E/2 CHANGES IN THE LIPID COMPONENT OF CANNED PORK PRODUCTS UNDER THE INFLUENCE OF HEAT TREATMENT

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**РЕЗЮМЕ**

**Объектом настоящей работы является установление влияния термической обработки при ограниченном доступе воздуха на глицеридный состав и некоторые сопутствующие жиров биологически активные вещества. Прослежены гидролизные и окислительные изменения, протекающие при различных температурных режимах и изменения стабильности посредством сравнения индукционных периодов жира до и после термической обработки.**

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L'objet du présent exposé, c'est l'établissement de l'action du traitement thermique, lors d'un accès limité d'air, sur la composition des glycérides et sur certaines substances biologiquement actives accompagnant les graisses. On fait une analyse des modifications concernant l'Hydrolise et l'oxydation qui ont lieu lors de régimes de température différents, ainsi que du changement de la stabilité, au moyen d'une comparaison des périodes d'induction des graisses avant et après le traitement thermique.

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The object of the present work is to establish the effect of heat treatment with a limited access of air on the glyceride composition and some biologically active substances accompanying fats. The hydrolytic and oxidation processes taking place at different temperature regimes are followed, as well as the change in stability by comparing the induction periods of the fat before and after heat treatment.

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In der vorliegenden Arbeit wird der Einfluss der Hitzebehandlung bei beschränktem Luftzutritt auf die Glyzeridenzusammensetzung und auf einige fettbegleitende, biologisch wirksame Stoffe festgestellt. Es werden die durch Hydrolyse und Oxydation auftretenden und bei verschiedenen Temperaturverhältnissen verlaufenden Veränderungen verfolgt, sowie auch die Stabilitätsänderungen durch Vergleich der Induktionsperioden des Fettes vor und nach der Hitzebehandlung.

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Deterioration of the fats is a constant problem in the food industry, as it appears in all operations in the meat industry. The existence of light, higher temperature and air are basic conditions for the iniciation of a number of processes leading to undesirable changes in food products. In conjunction with the acting factors, the deterioration of the fats can follow a hydrolytic pattern (with free fatty acids, mono, diglycerides and glycerine as end products), an oxy pattern (with hydrocomplexes, destructive carbomyl derivates and others as end products), or polymerisation processes.

The thermal treatment of canned meat products, creates conditions for changes in the fats under the presence of moisture, enzymes and air in limited quantities, as a result of wich are established free low and high fatty acids, oxy products and others. The scope of the present work is to follow the hydrolic and oxy changes in fats contained in canned meat products, pasteurized and sterilized under different temperature regimes.

## Material and Methodics

As material for the investigation was used pig meat containing about 50% fat and clean kidney fat from pigs. Both

types of material were used after a 24 hours of cooling at 0 - 4°C following slaughter.

The cooled material were machine comminuted with openings of the plate 3 mm, after wich were filled in lacquered 140 gr cans without vacuum. Both materials were treated for 60 minutes under temperatures generally used in the practice for pasteurization and sterilization of canned meat products of 72°, 82°, 110° and 121°C. As controls were used meat and kidney fat not thermally treated. Immediately after the termal treatment from the samples of each temperature regime were opened five tins, from which was obtained a mean sample for laboratory investigations.

The extraction of the fat from the mean meat and fat samples was made under normal conditions using ethyl ether in a laboratory mixer, after wich the miscella was dehydrated with anhydrous sodium sulphate. After filtration the solvent was destilled under vacuum.

The hydrolic changes of the obtained fats were followed by determining the free fatty acids in ethanol-ether media, expressed as acid figure (1).

The oxydizing changes were determined by the oxy groups contents after the jodometric method with cold soaking (2), while the refractory values of each sample were determined with the refractometer ABBE (3). The absorption spectrum of fats was also determined by spectrophotometer VSU2-P with 232 nm and 270 nm wavelength in 0,2% solution of cyclohexan and 1 cm cell (4). The stability of the fats was determined after the modified method of S. Ivanov (5) by measuring the induction period of each type of fat under conditions of accelerated oxidation by increasing the temperature. Parallel with the objective laboratory methods for evaluation the degree of fats oxidation, an organoleptic evaluation was made using the 20 points scale (6).

