THE ACIDIFICATION OF THE LACTIC ACID BACTERIA STARTERS

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Rezumat

Condiţiile de mediu la maturarea salamurilor crude trebuie să fie precis controlate pentru fiecare cultură starter folosită în parte pentru a se putea obţine o acidifiere optimă. Nu se cunosc influenţele individuale exercitate de fiecare parametru de mediu în parte şi din acest motiv acest control nu a putut fi realizat cu precizia cu care este nevoie. Se va prezenta un alt mod de abordare a determinării performanţei de acidifiere a culturilor starter în salamurile uscate. Principala caracteristică a acestei metode constă în faptul că se încearcă reproducerea cât mai precisă a parametrilor de mediu din depozitul de maturare astfel încât rezultatele obţinute să aibă aplicabilitate practică.

Résumé

Les conditions de milieu pour la maturation des salamis doivent être précisément controlées pour chaque culture starter utilisée pour obtenir une acidification optime. On ne connaît pas les influences individuelles exercées par chaque paramètre de milieu et, pour cette raison ce contrôle n'a pas pu être réalisé avec la précision dont on a besoin. On présentera une autre modalité de déterminer la performance d'acidification des cultures starter dans les salamis. La caractéristique principale de cette modalité consiste dans le fait d'essayer la reproduction plus précise des paramètres de milieu du dépôt de maturation pour que les résultats obtenus ayant une application pratique.

Abriss

Die Umweltbedingungen bei der Maturierung den Dauerwürsten müssen genau kontrolliert sein, teilweise für jede Beginnungs-Kultur, um die optimale Säuerung zu erlangen. Die individuellen Einflüsse jedem Milieuparameter sind nicht bekannt und dadurch diese Kontrolle konnte nicht mit der erforderlichen Genauigkeit gemessen sein. Es wird eine andere Anlegemöglichkeit dieser Säurenbestimmung den Beginnungs-Kulturen bei den Dauerwüste gezeigt. Die Hauptcharakteristik dieser Methode besteht in eine sehr präziser Nachbildung den Milieuparameter in den Maturierungslagerraum so dass die Ergebnisse sollen praktische Anwendbarkeit haben.

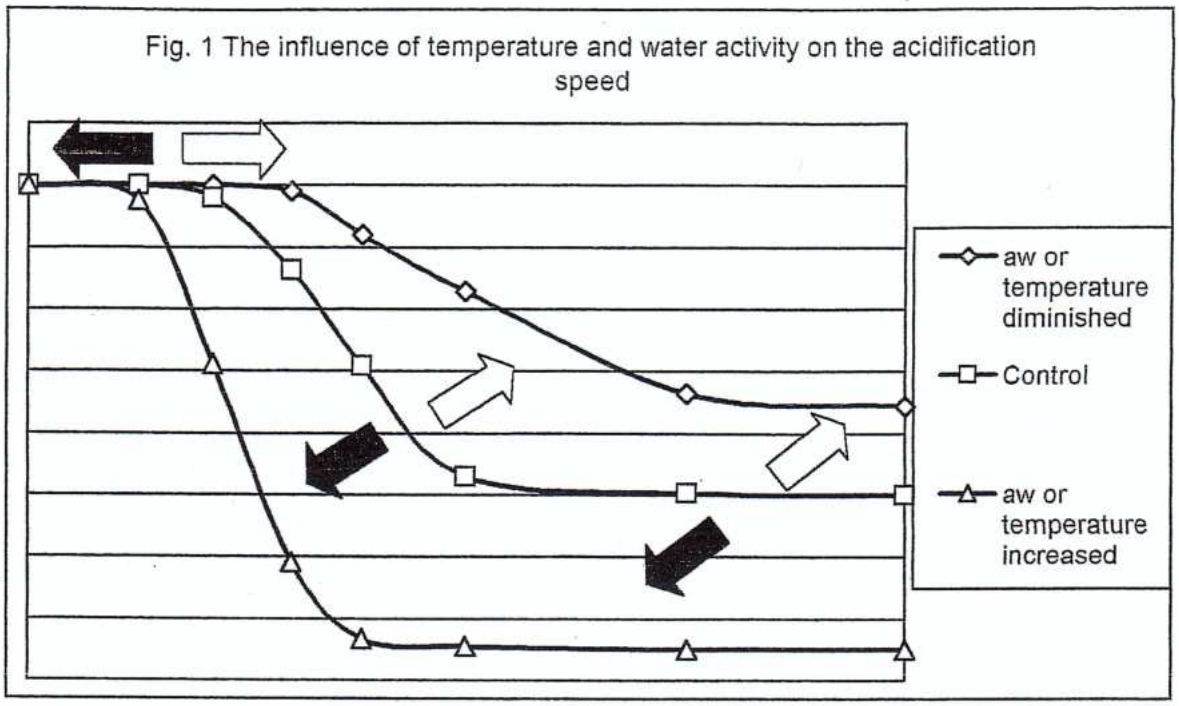
In order to achieve an optimum acidification of meat fermented product one has to be aware of the factors that influence the lactic bacteria starters. These factors depend at first of the lactic bacteria starter quality, such as bacterial species in its composition, total bacterial count, the ability of the star4ter to dominate the unwanted species from spontaneous microorganisms, and also the physical parameters during aging. The external factors are temperature, moist and the speed of the air through the aging room.

