DIFFERENTIAL SCANNING CALORIMETRY (DSC) OF HUMAN STRATUM CORNEUM: EFFECT OF AZONE

M. Goodman, B.W. Barry, Postgraduate School of Studies in Pharmacy, University of Bradford, Bradford, West Yorkshire, BD7 1DP, U.K.

Accelerants increase the permeability of human skin although we know little about their mechanisms of action. We are using DSC to examine the thermal behaviour of human stratum corneum (s.c.) as modified by accelerants.

S.c. samples, prepared by heat separation from abdominal, cadaver skin, were dried and then hydrated to various levels. By scanning a hydrated s.c. sample (approx 6mg) between 0-140°C at 10°C min^{-1}, a 4-peak thermogram was obtained (Fig 1 - hydration 25% w/w; see also Van Duzee, 1975). Transitions generally occur at around 39, 72, 86 and 105°C at this hydration level. (Hermetically sealed pans prevented interference from water at 100°C.) The first 2 peaks are reversible and we attribute them to lipid melting; extraction of stratum corneum by chloroform/methanol 2:1 v/v removes the first three peaks. The 86°C peak is irreversible if the sample is heated to 140°C but at least partly reversible if heated only to 95°C. By x-ray diffraction, Baden et al (1973) identified an α to β conformational change in human s.c. fibrous protein at 85°C; this peak may be a lipid/protein composite. The 105°C peak is irreversible and is attributable to protein denaturation.

The thermogram obtained depends on s.c. hydration level. Dry samples exhibit only 1 or 2 peaks; 4 peaks normally occur from 10% hydration upwards. As hydration increases, peaks sharpen and transition temperatures fall. Table 1 illustrates this (Sample A); also shown is a measure of the reproducibility of the method. The averaged transition temperatures ± S.D. of 7 samples from the same s.c. preparation are shown (Sample B).

Table 1. Transition temperatures on human s.c. at different hydration levels.

Sample and % Hydration (w/w)	Approximate Transition Temperature			
	40	75	85	100
Sample A Dry	-	77	88	-
Sample A 20%	40	73	83	112
Sample A 70%	39	70	82	95
Sample B 50%	37±2	70±1	81±1	95±2

We treated a 20% hydrated s.c. sample with 3% Azone and 0.1% Tween 20 in normal saline, blotted off excess reagent and hermetically sealed the sample. After 24h, the sample was scanned (Fig 2). The first three peaks disappeared leaving a single peak at 99 °C; we attribute this peak to protein denaturation as it is not reversible. Thus, Azone radically interfered with the s.c. lipids, appearing to fluidise them. The vehicle has little affect on the normal 4-peak system. Fig 2 is essentially similar to that given by a delipidised s.c. sample.

Fig. 1

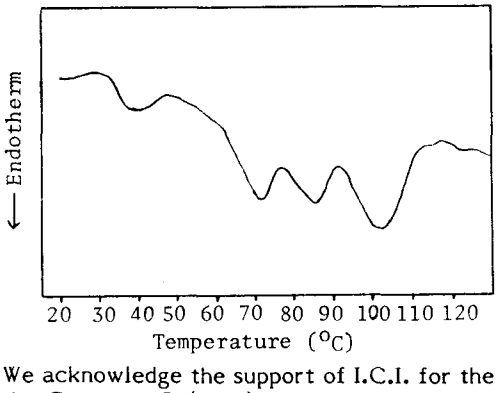
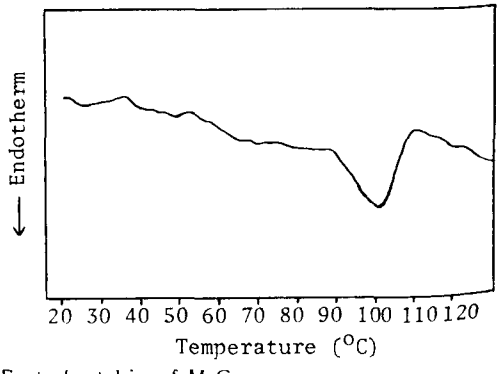


Fig. 2



We acknowledge the support of I.C.I. for the CASE studentship of M.G.

Van Duzee, B.F. (1975). J. Invest. Dermatol. 65:404-408.
Baden, H.P., Goldsmith, L.A., Bonor, L. (1973). J. Invest. Dermatol. 60:215-218.