COMPLEX COMPARISON OF TRACTOR TRANSMISSION SYSTEMS BETWEEN CONTINUOUSLY VARIABLE TRANSMISSION AND POWERSHIFT TRANSMISSION

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The main exercises are to ensure maximum power (i.e. cultivated area, transporting power) and agro technical and optimal working speed at tractor-implement aggregate operation.
Significant points are minimizing of costs and specific fuel consumption. This needs to ensure harmonized connection between the tractor engine and characteristics of transmission system at working points on field.
Application of gear ratio of continuous variable transmission and their centralized control together gives several advantages for the agriculture. For that reason we measured more tractor transmission systems for operating advantage in last years.
The result of quick and accurate computer programming is perfect corresponding between engine and Continuously Variable Transmission system. It is absolute conform together the engine speed and gear ratio to situation, travel speed and load. In this way achievable the followings: optimal fuel consumption, minimal exhaust, economical and designable operation.

NEW METHODS OF FRUIT TREE SPRAYING

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During the examinations, besides the spraying machines equipped with axial ventilators, the standard KERTITOX BORA 2000 and the KERTITOX BORA 1000 for intensive plantations, we studied the KERTITOX 600 spraying machine, as well, which is equipped with a linear spraying structure and a axial ventilator. We also examined the KERTITOX BORA 2000 plant detector spraying machine with infra red and ultra sound systems. The range of the coverage on both sides of the leaves was the lowest in the case of the standard KERTITOX BORA 2000, where the achieved values of 1,1-1,9, compared to other examined machines, are quite good results. In the case of the linear KERTITOX BORA 1000 machine the range 1,4-2,6 can also be considered good. The low air capacity KKERTITOX 600 machine's result 1,6-2,8 can also be acceptable considering the fact that the spraying in the next row significantly decreases the ratio of coverage on both sides of the leaves. By applying the infra red plant detector device we had a spray solution saving of 28,1-55,3%. By applying the ultra sound plant detector device, the spray solution saving altered between 49,8 and 68,4%.

EFFECT OF THE DRYING PROCESS ON THE CHARACTERISTICS OF THE CORN BATCHES

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Object of the OTKA (T 037-214) assisted researches are to determine the aggregation characteristics of the corn in the course of drying. Examinations are carrying on with three selected varieties of corn under laboratory and operative circumstances. Examinations contain among others the analysis of the bulk mass and density depending on the moisture content and the shrinkage of grain by the effect of moisture abstraction. The examinations covered the determination of the compressive stress connecting with the humidity, specific compression strain, elasticity modulus and pressure work.

DEVELOPMENT OF LEAKAGE CONTROLLED FLOW DIVERSION SAFETY VALVE

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The strict instructions for heat-treating of raw milk are contained in Codex Alimentarius Hungaricus, 92/46, 92/380 EU Directives and 1/2003 (I.08) FVM-ESzCsM decree. Most of the applied equipments for heat-treating of raw milk have no flow direction valve, which should guarantee the heat-treating of milk by directives in all cases.
The goal of the project: to develop a safety flow-diversion valve for small and medium dairy firms in order these firms will be able to satisfy the EU directions, in this way, their products can take part in the Eu dairy market as well
Developed flow-diversion valve fitted small pipe diameter has double valve seat and leakage system.
The main advantage of developed valve is the follows: the raw milk or failure heat-treated milk doesn't able to flow into the regenerative sections of equipment in the case of the failure of gaskets, even more it shows the gasket failure with leakage.
Using equipments with developed valve cancel a main critical point from the Quality Management System. Innovated valve is quickly installable with standard binder items.
The flow-diversion safety valve, which was developed by Zootechnika Ltd. and University of Szeged, sponsored by EU and Hungarian National Program GVOP 3.1.1-2004-05-0275/3.0. has a Qualification from Bundesanstalt für Milchforschung Institution Kiel n:KI-S 5/04.