At first, it seem to be very difficult to control that many factors, but a closer look shows that most of the parameters can be reduced to a few of them, that can describe all the others. The most important are temperature, the water activity, the amount of aging additives and the amount of starter. If all the products have a precise recipe, controlling the temperature and the water activity can control the aging. Also, is necessary a closer analysis on the effect on the process when changing these parameters. During the experiments there can be seen some slight variation of the parameters due to the variation of the composition of the meat.

The results that can be theoretically obtained are presented in figure 1.

There are presented three different effects using the arrows. At first, the lag phase is affected, than the acidification speed is affected and the value of the final pH is affected also. These relationships are generally known but none managed to study the influence when both of the parameters vary. Most of the experiments were carried out in controlled environments that are different from the usual environments from the aging room.

Fig. 1 The influence of temperature and water activity on the acidification speed

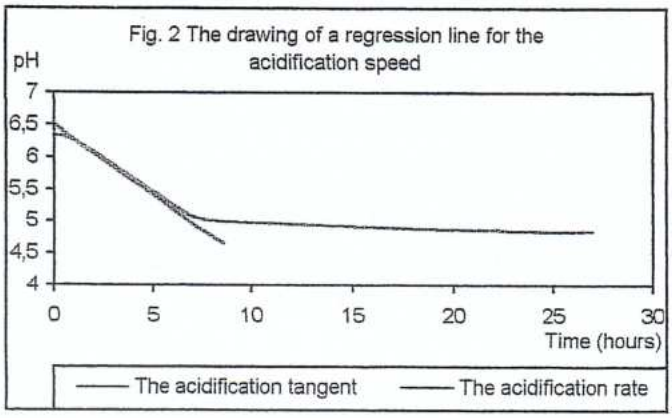


A solution of NaCl containing sterilized nutrients that are used usually for determinations do not contain competitive microorganisms. The experimental temperature of 44°C is situated in the area of optimum temperature of growth of the lactic bacteria of starters, but much higher than the temperatures used in the aging chamber[1]. The nutritive environment has a constant pH = 7, and also is ignored the meat buffering capacity[2]. If we use these methods for study we won't be able to consider the effect of the aging agents[3]. There was observed that the amount of lactic acid produced is not related to the pH diminution in the fermented meat products[4]. Also, the results from the above mentioned methods couldn't be used to raw fermented products. In order to achieve accurate information, there was chosen a new method, which considers the practice aspects[6].

Materials and methods

The main method consists of a composition acidification in a model composition made from minced thin pork, with known water activity, with nitrite, salt, and glucose that can be studied at different temperatures during the pH change. The speed of acidification can be determined, and the acidification performance, which is a mathematical calculated straight line, is used to determine the differences between different starters. The pH change is presented in figure 2.

Fig. 2 The drawing of a regression line for the acidification speed



The regression line include the final point of the lag phase until a pH of 5,2 – 5,3. This allows determining the best regression straight line. The same method can be used for lower pH domains.