## Results and Discussion

The data obtained from the laboratory investigations are presented in figures and tables.

From fig. 1 is evident, that after thermal treatment of pig meat and kidney fats, the contents of free fatty acids do not exibit any significant changes. It is also evident, that the destruction of the glycerids is not influenced by the temperature, i. e. the hydrolytic process is not directly influenced by the applied different temperature regimes.

On fig. 2 are presented data for the quantity of oxy groups, created after a 60 minutes treatment of the samples at 72°, 82°, 110°, and 121°C. It is evident that more significant accumulation of oxy products is seen in the samples of the kidney fat in accordance with the increase of the temperature - from 1.1% $J_2$ for the sample, not submited to any thermal treatment, to 14.8% $J_2$ for the sample sterilized at 121°C, while for the fat treated thermally in immediate contact with the meat, no oxy products are observed.

Table 1, presents the values of the refractions at 40°C, and the stability of the investigated samples. It is established that these two indexes are not influenced by the applied different temperature regimes of pasteurisation and sterilization for 60 minutes.

Data from the spectral analyses show that (fig. 3) in the region about 232 nm, in which the absorption is due to primary oxy products - unsaturated mono-hydro oxy products with a system of long chains (7,8),increases parallely with the temperature and is strongly evidenced with the samples of the kidney fat: $E_{232}$ = 0.582 for thermaly untreated fat, the absorption reaches a value of $E_{232}$ = 1.420 for the sample sterilized at 121°C. This absorption is related to the increase in the oxy products in the same sample. The extracted fats from the meat do not exibit basic changes, related to the temperature regime of treatment. The specters in the region of 270 nm, in which region are absorbed the by-products of the oxydation (7) - destructive low aldehydes and cetons and destructive low fatty acids - show, that the quantity of the secondary carbonyl complexes is negligeable and that the speed of destruction to oxy groups is considerabily lower from that of their formation.

The organoleptic evaluation of the investigated samples was made by 4 judges after the 20 points scale, while the results obtained were statistically treated. The data obtained show that the different temperature regimes of pasteurisation and sterilization do not clearly express an influence on the quality of the samples.

From the results obtained after the different methods for determination of the oxy-hydrolyc changes in the initial phase of the thermaly treated fats, it was established, that under the discribed conditions are prevalent the following oxy processes: creation and accumulation of oxy substances and an increase of the absorption value in the region of 232 nm. The presence of proteins supresses to a certain extend the oxy and hydrolyc processes in the fats and meat, which is most probably due to the expressed antioxydant action of certain amynoacids (9).

As a result of the investigations made, could be made the following conclusions:

1. For a better resolution of the oxy changes in fats (in the formulation of which exist fatty acids having more than one double bond) in the early stages of the oxydation, could be used as best sensitive the spectrophotometric method in the ultraviolet region for the determination of the oxy complexes. Further, it is qlso necessary to evaluate quantitatively the oxy products.