MICROWAVE TREATMENTS OF LIQUID FOOD

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The accession of Hungary to the European Union launched a lot of important development in the food industry. The growing market did not only result in the expansion of supply and the appearance of new products but it also created intense competition. Food quality and safety have become more significant in primary food processing. Meeting the requirements of both quality and safety is a very important step to the success in the EU. The application of microwave energy in preservation processes – for example in the pasteurization of liquid food products – may provide a great tool to meet those requirements. Significant improvement may be achieved by the innovation of traditional methods and by making use of the advantages (internal heat production, quickness) that microwave technology may provide.
This paper focuses on introducing the possible use of microwave energy in pasteurization processes (implementation, etc.). It also concentrates on looking for the opportunities to reduce costs of operation and to improve the quality and the safety of food.
Keywords: microwave, pasteurization, temperature, food quality

DETERMINATION OF THERMAL PARAMETERS UNDER INDUSTRIAL CONDITIONS

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The measurement and evaluation of industrial heat penetration curves can help at CAD design of heat transfer because the thermal parameters (e.g. thermal diffusivity) can be determined from it. We investigated the heat treatment of meat products with the Ball method, finite series solution of Fourier differential equation, calculation of thermal parameters from chemical composition and using robust regression. The obtained results were compared with calculation of finite difference method taking into account the temperature dependence of thermal diffusivity. In the course of our investigation we experienced that using robust regression reduced the standard deviation of determination. So the overestimation can be avoided. Although the Ball method using more simplification presumptions is more robust than the infinite series solution, the role of the measurement errors can be hardly cleared out. The initial and boundary conditions and the placement error of temperature sensor influence the value of thermal diffusivity. Its fluctuation caused rather by the temperature development than by the convection and denaturation. The assumption of the infinite large surface heat transfer coefficient resulted often unrealistic large thermal diffusivity values. The thermal diffusivity values deriving from methods dealing with the thermal diffusivities as constant and from chemical composition taking into account the average temperature of the process were close together. The temperature curves calculated with finite difference method taking into account the temperature dependence of thermal diffusivity proved the acceptability of the obtained results.

GEOMETRIC AND AGRO-PHYSICAL CHARACTERISTICS OF WINTER WHEAT VARIETIES

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This study presents the results of the authors' investigations into winter wheat varieties in the years 2000 - 2002. They tested the values of kernel size, kernel and mass density, porosity and also how kernel hardness changes in kernel hardness. Kernel size is noticeably influenced by the year the crop is harvested in, the main contributor being precipitation, first of all. Kernel hardness values reveal a similar tendency.
It was established that kernel hardness is related to several agro-physical characteristics. Investigations suggest that the inverse proportion between hectolitre weight and porosity is greatly influenced by the quality of endosperm texture, i.e. kernel hardness.

EFFECT OF SAMPLE SHAPE AND SIZE ON MEASURED IMPEDANCE SPECTRUM

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Magnitude and phase angle of electrical impedance of apple and potato samples with different shape and size were measured with an HP 4284A precision RLC meter in frequency range of 30 Hz – 1 MHz. The length of gold plated copper electrode pins was 5 mm. The measurements were performed with different electrode distances. A correction for the electrode polarization was calculated and the impedance of biological tissues was evaluated. The value of phase angle was practical independent from the size and shape of sample and the magnitude of impedance increased as the size of sample decreased.

DRYING CHARACTERISTICS OF DIFFERENT VEGETABLES

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Drying characteristics of different vegetables have been examined at the Institute for Biosystems Engineering for four years. Thin layer drying experiments were conducted based on a National R&D Program. Our aim was to model the drying inside belt driers in practice. Drying curves were determined in order to describe the heat and mass transport processes. The moisture gradients as driving force can be calculated from these equations. Our aim is to use water potential gradients instead of moisture gradients in modeling of mass transfer. In order to do this, sorption measurements were carried out in carrots. From the sorption curves water potential and pF values can be determined. Based on these examinations the heat and mass transport modeling was established.

DYNAMIC AND STATIC METHODS OF KERNEL HARDNESS MEASUREMENT

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In the last few decades the interest in the commercial classification of wheat varieties has increased significantly making the need for dividing kernels into hard and soft ones based on their kernel texture even greater. In our investigation we used two dynamic methods (Perten SKCS 4100 measuring device and Perten 3303 disk-type mill) and a quasi static method (LLOYD 1000 R testing machine) to measure kernel hardness. Our objective is to compare and critically analyse these three methods.
Our results suggest that all three methods are suitable for determining wheat kernel hardness. The static measuring method is a far more precise way of determining the kernel hardness of the same varieties harvested in different years. Besides, the results we received are far more informative. Dynamic methods, on the other hand, are quicker and show more resemblance to the milling processes.