For the experiment were used lactic frozen starters of *Lactobacillus curvatus 2, Lactobacillus curvatus 3, Pediococcus pentosaceus,* and *Pediococcus acidilactici.*

Total bacterial count is known for these starters and there was made a starter of 3 x 10^7 cells/ g. A part of the meat is kept as witness.

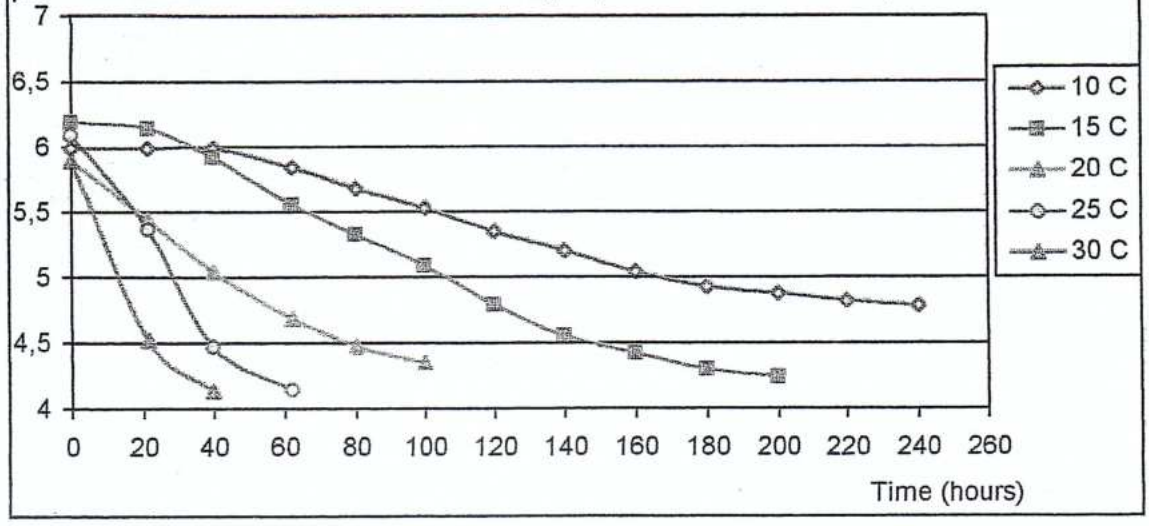
The water activity was adjusted by adding salt and nitrite. The amount was calculated on every case concerning the moisture of the composition. The glucose was added up to a level of 1%, also that cannot be a limit in the bacterial growth. In order to determine the influence of the temperature, the experiments took place at 10, 15, 20, 25 and 30^0 C, usually met in practice.

The media was prepared as follows: the thin refrigerated pork was minced, and the water activity was brought to the prescribed value using salt and nitrite. This mixture was divided in several portions, which were inoculated and then manually stirred. The products maintained their water activity because the containers are hermetically closed and kept at the prescribed temperature.

Results and discussion

Due to the experimentation on complete mediums with 4 inoculated samples and 1 not inoculated, at 5 different temperatures and 8 a_w values, there were obtained 200 acidification curves. In figure 3 is presented a sample inoculated with *Lactobacillus plantarum* at a_w = 0,962, at different temperatures.

Fig. 3 The acidification kinetics of the sample with *Lactobacillus curvatus* 3 at a_w=0,962 at different temperatures



The different values of the water activity are presented in figure 4. All the effects presented in figure 1 are verified also in practice[6]. When the water activity decreases, the lag phase grows and the final pH becomes higher. The acidification is very fast at a_w = 0,993 is due not only the high water activity, but also to the absence of the nitrite.