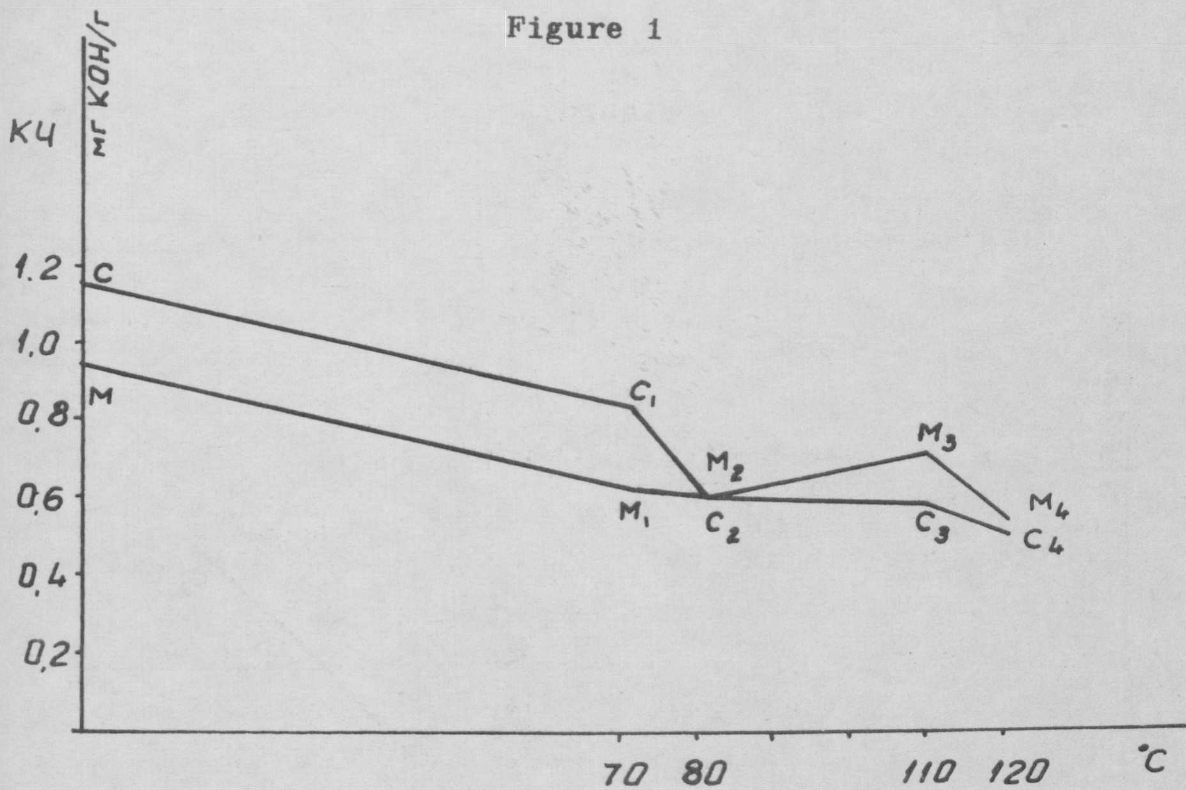
2. In hermetically closed tins, the different temperature regimes do not excercise any considerable influence on the oxy and hydrolyc changes in the fats from the meat during the pasteurization and sterilisation.

TABLE 1

Refraction Values and Stability

| Samples | | $n_D^{40}$ | Stability hours |
|---|---|---|---|
| 1. Fats from meat, not treated thermally | M | 1,4600 | about 15 |
| 2. Fats from meat, pasteurized at 72°C | $M_1$ | 1,4600 | about 15 |
| 3. Fats from meat, pasteurized at 82°C | $M_2$ | 1,4600 | about 15 |
| 4. Fats from meat, sterilized at 110°C | $M_3$ | 1,4600 | about 15 |
| 5. Fats from meat, sterilized at 121°C | $M_4$ | 1,4600 | about 15 |
| 6. Kidney fats, not trated thermally | C | 1,4592 | about 15 |
| 7. Kidney fats, pasteurized at 72°C | $C_1$ | 1,4592 | about 15 |
| 8. Kidney fats, pasteurized at 82°C | $C_2$ | 1,4592 | about 15 |
| 9. Kidney fats, sterilized at 110°C | $C_3$ | 1,4595 | about 15 |
| 10. Kidney fats, sterilized at 121°C | $C_4$ | 1,4596 | about 15 |