OPTIMAL FREQUENCIES OF INERTIA TYPE FRUIT TREE SHAKERS

(Sponsored by the Hungarian Scientific Research Fund)
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Optimal shaking frequency can by defined in many ways. In this paper optimal shaking frequency means shaking the tree at one of its natural frequencies, whereby the efficiency of the power input is the highest.

ENERGY ASPECTS OF WIND MEASUREMENTS IN HUNGARY

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The Hungarian wind atlas has not been ready yet, so we can choose a place to install just randomize or lean on the meteorological measuring, and after the necessary local wind measurements can we decide where rewarding the installation.
The main objectives are:
- to analyse the data of long-term measuring at several places, to show our experiences, and find out the trends and the criterions
- to analyse the Hungarian wind characteristic (wind speed, wind direction, the Hellmann's coefficient, the expectable energy production etc.), after the interpretation to show the Hungarian specialities, to give recommendation to selection the installation place, the mode of the measuring, and the recommended tasks during the analysis
- to define the correct parameters for the investors and the manufacturers, which help them to choose the best solution and best efficient wind generator
- by means of the analysing the Hellmann's coefficient to give an input data's to the Hungarian wind atlas, and a control data's locally or all around the country

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DETERMINATION OF THERMAL PARAMETERS UNDER INDUSTRIAL CONDITIONS

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Introduction

The estimation of the thermal diffusivity from heat penetration curves is a general practice in the literature of the heat treatment. It can be solved with a fast computer very quickly. Nevertheless we have to think about the use of the obtained results in further calculations so the accuracy is a fundamental requirement. Investigating the published values a real wide range can be observed. We summarised it for meat products in Table 1. It can be observed outlaying values (e.g., CARCIOFI et al. 2002), but the most values are in the range of about $1.2{\cdot}10^{-7} \div 1.4{\cdot}10^{-7}$ m²/s. Our aim was to investigate why the differences in literature data exist.

Table 1 Thermal diffusivities of meats and meat products

Author and publication year	a 10^7 [m²/s]	Notice
TSCHUBIK and MASLOW (1973)	1.2	Ham
DICKERSON and READ (1975)	1.2-1.3	Beef ham
RIEDEL (1969)	1.2-1.43	Calculated from water content 10-70°C
LŐRINCZ and LENCSEPETI (1973)	1.2	Cured meat
SANZ et al.(1987)	1.1-1.3	Lean meats
MITTAL and BLAISDELL (1984)	1.165-1.325	Meat batter
HUANG and MITTAL (1995)	1.6-1.9	Meat ball, during cooking and frying
McDONALD et al. (2002)	1.15-1.207	Cooling cooked beef
MITRA et al. (1995)	1.28-1.52	Mortadella in hot smoking and cooking chamber
KÖRMENDY (1991)	1.27	Ham sausage
KÖRMENDY (1991)	1.42	Cooked sausage „Veronai"
KÖRMENDY (1991)	1.74	Potted meat
KÖRMENDY (1991)	1.93	Sports spread with cheese
CARCIOFI et al. (2002)	2.4	Mortadella, in hot smoking and cooking chamber

Methods and materials

For the calculation of thermal diffusivity from chemical composition we used relationships of MILES et al. (1983), CHOI and OKOS (1986) and RIEDEL (1969), MARTENS (1982). The heat penetration curves were evaluated by Ball method and the thermal diffusivity calculated by RAMASWAMY (1982). As curve fitting methods we used classical least squares and robust regression (RAJKÓ, 1994). The aspects of convectivity and conductivity were investigated by Nusselt function for free convection. The convection limit was considered as Ra (Rayleigh number) = 1000 (MIHEJEV 1987). The thermal parameters of fats were taken from tables of KISS (1988). For the determination of the heat transfer coefficient we used the infinite series solution of Fourier differential equation (WONG 1983). For comparison with the temperature dependence we used the finite different method with finite surface heat transfer coefficient following TEIXIERA et al. (1969).

