ASPECT IN THE USE OF STARTER CULTURES IN MEAT PRODUCTS

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INTRODUCTION

Starter cultures are widely used in the meat industry. Currently the cultures are applied to raw sausage products, mould-ripened sausages, boiled sausage products, raw ham and piece meat products. In 1919 the first suggestions were made for use of microorganisms in dry sausage. But not till the late 50s starter cultures were applied in sausage making. Especially Niiniraara, Deibel, Niven were pioneers on this field. They have been made the presuppositions for the extensive utilization of the starter cultures in meat products. Afterwards it take place a stormy development.

The first attempts were directed only on raw sausage products. The task of the starter cultures was the fast diminution of the pH-value. Thus, the stability of the raw sausage making has been improved. Later other meat products were involved.

Furthermore microorganism cultures are also applied to improve the flavor of the products. About 20 years ago the aromatization of raw sausage products was beginning by means of starter cultures.

The paper will give a review of the current situation referring to the development and application of starter cultures in meat products.

MICROORGANISMS IN FOOD

In numerous foods microorganisms play an important role. The biochemical effects can be caused either by active microorganisms or by endoenzymes from dead microorganisms and the endogenous enzyme system. In the case of active microoranisms the biochemical reactions are effected by the metabolism. These substances react with the foodstuff. There by the microorganisms can be native microorganisms as well as starter cultures. This principle scheme is valid for all microbial-enzymatical reactions in foods (Fig.1).

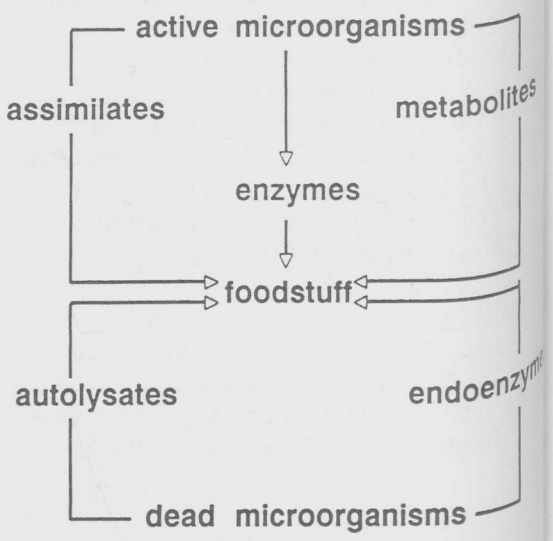

Fig.1: Effects of microorganisms on foods

In the case of meat products one can fi
both typs of contamination which are nat
as well as starter microorganisms. The adde
starter culture supported the effects of th
desireable species. As a rule only one str
is used as starter organism. The to
spectrum of the microorganisms in the mi
products is more extensive. In the start pha
one can isolate lactobacilli, micrococ
pseudomonas, peroxidase microorganism
a.s.o.. In the course of the ripening proce
only a few species are dominated. Thi
microorganisms must be supported by mea
of starter cultures (Fig.2).

STARTER CULTURES

The tasks of the starter cultures can b
summarized as following:

- acceleration of the ripening process
- suppression of the undesired microorganism
- reduction the microbiological risks
- improvement of the quality
- enhancement of the specific aroma.

Especially the ripening acceleration, th
suppression of undesired microorganisms a
the reduction of the microbial risks ca
related to the diminution of the pH-value. Th
to the metabolism of the bacteria. Th
improvement of the quality and th
enhancement of the specific aroma

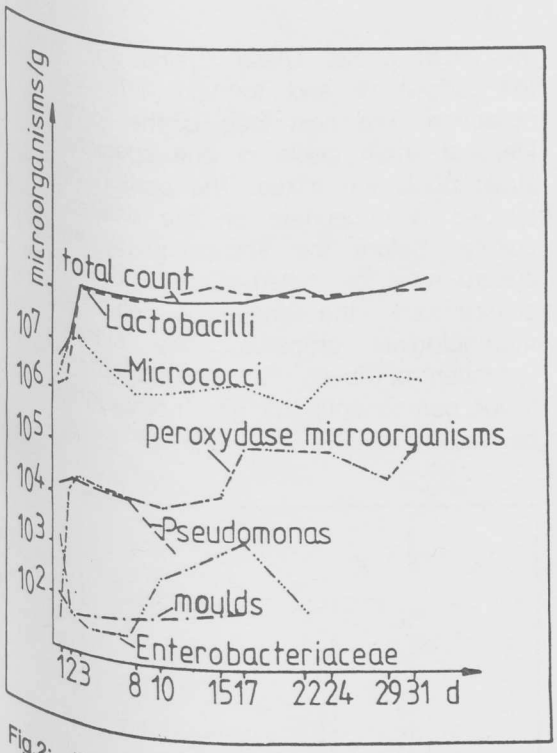

Fig.2: Bacteria count in dry sausages with starter cultures

caused by means of several microorganisms such as moulds, yeast and some bacteria.

