Determination of iron and tin in canned meat

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On investigating the corrosion process of metal containers a simple methodology of following the course of the process is important. A good measure of these processes is the determination of changes in the content of a selected metal in the examined food.

In case of canned meat it is essential to determine its content of iron and tin Other metals either appear in a small quantity or have no essential influence on the quality of product.

Many methods of determinations of these metals (1,2,3 and 4 are) known. However, only a few of them can be used in a normal laboratory engaged in the analysis of food. Owing to their sensitivity and simplicity, colorimetric and polarographic methods have the greatest importance. A defect of most of the described methods is that a separate procedure is needed for each component.

In order to solve the problem outlined abore the object of this work was the developenent of a procedure for an easy and accurate determination of iron and tin in the same sample of canned meat.

On the basis of preliminary tests we selected a producedure consisting in a wet mineralization of the sample and in the determination of

a) iron by a colorimetric method, using - dipyridyl (4,5), and of

b) tin by a polarographic method (3,6,7) in the obtained solution.

Investigations were made with sterilized canned meat ot the type "luncheon meat" and with modelled canned meat containing the longest shoulder muscle minced,

Experimental part

Sampling

On taking a sample representing the entire can of canned meat it is essential to carry out the determination accurately. It is difficult to take a representative sample because the mentioned metals appear partly in the form of deposits and are unevenly distributed in a charge (depending on the distance from the walls of the can). The homogenization of a whole charge and then withdrawing a sample from this homogenizate does not secure a sufficient reproducibility of the determination.

Ot the basis of comparing the results of preliminary investigations the folowing procedure was adopted. From a block of canned meat, three wedge-like samples (Fig.No.1) were cut ont the points of which were at the same time geometric centres of the canned meat block.

The weight of a taken sector, i.e. wedge, is proprotional to the quantity of jelly (i.e. of constituents liquefied on heating the product), Thus, in a 10-g sample

to be testeuantities of solids and liquids of the canned meat are present rotich truly represent the entire content of the block.

Example: the weight of a block of meat in a tin of 99 × 47 mm size was 200 g and that of jelly 50 g. It means that the jelly made up 1/5 of the content. The whole sample contains then for instadce 8 g of meat and 2 g of jelly.

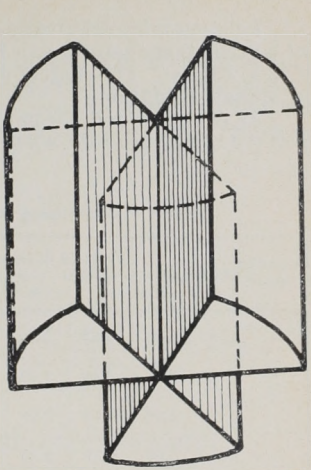

Fig. 1. The method of cutting out of the samples

Mineralization of a sample

A weighed portion of about 10 g of meat (collected im the way described above) was transferred to a 250 ml Kjeldahl fask, flooded with 3 ml of culphuric acid (d = 1,84) and 100 ml of concentrated nitric acid (d = 1,42) and heated with a small flame of a burner. For better mineralization of the sample, 20 ml portions of concentrated nitric acid were added several times (2-3) during the proccess. When vapours of sulphuric acid appeared, 1 ml of a 70-percent solution of perchloric acid was addes, and heating continued until colourless solution was obtained. After cooling the flask, 10 ml of redistilled water was added and the contents quantitatively transferred in a 25 ml volumetric flask. In the obtained solution (I) the content of iron and tin was determined.

Determination of iron

5 ml of solution I was made alkaline to pHi3,2 with a 30% sodium hydroxide solution, 2 ml of a 10% hydroxylamine hydrochloride solution was added and after stirring, the solution allowed to stand for 5 minutes. After adding 10 ml of an acetate buffer solution (pH = 3,8), 2 ml of a 0,1%dipyridine solution was added and completed with bisdistillaed water to 20 ml. The optical density of the solution was measured at 520 - nm wavelength.

Content of iron in a sample should be read from a standard line plotted on the basis of iron determinations in standard solutions containing from 0,0 to 0,5 mg Fe in 5 ml of the solution.

The obtained results can be converted into iron content in 1 g of a charge or in the whole mass of a charge.

Determination of tin

20 ml of the solution I was transferred into a 50 ml centrifuge tube 1 ml of an aluminium chloride solution concentrated to 2 ml A1/1 ml and a drop of a 0,1% methyl red solution added. The solution was made alkaline by adding ammonium hydroxide solution (d = 0,9) until the colour of the solution chanfed from raspberry red into straw-coloured. The excess of added ammonium hydroxide must not exceed 0,2 ml. After centrifuging the mixture (15 min., 3000 rpm.), the liquid was decanted and the deposit dissolved in 5 ml of a hydrochlorid acid solution (1/1). After completing to 20 ml with a saturated ammonium chloride solution, the obtained solution was transferred into a polarographic cell. It is advisable to add 1 drop of a saturated cresol red solution in 70% ethanol.