Results

The highest value in Table 1 derives from CARCIOFI et al. (2002). They explained it by the change of the thermal parameters due to the protein denaturation about 70°C. The heat penetration curves of Ball and Fourier would have been broken earlier because the myosin fraction at 50-55°C and sarcoplasmic protein about 60°C already denatured which does not happen in all layers at the same time. However the reason is different. According to our experience the moist heat transfer coefficient of moist air stream in cooking chamber can be expected about 200-400 W/m²K. RAMASWAMY et al. (1983) measured 10000-15000 W/m²K surface heat transfer coefficient for pour steam condensation which can be decreased to 1000 W/m²K in case of 50% condensate content. Thus Eq. (1) appeared in CARCIOFI et al. (2002) is not proper for the estimation of thermal diffusivity. If we recalculated f_h value using the thermal diffusivity given by CARCIOFI et al. (2002), 45-52 min can be obtained. f_h values for our cooked sausages similar in size and composition are summarised in Table 2. The values obtained by our calculations are about two times greater, but the standard deviations correspond to the published values (SINGH 1982). If we calculate the thermal diffusivity with our f_h value, then we are in the region of $1.29 \div 1.48{\cdot}10^{-7}$ m²/s which is the most frequent region in Table 1. The same is true for the calculations with the 200-400 W/m²K finite surface heat transfer coefficient. The procedure of CARCIOFI et al. (2002) neglects the finite surface heat transfer coefficient, as used by others as well (JARAMILLO-FLORES AND HERNANDEZ-SANCHEZ 2000). They obtained high values similar to the water ones.

Table 2 Ball slope indexes for cooked sausages (f_h)

	Sausage „Olasz"	Sausage „Veronai"	Sausage „Vadász"
Mean	84.5	85.4	84.2
Standard Deviation (SD)	7.7	6.5	6.1
Relative SD	9.2	7.7	7.2

The high thermal diffusivity values for foods, higher than ones of water, can not be accepted. Although the thermal conductivity, specific heat and density are different for fat, water and protein the water has the highest thermal conductivity and protein and fat has smaller ones. If we take into account the ratios of the chemical compositions of cooked meat products (for water 60-70 %, for protein 10-12 %, and for fat 18-20 %, resp.), then the fat and protein should decrease the thermal diffusivity values, therefore the thermal diffusivity of the products has to be smaller than the water ones in spite of that smaller specific heat and about the same order of density (Table 3).

Table 3 Thermal parameters of sausages and its constituents

Product	Thermal diffusivity [m²/s]*10^{-7}	Thermal conductivity [W/mK]	Specific heat [J/kgK]	Density [kg/m³]
Sausage „Vadász"	1.401	0.457	3431	950
Mortadella	1.300	0.430	3211	1029
Sausage „Olasz"	1.537	0.500	3758	866
Mean	1.307	0.451	3325	1036
Lean meat	1.307	0.500	3610	1058
Fat	0.961	0.180	2014	930
Water	1.435	0.600	4180	1000
Protein	0.762	0.200	1900	1380

The value of MITRA et al. (1995) is surprisingly in the upper region of the expectable values because of the unrealistic high specific heat (4600 J/kgK) used. The thermal diffusivity calculated from the composition does not support the wide range of figure of KÖRMENDY (1991). If we calculate the thermal diffusivity from the composition according to MILES et al. (1983) we obtain the lower level of the presented published values in Table 1, meanwhile the equation taking into account the temperature dependence show a maximum $1.5{\cdot}10^{-7} \div 1.6{\cdot}10^{-7}$ m²/s (Figure 1).

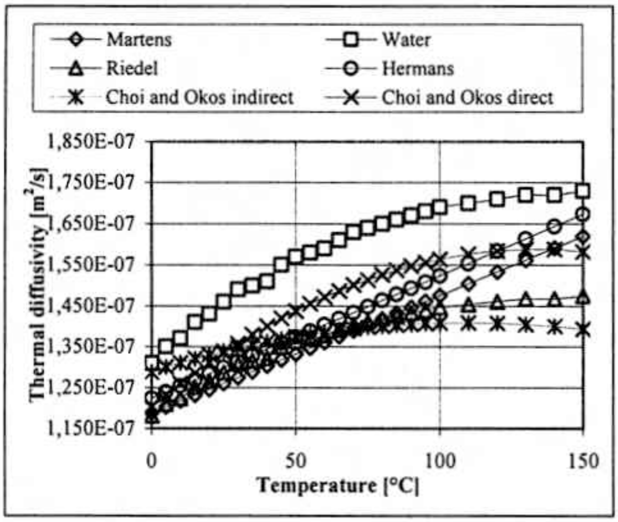

Fig. 1 Temperature dependent thermal diffusivity calculated from chemical composition

