148y Thermodynamics of Water Interaction in Stratum Corneum by Using Isothermal Calorimetry

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The Stratum Corneum (SC) is an important biological barrier retarding both water loss from the body and the absorption of hazardous materials from the environment. Isothermal calorimetry provides a tool by which one can develop thermodynamic data regarding the affinity of water and industrially important solvents for this tissue. This information is central to the interpretation of equilibrium uptake of water and is indirectly related skin permeability, which changes as the tissue swells. Heat of absorption of water in excised human SC at various relative humidities was measured at 32 ˚C using back and thigh skin from different donors. These measurements, combined with the water vapor sorption isotherm, were used to calculate the integral and differential enthalpies of binding of water to SC. Irreversible effects were avoided by drying all SC samples under high vacuum at room temperature. Differential enthalpy values suggest hydrogen bonding interactions similar to those in wool keratin. The changes in differential enthalpies and entropies followed a predictable sequence as the film of water formed on the SC. The result may be interpreted in terms of a BET isotherm with monolayer volume V_m = 3.96 g H_2O/100 g SC and C = exp [(ΔH_1 - ΔH_L)/RT] = 13.2.