## EFFECT OF THE TIME INTERVAL FOR TEMPERATURE MEASUREMENT ON THE PRECISION OF F-VALUE DETERMINATION

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Summary

According to a method of sterilization value estimation, $F = \tau_p / K_{F_1} + K_{F_2} + K_{F_3} + \ldots\ldots + K_{F_n} /$ , where:

F = sterilization value, in minutes;

$\tau_p$ = interval of time during which temperature is measured in the geometric centre of the can;

$K_F$ = coefficient of conversion.

Depending on a number of factors, different values are assumed for $\tau_p$: 1, 2, 3, 5 minutes.

It is established that, with different $\tau_p$ values, the precision of F estimation in a given sterilization regime is different.

## INFLUENCE DE L'INTERVALLE DE MESURAGE DE LA TEMPÉRATURE SUR LA PRÉCISION LORS DE LA DÉTERMINATION DE LA VALEUR F

Ivan Baytchev

Résumé

D'après une des méthodes d'évaluation de la valeur de stérilisation, $F = \tau_p / K_{F_1} + K_{F_2} + K_{F_3} + \ldots\ldots + K_{F_n} /$, où:

F = la valeur de stérilisation, exprimée en minutes

$\tau_p$ = le laps de temps pendant lequel on mesure la température dans le centre géométrique de la conserve

$K_F$ = le coefficient de conversion

En dépendance d'une série de facteurs, on admet des durées différentes pour le $\tau_p$: 1, 2, 3, 5 minutes.

On a établi que pour les valeurs variables de $\tau_p$, la précision d'évaluation de F est différente pour un régime de stérilisation donné.

## EINFLUSS DES ZEITINTERVALLS ZUR TEMPERATURMESSUNG AUF DIE GENAUIGKEIT BEI DER BESTIMMUNG DES F - WERTES.

Ivan Baitschev

Zusammenfassung

Nach einer der Methoden zur Berechnung des Sterilisationswertes ist $F = \tau_p / K_{F_1} + K_{F_2} + K_{F_3} \ldots\ldots\ldots + K_{F_n} /$

wobei

F = Sterilisationswert in min.

$\tau_p$ = Zeitintervall, in welchem die Kerntemperatur des Doseninhalts gemessen wird.

$K_F$ = Überführungskoeffizient

In Abhängigkeit von einer Anzahl Faktoren werden für $\tau_p$ verschiedene Grössen angenommen: 1, 2, 3, 5 min.

Es wird festgestellt, dass bei verschiedenen Grössen von $\tau_p$ die Genauigkeit der Berechnung von F bei gegebenen Sterilisationsbedingungen verschieden ist.

## ВЛИЯНИЕ ИНТЕРВАЛА ДЛЯ ИЗМЕРЕНИЯ ТЕМПЕРАТУРЫ НА ТОЧНОСТЬ ПРИ ОПРЕДЕЛЕНИИ F-СТОИМОСТИ

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Аннотация

Сообразно с одним из методов вычисления стерилизационной стоимости $F = \tau_p / K_{F_1} + K_{F_2} + K_{F_3} \ldots\ldots\ldots\ldots + K_{F_n} /$

где:

F = стерилизационная стоимость в минутах

$\tau_p$ = интервал времени, в течение которого измеряют температуру в геометрическом центре консервов.

$K_F$ = переводный коэффициент.

В зависимости от ряда факторов для $\tau_p$ принимают различные величины: 1, 2, 3, 5 минут.

Установлено, что при разных величинах $\tau_p$ точность вычисления F при данном стерилизационном режиме разная.

## EFFECT OF THE TIME INTERVAL FOR TEMPERATURE MEASUREMENT ON THE PRECISION OF F-VALUE DETERMINATION

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There are different methods to determine sterilization value (14, 10, 13, 3, 8, 9, 1, 5, 2). An obligatory condition in each method is the presence of data on temperature change in the geometric centre of the cans in the process of their heat treatment.

According to the method of reduced effect (6, 9, 7, 11, 12,4), $F = \tau p / K_{F_1} + K_{F_2} + K_{F_3} + \ldots\ldots K_{F_n} /$ , where:

F = sterilization value in minutes,

$\tau p$ = interval of time at which temperature is measured in the geometric centre of the can, and

$K_F$ = coefficient of conversion.

The time interval for temperature measurement ($\tau p$) may be 1, 2, 5, and more, minutes.

The purpose of the present study is to elucidate the effect of the quantity of $\tau p$ on the precision in the determination,and on the quantity of F, respectively.

MATERIAL AND METHODS

Heat treatment was performed on three types of canned meat articles, different in content and structure

| Type of canned meat | Package | Formula of sterilization |
|---|---|---|
| Beef in natural juice | 220 g, Ø = 99 | $\frac{6 - 50 - 30}{120^{o}C}$ |
| Luncheon Meat | 340 g, Ø = 99 | $\frac{6 - 50 - 52}{116^{o}C}$ |
| Canned Frankfurters | 454 g, Ø = 73 | $\frac{6 - 36 - 22}{106^{o}C}$ |

Temperature was measured using a recording four-canal electropotentiometer and was reat at 1, 2, 3, 4, 5, and 6 minutes intervals.

