

# KINETICS OF THE INHIBITION OF PORK MUSCLE CATHEPSIN D WITH CURING INGREDIENTS

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## INTRODUCTION

The autolytical conversions of animal tissues post mortem are determined with a number of physico-chemical and biochemical changes in muscle fibers, with the breakage of biological systems in the living organism. Lactic acid accumulation in the tissues results in such conditions that favour the catheptic activity improving product consistency and digestibility with digestive enzymes. In the manufacture of cured pork products salt is added to impart a specific flavour and to improve the processing properties of the raw meat. Salt contributes to directed development of biochemical processes, and at the same accelerates oxidative changes of meat heme pigments. To stabilize meat natural colour, NaNO<sub>2</sub> is added to cure. Previously (1) we found the inactivating effect of different NaCl concentrations on tissue proteases activity. It was shown that NaCl was a non-competing inhibitor. The aim of this study was to establish NaCl and NaNO<sub>2</sub> influence on the activity of pork muscle proteases.

## MATERIALS AND METHODS

Methods are disclosed in Kudryashov et al. (1987) (1). The activity of proteases was investigated by Anson's method when incubating muscle homogenates in the presence of sodium

chloride and/or nitrite (2). NaCl together with the buffer solution at pH 3.0 was added to the incubation mixture to provide the ultimate concentration of the former (x) 0.09, 0.17, 0.26, 0.35, 0.43, 0.52, 0.60, 0.69, 0.86, 1.21, 1.72 and 2.59 M; NaNO<sub>2</sub> was added to ensure its final level of 0.72·10<sup>-5</sup>, 1.08·10<sup>-5</sup>, 1.44·10<sup>-5</sup> M. The proteolytic activity of cathepsins was expressed as micromoles of tyrosine/hr/g of the tissue.

## RESULTS

The activity of pork muscle cathepsins as effected with sodium nitrite and chloride added at the above levels is shown in Figs. 1 and 2. The experimental data evidence the inhibiting effect of the curing ingredients upon the tissue enzymes. A linear relation of the muscle catheptic activity (y) to sodium nitrite concentration (d) at different levels of sodium chloride (x) is evident (Fig. 1).

The y/d plot at fixed x = x<sub>i</sub> (i = 1, 2...13) allowed to get a series of parallel straight lines described with the function of the y = -K·d + C type. The parallelism makes it possible to conclude that K is not related to x, and C depends on x. Statistical analysis of the experimental data by means of the least square method yielded the K-values for 10 straight lines, their mean being calculated as K = 0.16·10<sup>5</sup>.

To find C, y is plotted against x at the fixed d = d<sub>j</sub> (j = 1, 2, 3, 4), it yielding a number of curves of the logarithmic type (Fig. 2). Their approximation is possible with the function of the C = e<sup>-ax</sup> type. Thus, the relation of the catheptic activity to NaCl and NaNO<sub>2</sub> can be described with a non-linear model of the y = -K·d + e<sup>-ax</sup> type.