Polarographic determination was carried out in a nitrogen stream (15 minutes of a preliminary saturation). For the determination of tin a wave of potential of 0,52 V was used. The content of tin in the solution was determined by the method of standard addition.

As in case of iron, the obtained results are to be converted to tin content of 1 g of the charge or in the whole mass of a charge.

Table 1

Results of determining the tin content ($\times 10G^{-4}$) in selected canned meats

Canned meat	Tin	Result of determination				Standard deviation S (x)	Standard error S ($\bar{x}$)	Confidence interval (α=0,05)	Variability ratis Vx (%)
		1	2	3	Average				
A	a	3.81	3.83	3.88	3.84	3.91	0,157	0.052	0.121	4.02
	b	3.90	3.88	3.93	3.90					
	c	3.96	4.02	3.98	3.99					
B	a	5.21	5.19	5.24	5.21	5.15	0.045	0.015	0.034	0.87
	b	5.16	5.14	5.20	5.16					
	c	5.12	5.04	5.09	5.08					
C	a	4.12	4.18	4.10	4.13	4.20	0.062	0.020	0.047	1.47
	b	4.23	4.26	4.16	4.21					
	c	4.25	4.23	4.30	4.26					

Table 2

Results of determining the iron content ($\times 10G^{-4}$) in selected canned meats

Canned meat	Tin	Result of determination				Standard deviation S (x)	Standard error S ($\bar{x}$)	Confidence interval (α=0,05)	Variability ratio Vx (%)
		1	2	3	Average				
A	a	15.88	15.96	15.98	15.94	16.25	0.242	0.081	0.186	1.49
	b	16.32	16.48	16.31	16.37					
	c	16.42	16.51	16.40	16.44					
B	a	16.92	16.50	16.96	16.92	17.12	0.209	0.070	0.160	1.22
	b	17.03	17.00	17.06	17.03					
	c	17.42	17.36	17.43	17.40					
C	a	18.40	18.51	18.46	18.46	18.34	0.171	0.057	0.131	0.92
	b	18.66	18.70	178.1	18.69					
	c	18.72	18.78	18.79	18.76					

Remarks to the results

By the described method, determinations of iron and tin in large quantities of canned meat were carried made. The results obtained in several tests are shown in Tables 1 and 2. The exhibited results point to a high accuraly of the described method. Owing to the simplicity and accuracy of the method, it can be used for following the course of corrosive processes in canned meat.

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VAS ÉS ÓN MEGHATÁROZÁSA HÚSKONZERVEKBEN

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Módszert dolgoztak ki vas és ón meghatározására húskonzervekben. A módszer lehetővé teszi mindkét fém meghatározását ugyanabban a mintában kénsavval és tömény salétromsavval végzett feltárás után, a vasat kolorimetriásan (α, α'-dipiridillel), az ónt polarográfiásan határozzák meg. Egyszerűsége és pontossága folytán a módszer alkalmas a húskonzervekben végbemenő korróziós folyamatok követésére.

ОПРЕДЕЛЕНИЕ ЖЕЛЕЗА И ОЛОВА В МЯСНЫХ КОНСЕРВАХ

В. Ухман, Й. Войиховски, Й. Пикул

Авторы разработали метод для определения железа и олова в мясных консервах. Этот метод предоставляет возможность в одном и том же образце определить оба металла. После проведения обнаружения помощью серной кислоты и концентрированной азотной кислоты, колометрически (γ, δ' – дипиридиллом) определили железо, а полярографически определили олово. Метод является простым и точным и подходящий для наблюдения процессов коррозии происходящих в мясных консервах.

BESTIMMUNG VON EISEN UND ZINN IN FLEISCHKONSERVEN

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Eine Methode wurde zur Bestimmung des Eisen- und Zinngehaltes in Fleischkonserven entwickelt. Mittels dieser Methode kann man beide Metalle in demselben Muster unter Aufschluss mit einem Gemisch von Schwefelsäure und konzentrierter Salpetersäure bestimmen, wobei Eisen kolorimetrisch (α, α'-Dpyridyl) während Zinn polarographisch bestimmt wird. Infolge ihrer Einfachheit und Genauigkeit ist die Methode zur Nachfolgung des Ganges von korrosiven Prozessen in Fleischkonserven geeignet.