Starter cultures

GEWÜRZMÜLLER has been supplying starter cultures to the meat industry for 30 years and is one of the pioneers in this field. This comes as no surprise, since the company has always held close ties to research establishments inside and outside Germany in the whole field of meat processing. An especially important example is the joint venture initiated in 1980 with the Institut für Lebesmitteltechnologie (institute for food technology) at the University of Hohenheim headed by Prof. Dr. W. P. Hammes, which has led to the development of many biotechnological innovations for application in the meat industry. In order to turn the knowledge gained into efficient and reliable microbial preparations that match market requirements using the shortest possible route, the BITEC Biotechnikum R&D centre started operations in 1989 as one of the most modern facilities of its type in Europe. The BITEC trademark is synonymous with GEWÜRZMÜLLER biotechnology – uniting biotechnology, meat technology research and development, and thorough practical knowledge and utilising this combination for the meat industry.

Probiotic cultures for raw fermented sausage

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Probiotic foodstuffs are a specialist segment of what is known as „functional food." This covers foodstuffs that have a positive influence on the physical or mental condition of the consumer that goes beyond the actual nutritional value of the food. In order to understand what probiotic foods entail, one has to realise that the human intestine is home to 10^{14} species of microorganism. Some of these species are absolutely necessary for the human body to function properly while providing a human being with a subjective feeling of good health; some are desirable; some have no obvious function; yet others can be unhealthy. The goal of a probiotic concept is to influence the biological balance of the intestine to create effects that improve health or well-being. There are several ways of reaching this goal: on the one hand, a selective growth advantage may be given to desirable microorganisms, and on the other hand, desirable microorganisms with certain characteristics – known as probiotic microorganisms – may be brought directly into the intestine. When considering the concept of functional food, these probiotic microorganisms have to be introduced into the body through the normal nutrition. On the market, the vectors for introducing these probiotic bacteria into the intestine have so far mainly been milk products, but also various forms of muesli and breakfast cereals. The newest development comprises starter cultures for the production of raw sausage that exhibit probiotic effects along with their technological characteristics. Besides the traditional, tried and trusted Lactobacillus sakei strain, BITEC LK-30 plus and BITEC LS-30 plus formulations contain a probiotic strain of Lactobacillus paracasei, a microorganism that reaches the intestinal tract in large numbers and in good condition due to its high resistance against digestive acids and bile. This strain's probiotic effect could be established in a joint clinical study with the universities of Jena and Hohenheim that demonstrated a positive effect of the microorganism on the digestion in addition to a modulating effect on the immune system, thus contributing to a general improvement in well-being.

Biotechnology and raw cured-meat products, Protective cultures

Biotechnology and raw cured-meat products

Like raw fermented sausage, microorganisms are also used in the manufacture of bacon, gammon, and other raw cured-meat products. The characteristics required of these microorganisms are similar to those used in the production of raw sausage:

- Competition effect and limited acid formation in order to increase the shelf life and hygienic safety of the product.
- Nitrate reductase activity in order to ensure the reddening effect and aroma formation.
- Catalase activity for the stabilisation of colour and aroma.
- Lipase and proteinase activity for aroma formation.

In the manufacture of raw cured-meat products, microorganisms have to fulfil their roles in an environment that is far more extreme than that found in raw fermented sausage. The salt content is much higher, the maturing temperatures are significantly lower, and there is also no possibility of distributing the microorganism evenly in the meat. GEWÜRZMÜLLER produces the BITEC RP-3 formulation for use in the production of raw cured-meat products, a formulation that contains a microorganism adapted to this environment. This starter culture reduces the risks in production hygiene, improves the reddening effect and cured-meat colour stability, and supports the development of the characteristic cured-meat aroma.