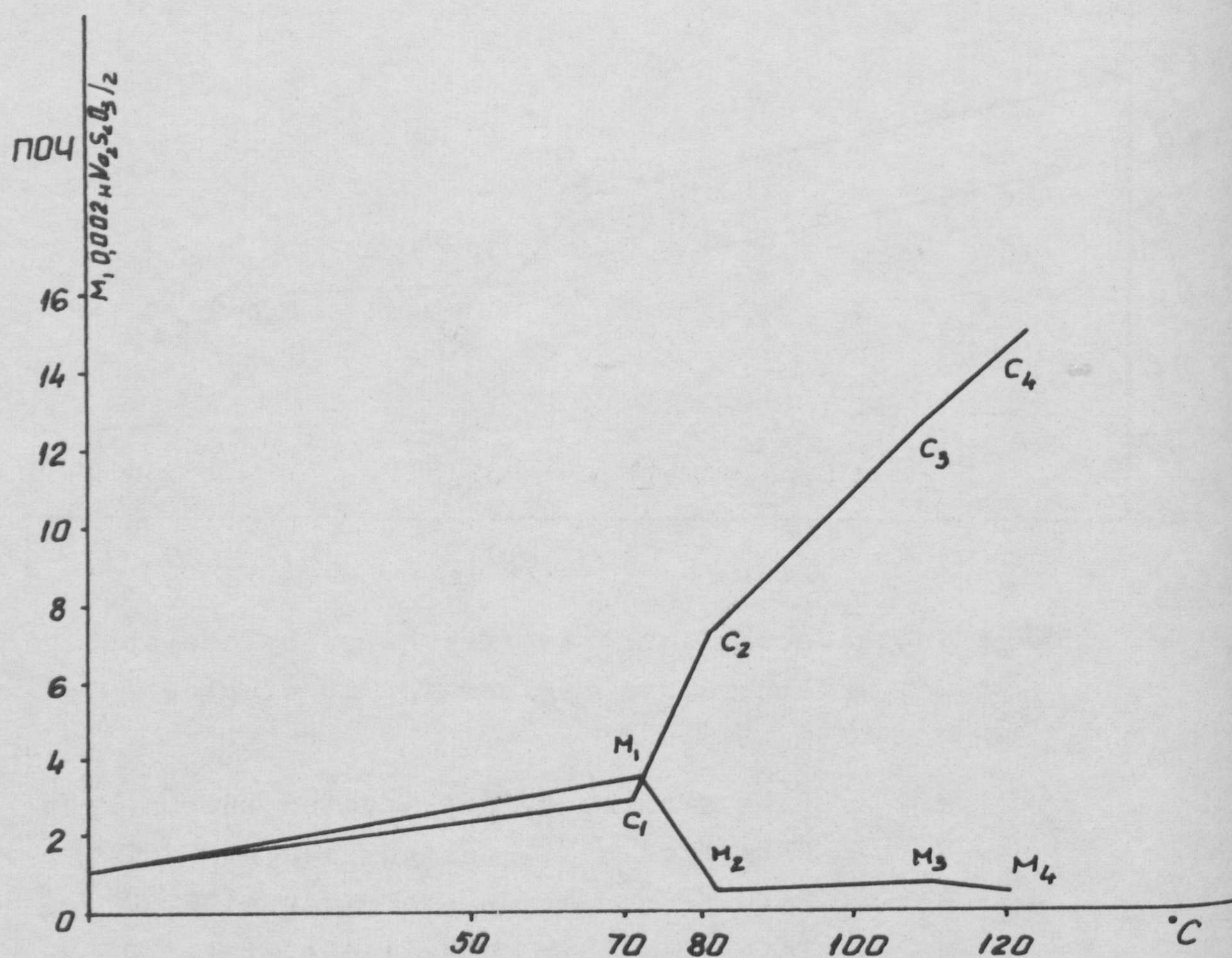
Figure 1




**Change in the acid figure as influenced by the applied temperature regimes for 60 minutes**

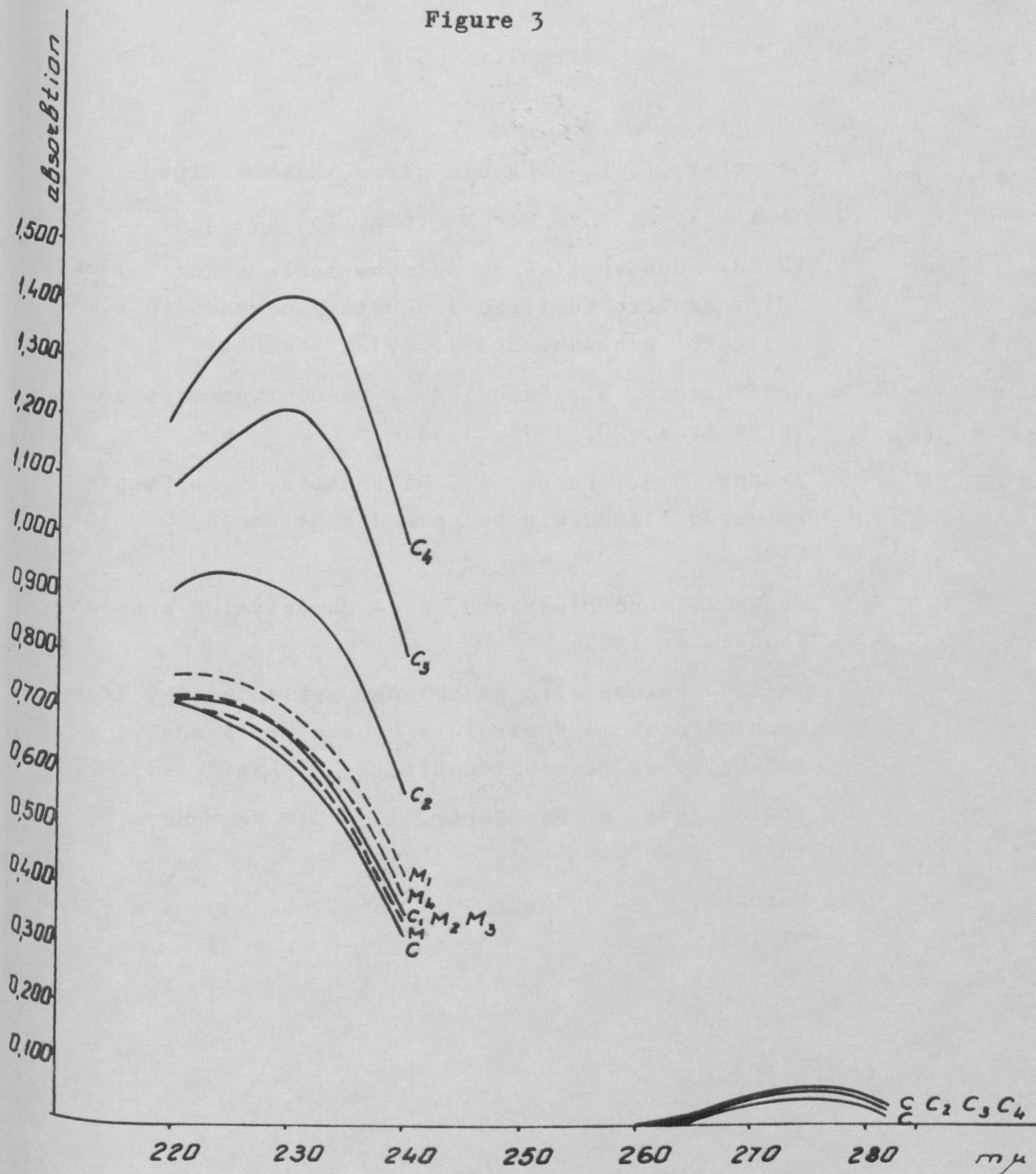
- M - Fats from meat, not treated thermally
- $M_1$ - Fats from meat, pasteurized at 72°C
- $M_2$ - Fats from meat, pasteurized at 82°C
- $M_3$ - Fats from meat, sterilized at 110°C
- $M_4$ - Fats from meat, sterilized at 121°C
- C - Kidney fats, not treated thermally
- $C_1$ - Kidney fats, pasteurized at 72°C
- $C_2$ - Kideny fats, pasteurized at 82°C
- $C_3$ - Kidney fats, sterilized at 110°C
- $C_4$ - Kidney fats, sterilized at 121°C

Figure 2




Changes in the oxy figure following the applied temperature regimes for 60 minutes: the markings are as on figure 1.

Figure 3




Spectres in the ultraviolet region:
markings are as on figure 1.

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