Frequently applied starter cultures contain strains of the following genera:

- Lactobacillus
- Lactococcus (Streptococcus)
- Micrococcus
- Pediococcus
- Streptomyces
- Debaryomyces
- Candida
- Penicillium.

However, currently the lactic acid bacteria are most important in the meat industry. The fermentation properities are the reason for it. Thus, they are able to metabolize several C-sources and to produce organic acid. Some species have a great NaCl-tolerance such as Lactobacilus sake, Lactobacillus curvatus, or Pediococcus acidilactici. But also other lactic acid bacteria can be used as starter culture. The knowledge of the growth conditions is necessary for the choise of the microorganisms using as starter cultures. The most important parameters are:

- temperature scope
- NaCl-tolerance
- anaerobic growth behaviour
- nitrite tolerance

There is a competition between the several microorganism species. The result of this competition is influenced by the parameters of the growth condition directly.

The aim of the application of starter cultures can be characterized with the parameters of the quality characteristic: color, aroma, preservation, firmness and residue content. These parameters are close connected with special effects due to the metabolism of the starter organisms:

color	nitrate reduction pH-drop O_2consumption H_2O_2breakdown
aroma	acid production protein degradation fat degradation rancidity
preservation	pH-drop nitrate reduction suppression of undesirable microorganisms
firmness	pH-drop
low residue content	nitrite degradation mycotoxin production

These parameters are influenced during the course of growth of the microorganisms. The connection between bacteria count and ripening time of raw sausage is shown in figure 3. Furthermore the course of the pH-value and the a_w-value is demonstrated. Especially, the suppression of undesirable microorganisms is caused by the pH-drop.

All the mentioned factors of the quality criteria must be taken into consideration for the development of high effective starter cultures. The principle way is shown in figure 4.

In order to manufacture a stable, effective starter culture several various mixed populations are cultivate for a few passages. The proportion of the species of the mixed population is then dependent on the fermentation conditions, such as temperature breeding time, substrate etc..
During the next step strains are isolated from