The larger thermal diffusivities are often explained by convection. KÖRMENDY (1991) gave 20% larger thermal conductivity and thermal diffusivity as expectable according to Table 3 He explained it by local convection effect in melted fat. If it happens to, then the 3-5 times faster convection heat transfer would cause a break in either Fourier or Ball graphs. It was not experienced in our measurements, because the fat and water are in emulgated and immobilised form in a protein matrix in case of homogenous product. If the fat is dispersed as particle in the product (typical particle size in meat products is 5-20 mm) the convection can be considered as equivalent thermal conductivity in narrow closed space. The product of Pr·Gr values are far under 100 calculated for fully melted fat and the resulting convective heat transfer coefficient is 0.4÷0.5 W/m^2K which is much smaller than the 40÷60 W/m^2K of water and even than the 5÷10 W/m^2K of still air. So the heat transfer intensity is 1/10 of the air which implies very slow heat transfer. The immobilisation is true here as well. The fat is involved in a connective tissue structure having very short distance between the connective tissue membranes. These are only partly disrupted during mincing or chopping. Therefore the convection has only a minor role. It is interesting that the value of DICKERSON and READ (1975) is in the acceptable range although they used variable ambient temperature determination. On the other hand the constant ambient temperature is most frequently used in the heat treatment and in laboratory determination as well. RIEDEL's method (1975) incorporates the temperature dependence of thermal diffusivity of water giving lower and upper limit for the range of 10-80°C, see **Hiba! A hivatkozási forrás nem található.**.

The differences in thermal diffusivities are due to the circumstances of the heat penetration measurements. The **Fig.** *2* show the differences for different ambient temperature and package size having very little filling weight differences (12 lb =5443 g, 11 lb 4891 g) but considerable difference in size (12 lb oblong 105X160X 305mm and 11lb Pullman (110X110X 380mm).

The least squares fitting of FDE ISS gave for the same materials significantly different thermal diffusivity values for holding and cooling. This evaluation is much more sensitive for the violating the presumptions compared to the Ball evaluation (LARKIN and STEFFE 1987).

The extrapolated thermal diffusivity for the core is about $1.3 \cdot 10^{-7}$ m^2/s. It is in agreement with the expected value in Table 1 and fitted value for 12 lb cans in Table 4. Similar phenomena arose if the temperature sensor placement error increased (Fig. 3).

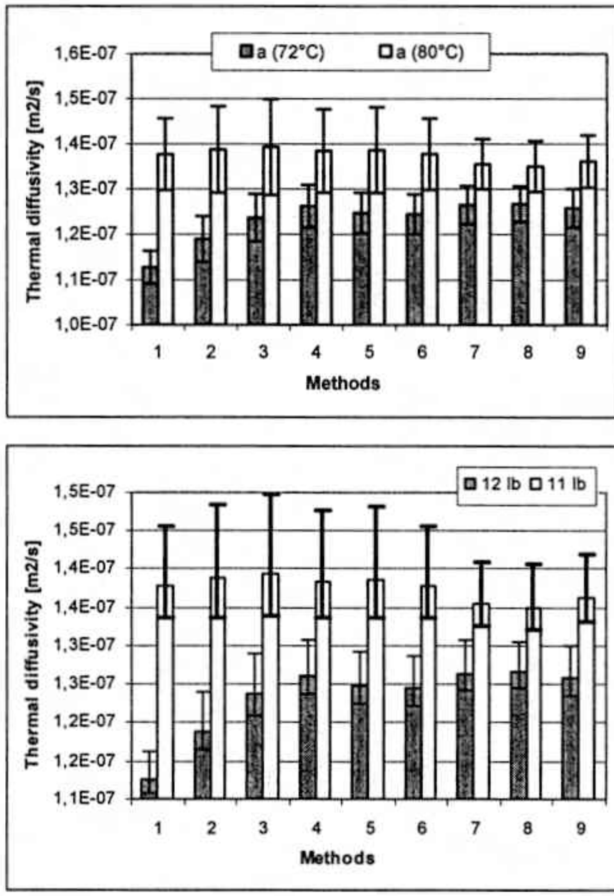

Fig. 2 Thermal diffusivities obtained by Ball method and robust regressions. 72 and 80°C ambient temperature in semi preserved ham packed 12 lb cans (LEFT). 11 lb Pullman and 12 lb oblong cans temperature 12 lb semi preserved ham (RIGHT)

