophobic polymer matrix and has been shown to be as effective as plastic film in promoting corticosteroid-induced blanching (Martin and Marriott 1989). In contrast to plastic film, the hydrocolloid patch absorbs water vapour, preventing maceration of the underlying skin. It is probable that the function of promoting drug absorption is partially dependent on the relative hydrocolloid content. The purpose of this study was to determine the effect of varying the proportion of two hydrocolloids, sodium carboxymethylcellulose (SCMC) and pectin within the patch on water uptake and to assess the resultant effects on microstructure within the patch by determining the rheological properties of the matrix.

Preweighed 3 cm x 3 cm squares of each patch type were supported on a wire mesh above 500 ml distilled water within a vacuum desiccator at 20°C. A vacuum was maintained for predetermined time periods, allowing vapour hydration of the patches to proceed. After removal from the saturated environment, the patches were reweighed and subjected to an oscillatory shear test using a Dynamic Spectrometer (Rheometrics) to determine any resultant changes in elastic modulus (G') and loss modulus (G''). The test used parallel plate geometry at 1% strain and evaluated the rheological parameters at a range of frequencies from 1- 100 rads s^{-1}.

The patches all showed an increase in weight as the time of exposure to water vapour increased and the kinetics of hydration of all patches was found to be a linear function of time up to 120 h.The results show that hydration rate was dependent upon the hydrocolloid composition, the values (expressed as mg cm^{-2} h^{-1}) were as follows: SCMC 39%, 0.33; SCMC 26% pectin 13%, 0.20; SCMC 19.5% pectin 19.5%, 0.14; SCMC 13% pectin 26%, 0.08; pectin 39%, 0.05.

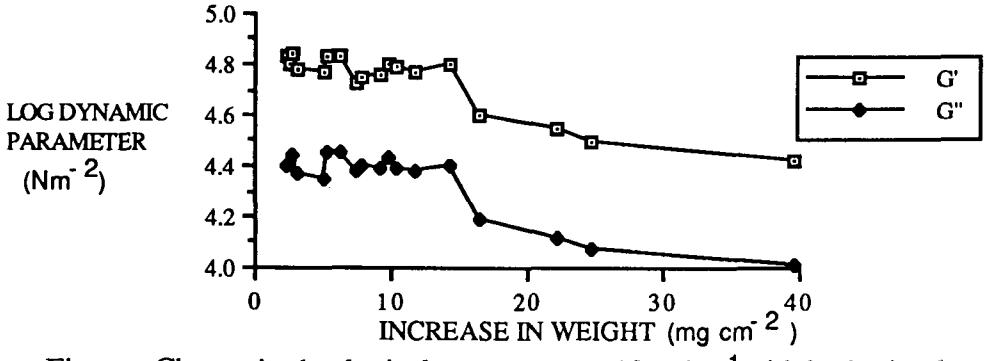

Figure : Change in rheological parameters at 10 rad s^{-1} with hydration level

Rheological studies showed that for all patches there was no change in either G' or G'' from unhydrated values up to a water uptake level of 16 mg cm^{-2} of patch (Figure). Subsequent hydration beyond this level resulted in a proportional reduction in both rheological parameters with increased hydration. During the early stages of hydration when no change in the G' and G'' values occur, it is probable that the water is bound and therefore causes little disruption to the microstructure of the matrix within the patch. At higher levels of hydration, availability of water in the unbound state and swelling of the hydrocolloid component would cause a reduction in G' and G''.

This study illustrates how the formulation of a hydrocolloid containing dermatological patch can be tailored to absorb varying amounts of water vapour. The concommitant rheological changes may affect the extent of occlusion afforded to the skin which in turn could alter the bioavailability of topical drugs applied beneath such patches.

Martin, G.P., Marriott C. (1989) Curr. Ther. Res. 46:828-836