# DETERMINATION OF THE MOISTURE CONTENT OF THE MONOMOLECULAR LAYER AND THE ENERGY OF WATER BINDING TO THE MATERIAL OF FREEZE-DRIED MEAT PRODUCTS AND MODEL BODIES

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In freeze-drying, three separate stages of moisture removal from the product may be distinguished: ice sublimation, evaporation of overcooled liquid in the product body and evaporation of bound moisture at a temperature above 0°C at the end of the process.

The present study envolves the bound moisture, while our attention was mainly directed to that part of the moisture which by classification data about the forms of water binding is related to the absorption of the monomolecular layer.

It is known that the process of absorption is connected with release of considerable heat energy.Further, the biggest quantity of energy is released when binding the first monomolecular layer, which is under a big molecule power field pressure.

Consequently, with desorption of moisture in the product (as a last stage of freeze-drying) if we could obstain from the sorption of the monolayer moisture, then we could realize:

1) shorter process time
2) decrease in the energy needed for drying
3) improvement in the natural-biological quality of the end product.

The last listed advantage is due to the protection role of the monomolecular layer - the exidative processes during storage of sublimatiom preserved products are limited.

For evaluation of the energy for binding the moisture to the material we used the method of Krischer (1).With known sorption isotherme for a given product,under different temperatures may be determined the heat of binding $h_b$ or the sorption temperature:

$h_s = h_v + h_b$; with $h_v$ = evaporation heat.

To obtain the isoterme for sorption we followed the experimental tensimetric method.Samples of beef and a model body 'Tylose' of a determined mass were taken in weighing glasses.The samples were placed in an excicator containing a solution of sulphuric acid of a given concentration, thus ensuring a constant humidity of the air in the excicators.After obtaining a moisture balance we determined the respective point for the sorption isoterme. We determined two experimental points, and after the equation of Henderson:

$\varphi = 1 - e^{-kTW^n}$

where

$\varphi$ - is the relative air humidity
T - the absolute temperature
W - balance moisture content
k,n- empirical material constants which are determined by at least two experimentaly found points,we could calculate the sorption isoterme and to extrapolate it for other temperatures.Then we compared the sorption isotermes for beef and the model body 'Tylose'.As a base for similar comparisons in these studies we took the results obtained in point 3.

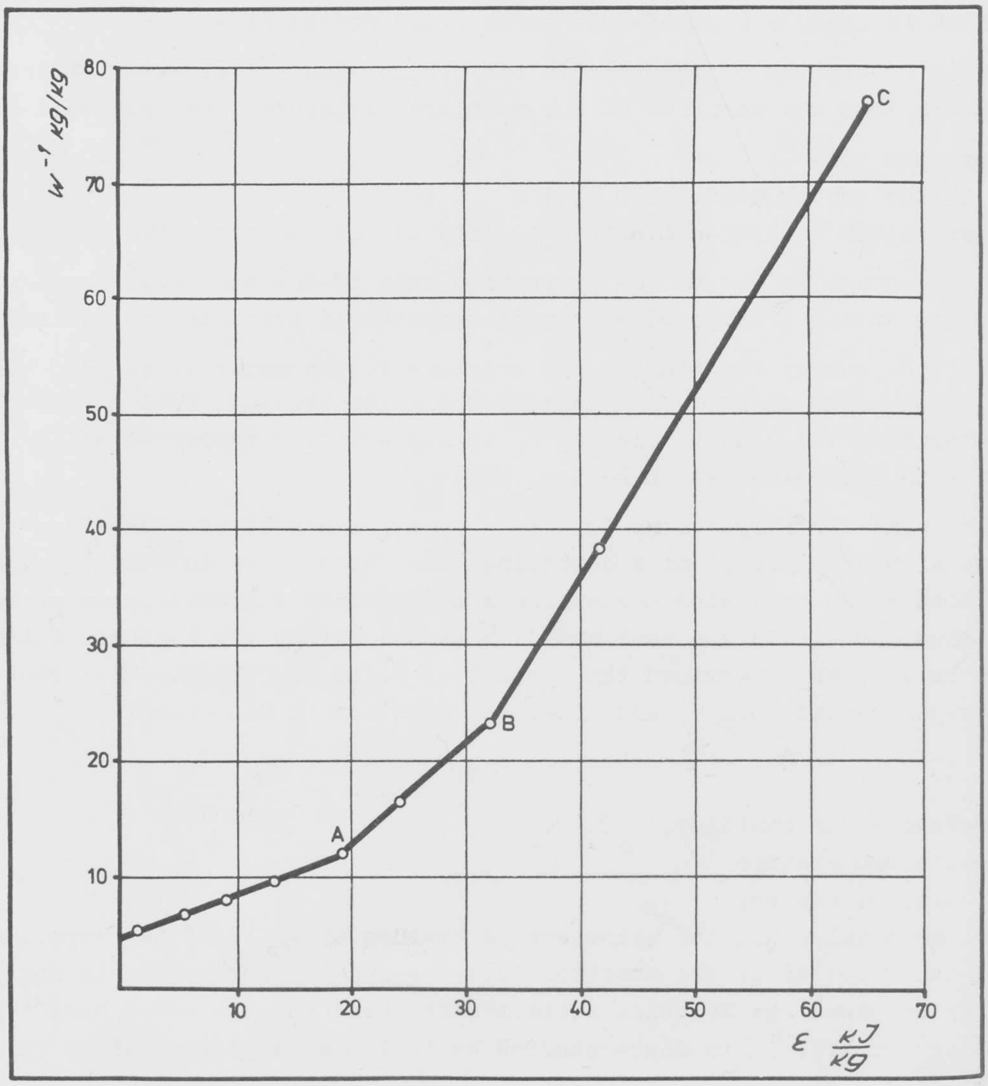
The comparison between the isotermes of sorption for beef and the model body 'Tylose' and the results obtained when evaluating the sorption heat (binding) after the method of Krischer, made possible the construction of the graphic relation between the degree of dryness 1/W and the energy for binding the moisture to the product E. The attached graph in coordinates

1/W and E is constructed on the bases of the isoterme of sorption at +37°C.No significant difference between the isotermes for beef and the model body could be observed.

The graph reveals that the isoterme consists of several straight parts.From the analyses of the curve may be derived the following conclusion: the singular point, p.B in the range of the high degree of dryness corresponds to the limit between the moisture of the monomolecular layer and the polymolecular adsorption. In our case, the singular point is within the range of about 4,3% moisture in relative units,which in turn corresponds to the quantity of monomolecular layer adsorped moisture,calculated after the method of VET - 4,9% (4) and to about 5%, calculated after the method of Egorov (5).

The obtained results permit the following conclusions:

- the quantity of adsorption bound monomolecular layer of moisture (about 4,5%) is securely bound to the product.This can be proved by the energy of the layer (see graph) which is between the ranges of 30 to 35 kJ/kg.
- the elimination of the monomolecular layer moisture leads to additional energy losses, unjustified elongation of the drying cycle, and deterioration of the hydrophilic properties of the product.




Graphic dependability for calculating the moisture in the monomolecular layer.

The present study provided suffucient ground to beleive that the separation of this percentage of moisture (preliminarily evaluated after the given method for each separate product) is not necessary, while this conclusion shall reflect on the price, taste and marketable qualities of the product.

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