Table 4 Thermal diffusivities obtained by least squares fitting of FDE ISS curve for holding and cooling phases [m^2/s]

Packaging	Holding phase		Cooling phase	
	Mean*10^{-7}	SD*10^{-9}	Mean*10^{-7}	SD*10^{-9}
11lb Pullman	1,41	5,5	1,16	6,8
12lb Oblong	1,30	7,4	1,13	6,5

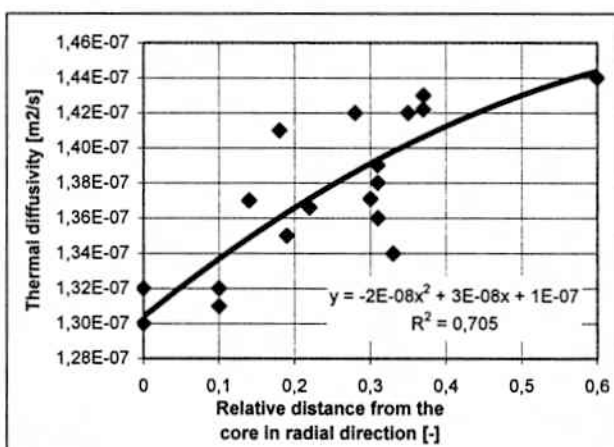

Fig. 3 Effect of temperature sensor placement error on the thermal diffusivity for Parisers (d=80 mm)

The temperature development calculated with constant and variable (RIEDEL 1969) thermal diffusivity were very close to the ones calculated with $1.3 \cdot 10^{-7}$ m^2/s constant thermal diffusivity (Fig. 4) which correspond to the most frequent region of the values in Table 1.

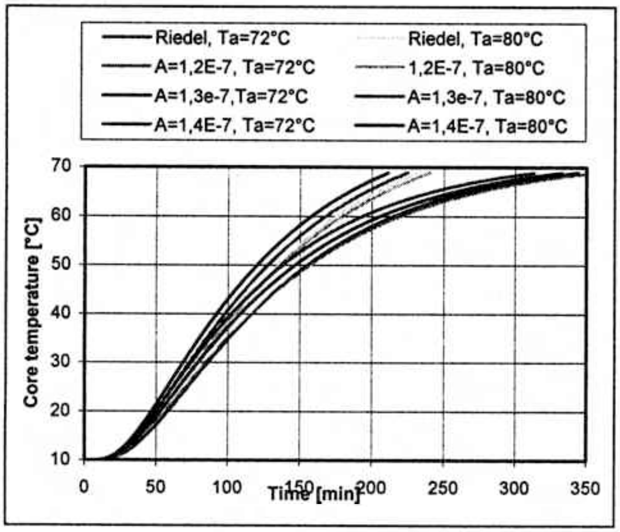

Fig. 4 Temperature development in ham packaged into 12 lb cans Calculated with constant and variable thermal diffusivity (Riedel 1969).

Conclusions

- The determination methods treating the thermal diffusivity as constant give values reflecting the average temperature during the process. Thus it is possible that different thermal diffusivities can be obtained depending on the heat penetration circumstances for meat products with the same or similar chemical composition.
- The temperature sensor placement error increases the thermal diffusivity. Thus the measuring position affects the thermal diffusivity and the f_h slope index of Ball. The same is true for the driving force.
- The above mentioned effects arise together many times. Therefore we can say for the practice that the constant thermal diffusivity determination gives good preliminary estimation provided the initial and boundary conditions are not changed and we calculate it for the core. After changing the conditions, shifting could be expected in thermal diffusivity. The temperature dependence should be taken into consideration for the exact (more precise) calculation.

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