From the data on the heating of cans we found the F-values corresponding to the applied interval, $\tau p$.

RESULTS AND DISCUSSION

The change of temperature in the geometric centre of the c in Canned Frankfurters and the F-values obtained with different $\tau p$ are shown in Fig. 1.

Results indicate that with $\tau p$ = 1 min., F is the lowest: 0,5589 min. With the increase of $\tau p$, F increases and on the 4th minute reaches its maximum: 0,5812 min. Then it is reduced, but remains higher than the one obtained with $\tau p$ = 1. The differe between the lowest and the highest F-value is 0,0223. Having in mind that the can is of the category of "three-quarter" cans and its heat treatment is performed in comparatively short time, it can be assumed that that difference is not to be underrated. Th is particularly true of cases of accurately optimized thermal re gimes applied in production allowing of however partial diversi of a sanitary or technological character.

The dynamics of temperature change and the values for F wi different $\tau p$ for canned "Beef in natural juice" are shown in Fig. 2.

When reading temperature at 2 min. intervals, F is the l est: 9,1398 min., and also quite close to the F obtained when reading temperature change at 1 min. intervals. The highest F va lue is obtained with $\tau p$ = 6 min.: 9,2010 min.

In our case canned "Beef in natural juice" has a long per of true sterilization (50 min.) and a high F value. Under such circumstances, the difference of 0,612 between the lowest and highest F value cannot be decisive. But if that difference repr senting practically more than 1/2 min. of F value, refers to a canned article with an F = 5 min., then it could be fatal to th ned article quality at the slightest diversions from the normal technological and sanitary order of production.

Fig. 3 shows the curve of heating of Luncheon Meat and the F values obtained with different time intervals for temperature reading.



The lowest F value is obtained with $\tau p$ = 2 min., and the highest, with $\tau p$ = 6 min. The difference between the lowest and the highest F value is 0,0438 min. Obviously for this type of canned article, which is subjected to heat treatment with a total sterilization value of 0,600 - 0,800, the difference of 0,0438, obtained in F for different $\tau p$, is considerable. It should be kept in mind particularly in respect of studies aiming at the development of new thermal regimes or the optimization of existing ones.

A characteristic feature, though without an absolute regularity, is the increase of F value with the increase of $\tau p$. On the other hand, there is no definite correlation between the composition of cans: the manner of their heating, respectively, and the differences obtained in F values with different $\tau p$.

CONCLUSIONS

1. The time interval ($\tau p$) at which temperature is read in the geometric centre of the can, exerts an influence on the quantity of F value.

2. Lower F values are obtained when reading temperature at 1 and 2 min. intervals.

3. In research, and studies aiming at the creation of new thermal regimes or the optimization of existing ones, temperature changes should be read at 1 to 2 min. intervals.

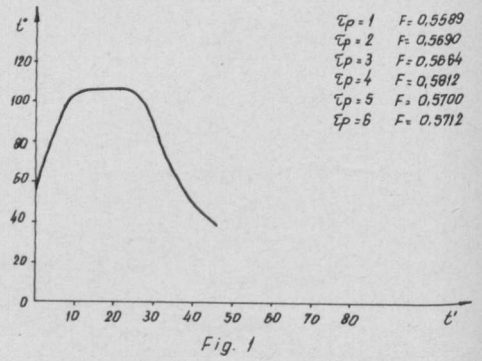


Fig. 1

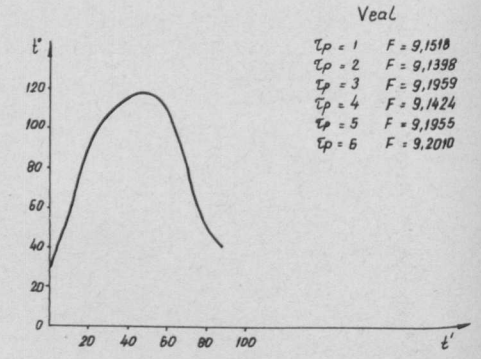


Fig. 2

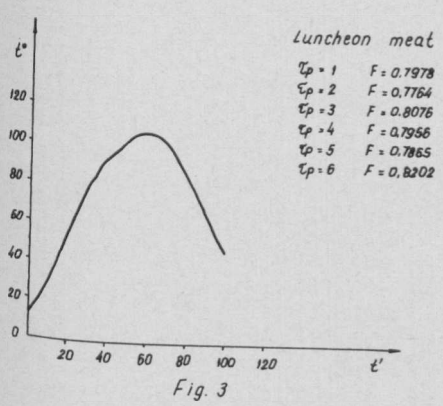


Fig. 3

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