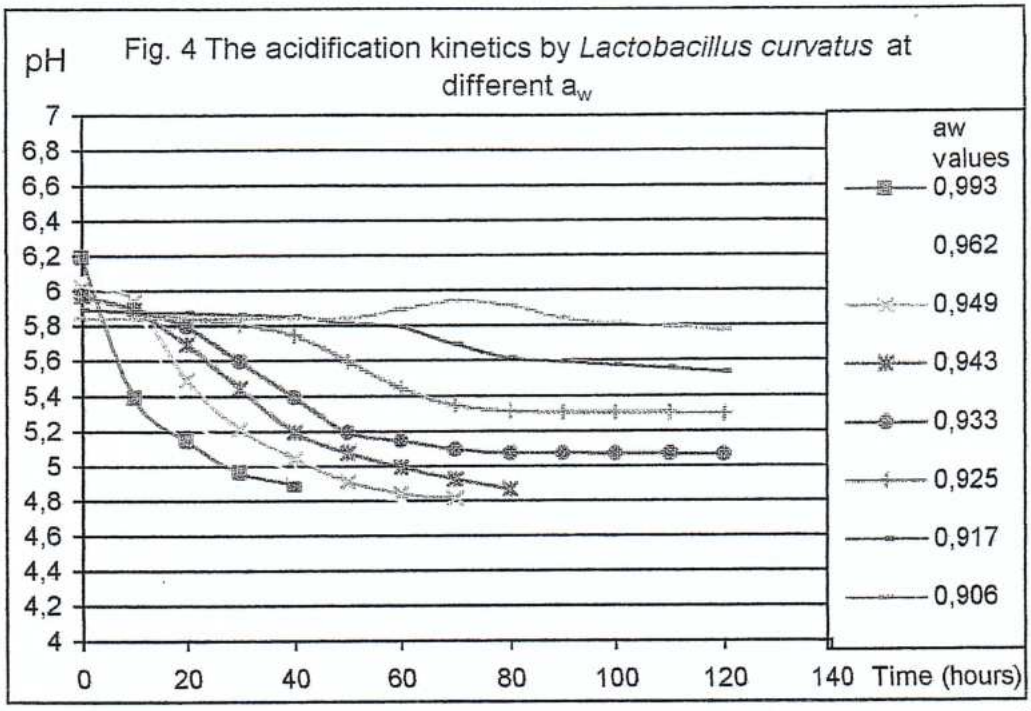


Fig. 4 The acidification kinetics by *Lactobacillus curvatus* at different a_w

These representative curves were calculated for all the starters and presented in figure 5 and 6.

Usually, the dependence between the acidification performance and the water activity can be easy described through a linear equation. Also, *Pediococcus pentosaceus* and *Pediococcus acidilacti* present almost the same acidification power. *Lactobacillus curvatus* 2 presents almost the same values at 30°C, but the decrease of water activity does not produce the same inhibition as for *Pediococcus*. *Lactobacillus curvatus* is an exception, which survives at lower water activities and produces acidification faster than the other strains.

It is obvious that the inhibition produced at 30°C is more intense than the inhibition produced at 10°C, but the acidification power is similarly low for all the strains at this temperature and also the water activity does not influence much the acidification power. The spontaneous microorganisms has a minimum of activity at a_w = 0,93, *Pediococcus* and *Lactobacillus curvatus* have activity at a_w = 0,92 and *Lactobacillus curvatus* presents activity until a_w = 0,91.When the water activity is very low, the acidification power is almost independent from the temperature. During the experiment, the natural microorganisms have a lower acidification power than any starter used. The increase of the temperature leads to a small growth of the acidification power of the spontaneous microorganisms, but to a considerable growth of the acidification power of the starters. During all the experimental condition, the growth of the acidification power increased in the next order:

1. *Pediococcus acidilacti*
2. *Pediococcus pentosaceus*
3. *Lactobacillus curvatus 2*
4. *Lactobacillus curvatus 3.*

The difference between their acidification powers is the biggest at 30°C and the smallest at 10°C. the temperature influences so much the fermentation that the strain is not so important. The influence of the temperature does not have a linear dependence. The acidification power diminishes more when decreasing the temperature from 30°C to 20°C then when decreasing from 20°C to 10°C. *Pediococcus acidilacti* had a smaller acidification power than the *Pediococcus pentosaceus.*

Fig. 5 The acidification performance of different strains at different temperatures