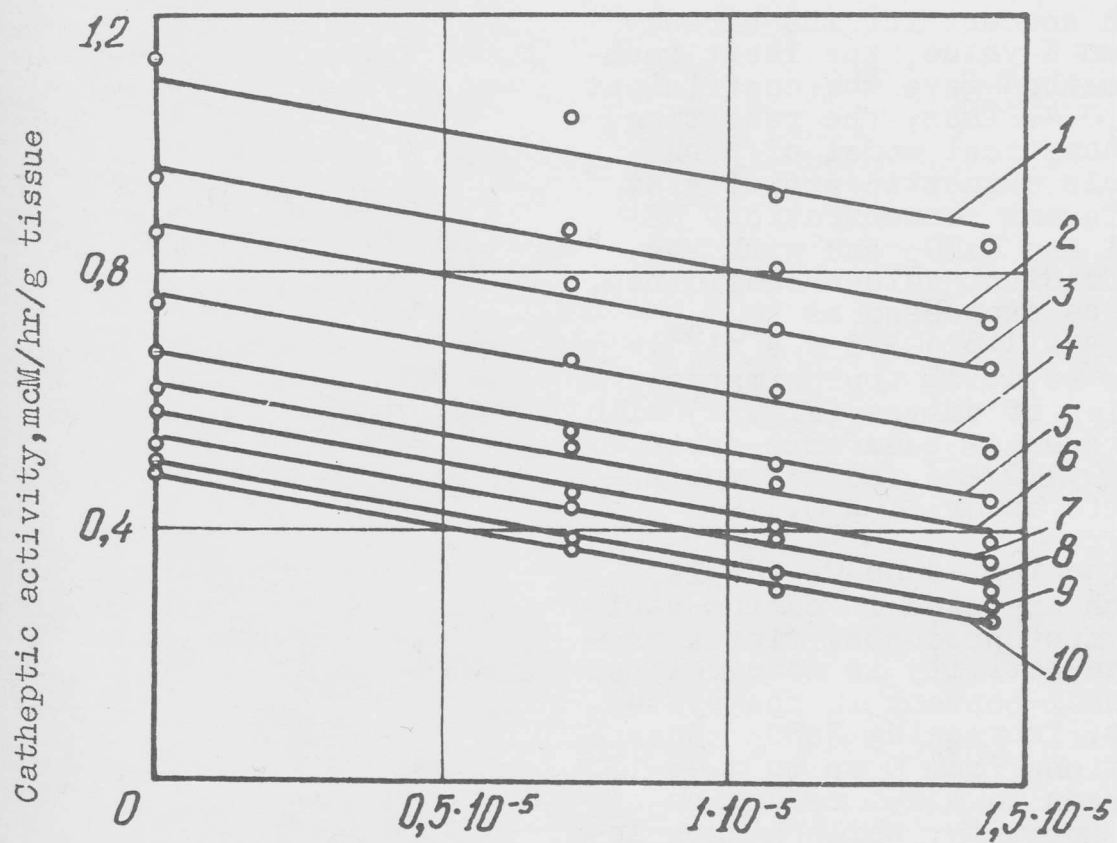


Fig. 1.  $\text{NaNO}_2$  concentration,  $10^{-5}$  M

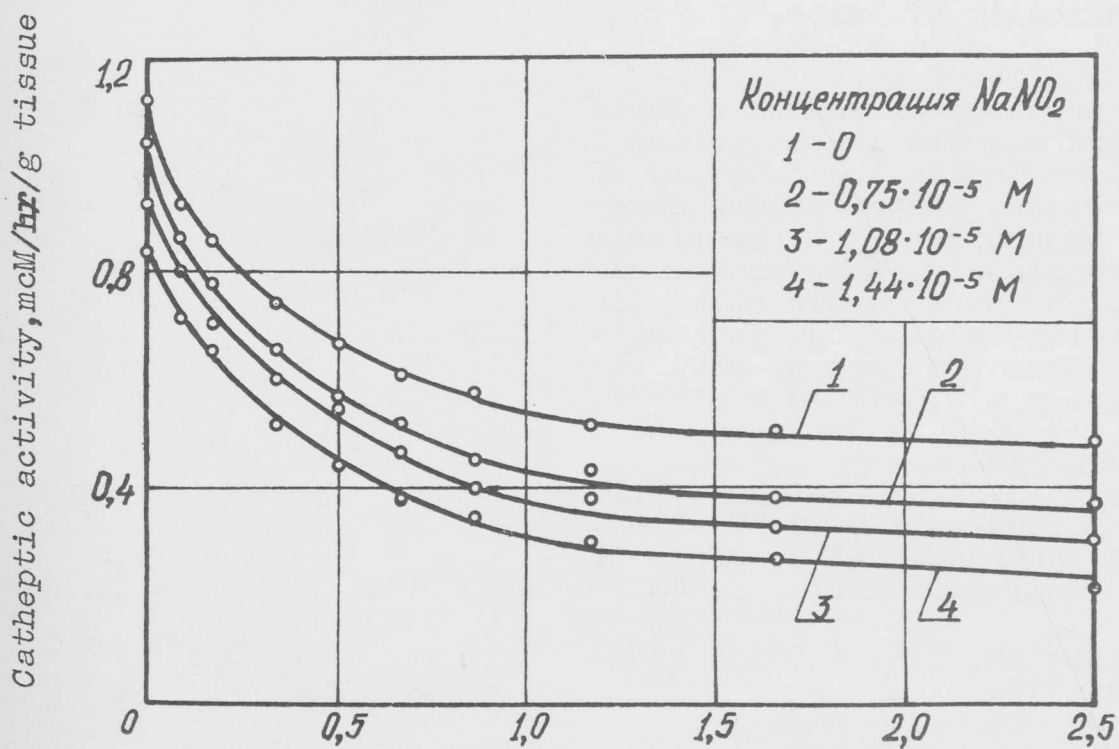


Fig. 2. NaCl concentration, M

With account for the already known K-value, the least square method gave the coefficient  $a = 0.4$ . Thus, the resulting mathematical model of pork muscle catheptic activity at different concentrations of NaCl and NaNO<sub>2</sub> and with the coefficient values considered, can be expressed as

$$y = 1.6 \cdot 10^5 \cdot d + e^{-0.4x}.$$

This relation approximates a series of curves (Fig. 2) with the average quadratic error  $\delta = 0.102$  and the maximum absolute error  $\Delta = 0.148$ .

At the tested NaNO<sub>2</sub> levels, which are used in curing various meat products, tissue protease activity is more related to NaCl content in the system. Thus, increasing NaNO<sub>2</sub> concentrations from 0 up to  $1.44 \cdot 10^{-5}$  M leads to a 25% reduction of the activity, while higher levels of NaCl (from 0 up to 0.86 M) in the absence of NaNO<sub>2</sub> inactivate cathepsins practically by twice.

#### CONCLUSIONS

The presence of sodium chloride and nitrite in the curing mixture lowers the activity of the tissue proteolytical enzymes though does not inactivate it completely. A mathematical model of pork muscle catheptic activity is obtained for various concentrations of NaCl and NaNO<sub>2</sub>:  $y = 1.6 \cdot 10^5 \cdot d + e^{-0.4x}$ .

#### REFERENCES

Kudryashov, L.S., Shaiakina, L.P. and Bolshakov, A.S. (1987). Proc. 33rd International Congress of Meat Sci. & Technol., p. 40.

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