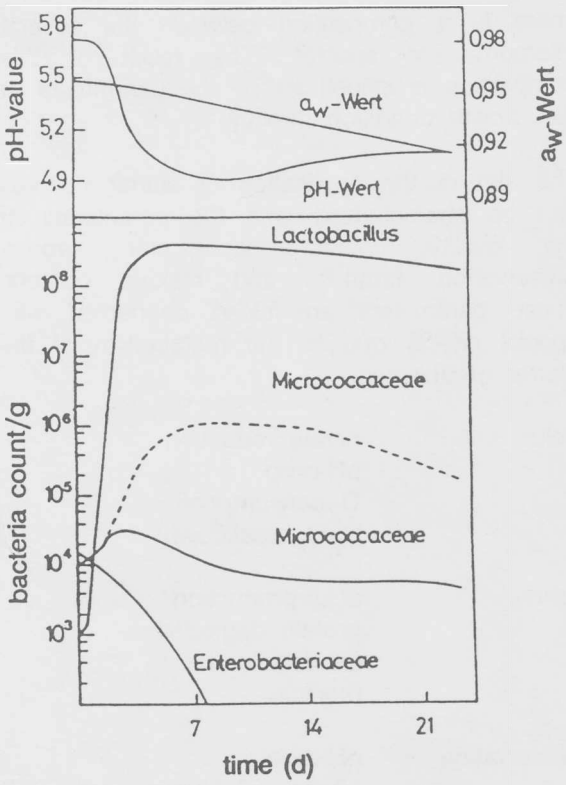

Fig.3: Ripening process of raw sausage

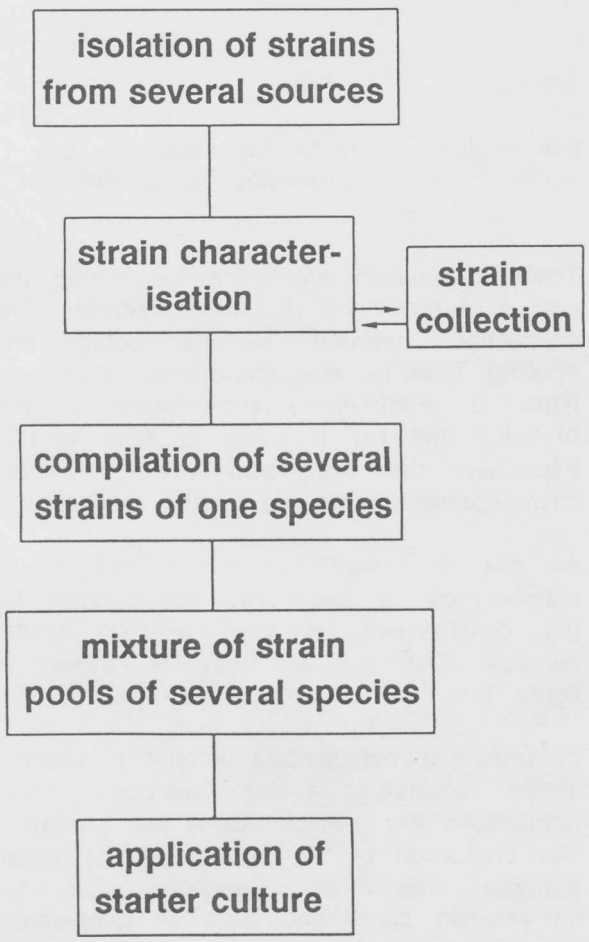

Fig.4: Development of high effective starter cultures

the strain pools. These strains are used the judgement and to take into the st collection. The next step is the formation identical strain pools of one species. Se strain pools are mixed. The portion of se species is dependent on the desired typ culture. Before the application is made culture must be tested. Criteria for the st culture are the metabolic efficiency, morphological properties, the stability, formation of flavor. For the judgement of flavor components the gaschromatography be used (Fig. 5).

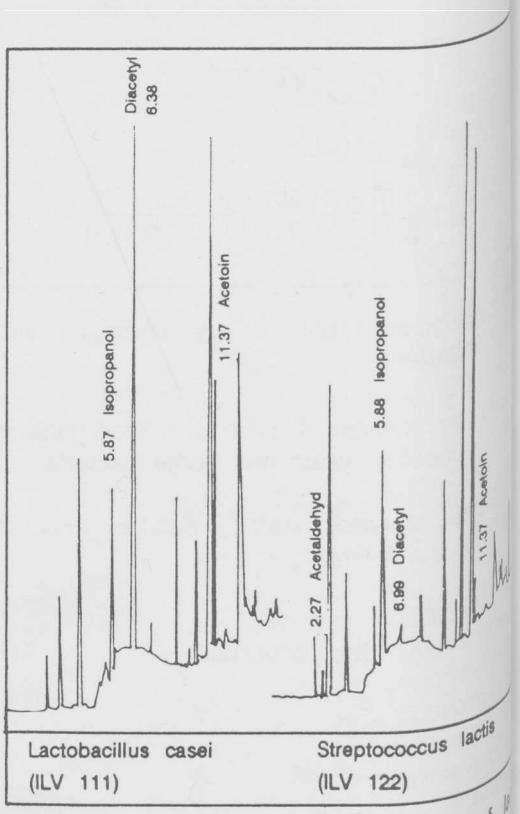

Fig.5: Gaschromatogram of strains of ... acid bacteria

During the past few years the mod methods of genetic engineering are also u for starter cultures, especially on the analy field. Basical papers are published by Te Numerous properties of the bacteria plasmidcoded such as

- metabolism of lactose
- proteolytic system
- metabolism of citrate
- formation of bacteriocine
- formation of mucus
- resistance against bacteriophages

Therefore, simple gentical methods can be used for the improvement of the starter cultures. For mesophilic lactic acid bacteria several mechanisms of gentransfer are developed:

mechanism	function
conjugation	metabolism of lactose proteolytical activity formation of bacteriocine metabolism of citrate antibiotic resistance phages resistance
transduction	metabolism of lactose
transformation	metabolism of lactose synthesis of phages
fusion of protoplasts	metabolism of lactose

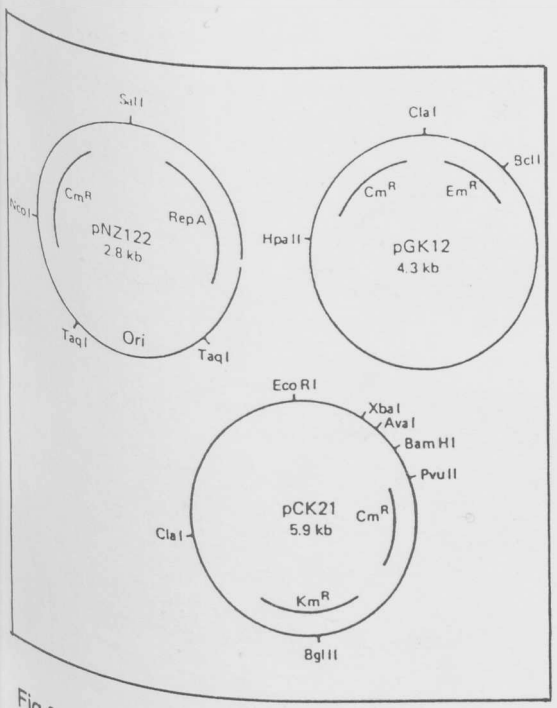

Fig.6: Construction of cloning vectors for lactococcus

Nowadays cloning vectors for lactococcus, staphylococcus carnous etc. are available. The construction of cloning vectors for lactococcus is shown in figure 6.

With them the properties of starter cultures can be influenced and new high effective strains will be available.

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