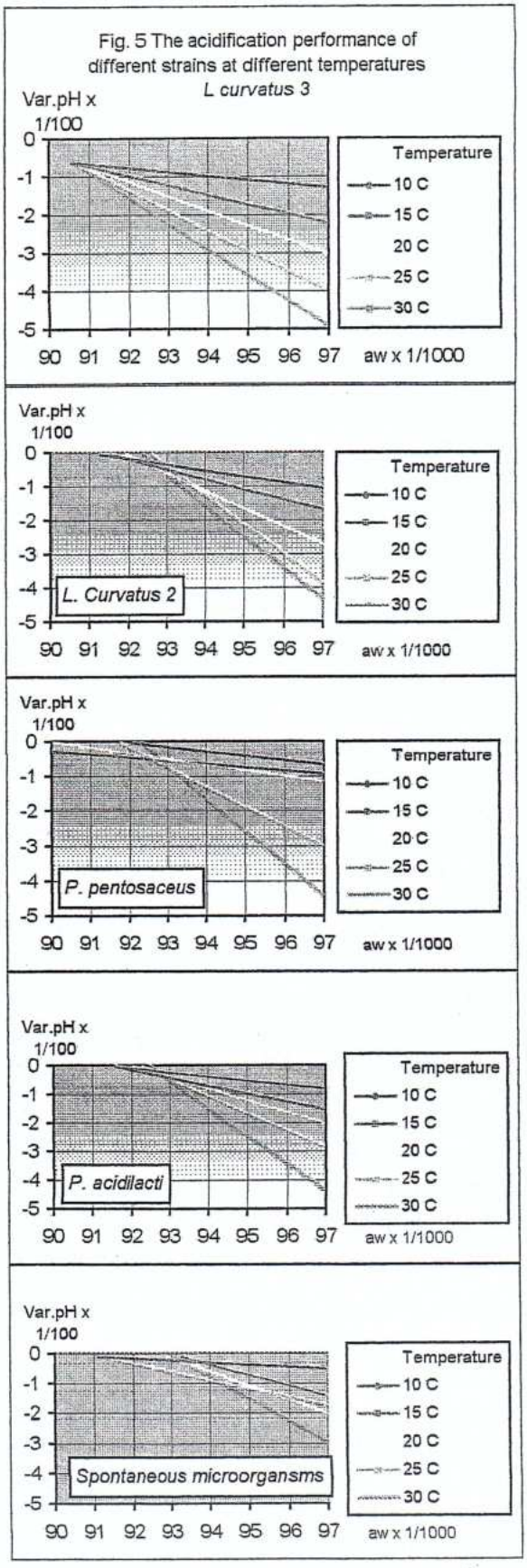
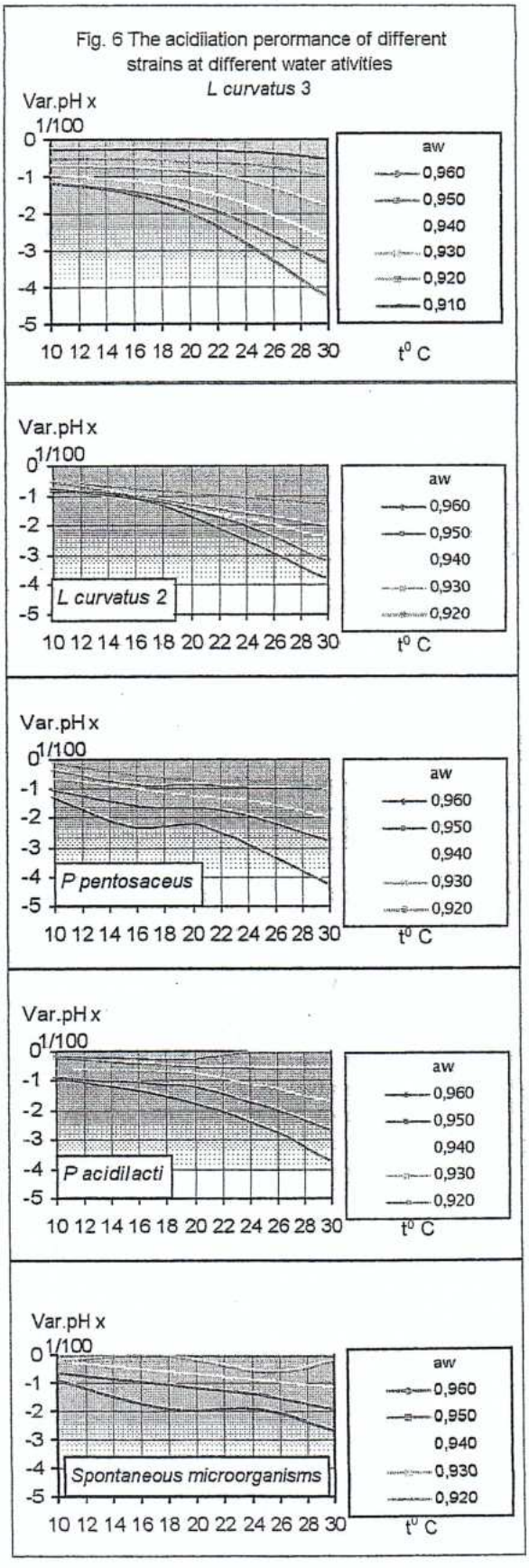


