MICROCALORIMETRIC INVESTIGATION OF HYDRATED WATER OF RAT SKIN COLLAGEN IN THE TEMPERATURE RANGE 20-106^{0}C

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The hydration of swelled samples of white rat skin collagen in the temperature range 20-106^{0}C was determined by DSC. This DSC gives the possibility to work both in the scanning regime and in the regime close to isothermic one. This type of calorimeter we called DSIC. Its sensitivity is 0.1μcal, scanning rate –0.02-1.0 ^{0}C/min. In the regime close to isothermic one, the temperature changes not more than by 0.1^{0}C during 10 hours. The volume of measuring vessels, at scanning in the temperature range 0-140^{0}C for study biopolymer solutions, is 0.1-0.3 cm^3, and at study of hydration of samples in the regime close to isothermic one the volume of vessel is from 0.005 to 0.01cm^3.

The determination of bound water quantity in collagen was carried out on the basis of high precise and reliable measurements of heat corresponding to water evaporated from the sample at atmospheric pressure and fixed temperature. The evaporation is carried out due to simultaneous opening of measuring vessel and comparison vessel, containing inert mass, which has the same heat capacity as the preparation. The enthalpy of evaporated water (ΔH_{free}) was calculated from the area located between dependence curve $\Delta H = f(t)$ and base curve (Fig.1, 2). This value with exactness up to 2% coincides with Table data [1] at a given temperature.

The bound water (Δn) is calculated from the ratio Δn (H$_2$O)= $\Delta H_{bound}/\Delta H$ (T)*M, where $\Delta H_{bound} = \Delta H_{expected} - \Delta H_{free}$. ΔH (T) is an evaporation enthalpy of 1gram of water at a given fixed temperature, M-dry weight of preparation in grams (Fig.3).
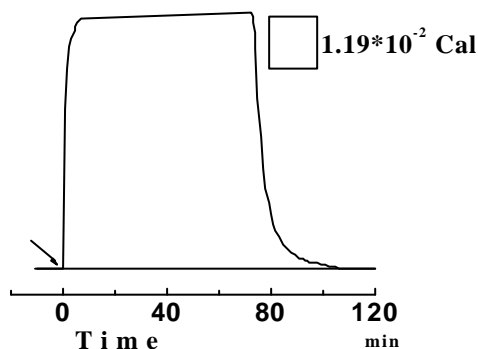

1.19*10^{-2} Cal

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Fig.1. Microcalorimetric record of bidistilled water evaporation process. The measuring vessel contains 0.485 mg H$_2$O. The moment of vessel opening (T=30.05^{0}C) is indicated by an arrow.
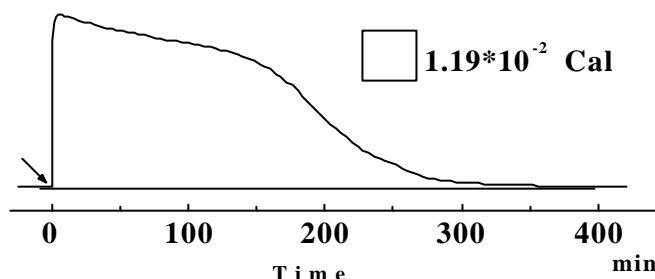
Fig.2. Microcalorimetric record of water evaporation process from swelled collagen of rat skin. The measuring vessel contains 1.97 mg of swelled collagen M$_{dry}$= 1.505 mg. The moment of vessel opening (T=30.05 ^{0}C) is indicated by an arrow.
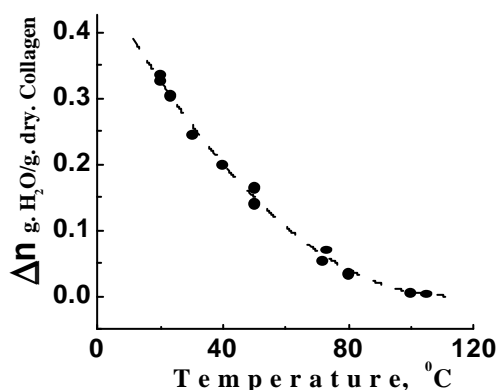

Fig.3. Dependence of hydration of white rat skin native collagen on temperature.

Reference:

1. Tables of Physical and Chemical Constants And Some Mathematical Functions. G.W.C.Kaye and T.N.Laby. Ninth Edition. London. 1941.