Fig. 6 The acidiiation perormance of different strains at different water ativities



Unlike these two strains *Lactobacillus curvatus 3* and *Lactobacillus curvatus 2* present totally different acidification powers. The influence of the temperature presents an exponentially

reduced character, being almost straight. *Lactobacillus curvatus 3* had the best acidification power in all the experiments.

Lactobacillus curvatus 2 is more sensitive at low temperatures than *Lactobacillus curvatus 3.* Also, at 15°C the acidification power of *Lactobacillus curvatus 3* is almost double than the acidification power of the *Lactobacillus curvatus 2.*

.The influence of the water activity can be judged only linked to temperature, as shown in figure 7.

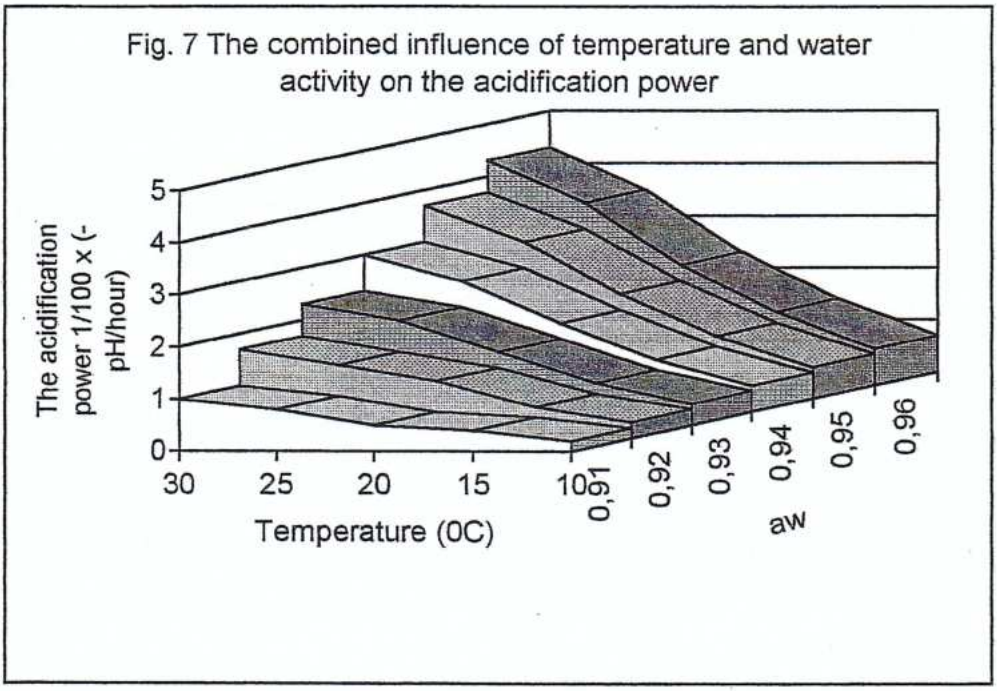


Fig. 7 The combined influence of temperature and water activity on the acidification power

Conclusions

All the experimental results prove that is possible to influence the aging of the raw salami by controlling strictly the water activity and the temperature. The major influences of these two parameters on the acidification power of starters prove the importance of establishing the right parameters in order to achieve a maximum of acidification. These experimental methods can be applied at studies concerning the influence of spices, type of strain, carbohydrates mixture, and so on. Also is easier to meet the special necessities of a recipe and can be created more precise studies.

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