Protective cultures

One of the tasks that starter cultures face in the production of raw fermented sausage and raw cured-meat products is to prevent the growth of microorganisms that cause spoiling or disease, thereby ensuring the shelf life of the product. In this respect, they therefore fulfil a protective function and act as „protective cultures“. Under normal circumstances, this effect is mainly the result of lactic acids produced during the fermentation process. Apart from that, there is a range of lactic acid bacteria that can also produce other antagonistic substances – substances that are able to hinder the reproduction of other microorganisms; apart from lactic acid, they include acetic acid, carbon dioxide, hydrogen peroxide, dyacetyl and acetoin. Without lactic acid, these other substances do not play a role in the stabilisation of raw fermented sausage, or any other meat product for that matter. This is partly due to the fact that they do not show any relevant effect in the concentrations given. However, some of these substances also have unacceptable side effects. In the last few years, a certain group of compounds has increasingly attracted the focus of interest in this field; these are known as bacteriocins. Tasteless and colourless, bacteriocins are protein-like compounds with a greater or lesser capability of preventing other gram-positive microorganisms from developing. Currently, lactic acid bacteria that produce a bacteriocin against the pathogenic Listeria monocytogenes bacterium have proved to be of special interest. Listeria-type bacteria are especially important for two reasons: firstly, while relatively seldom, an infection with this kind of bacterium is fatal in 30% of all cases; secondly, listerias have the unpleasant property of reproducing at refrigeration temperatures, so that unlike salmonella, they cannot be effectively prevented by cooling the product. GEWÜRZMÜLLER has developed a starter culture under the BITEC LKB-5 brand name for the meat industry, a culture that contains a bacteriocin-producing lactic acid bacterium. Incidentally, it has been shown that there are no bacteriocins that can actively combat salmonella, but the resistance of this pathogen seems to be significantly impaired by bacteriocins.

Mixture of highly concentrated, freeze-dried microorganisms on a carrier

BITEC LS-25 plus

Probiotic properties

Art. Code 814/10

Starter and aroma culture for raw fermented sausage manufactured with nitrite curing salt. LS-25 is an acidifying culture that contains two different species of lactobacillus with both technological and probiotic characteristics. This probiotic starter and aroma culture produces a pronounced lactic acid fermentation aroma and a powerful colour with good colour stability in addition to its protective function through its acidifying property and high degree of competitiveness. Scientific studies have established that the strain additionally present in LS-25 plus has probiotic properties. Regular consumption of raw fermented sausage produced with LS-25 plus supports the body's own immune system. This is a product that tastes good and helps keep the consumer in good health. Combination of lactobacilli and staphylococci.
25 g bag for 100 kg of sausage mass. Other package sizes are available on request.

BITEC LK-30 plus

Probiotic properties

Art. Code 816/10

Starter and aroma culture for raw sausage produced with common salt and curing salt or with nitrite curing salt. LK-30 plus is a mildly acidifying culture with technological and probiotic properties that produces a sweet fermentation aroma in addition to an improvement in colour formation, colour stability and fat stability. Scientific studies have shown that the strain additionally present in LK-30 plus possesses probiotic qualities. Regular consumption of raw sausage produced with LK-30 plus supports the body's immune system. This is a product that tastes good and helps keep the consumer in good health.
25 g bag for 100 kg of sausage mass. Other package sizes are available on request.

BITEC RP-3

Art. Code 819/05

Starter culture for cured meat goods produced with common salt and curing salt or with nitrite curing salt. This culture contributes to an increase in the microbiological safety of the product through its natural protective function. It improves the maturing aroma, colour stability and fat stability. Combination of lactobacilli, staphylococci and micrococci.
50 g bag for 200 kg of sausage mass. Other package sizes are available on request.

(light-coloured powder).

BITEC LKB-5

Art. Code 825/10

Protective culture for raw sausage produced with common salt and curing salt or with nitrite curing salt. LKB-5 is a protective culture that contains a bacteriocin-producing strain of bacterium in addition to nitrate-reducing microorganisms. LKB-5 is used for raw fermented sausage where listeria development is encouraged by reduced drying. Apart from that, this culture produces a mild acidic taste.
25 g bag for 100 kg of sausage mass. Other package sizes are available on request.

BITEC LS-1

Art. Code 803/00

Starter culture for raw fermented sausage produced with common salt and curing salt or with nitrite curing salt. Through the presence of a specifically selected lactobacillus strain with high competitiveness, LS-1 can be viewed as a form of biological protection. This natural protective function represents a barrier to the growth of contamination organisms.
LS-1 creates a consistent acidification process and contributes to a marked fermentation aroma. It also accelerates colour formation, improves colour stability, fat stability and consistency. Combination of lactobacilli, staphylococci and micrococci.
25 g bag for 100 kg of sausage mass. Other package sizes are available on request.

BITEC LS-25

Art. Code 805/10

Starter culture for raw fermented sausage produced with nitrite curing salt. LS-25 enables a rapid acidification process and a typical fermentation aroma, accelerates colour formation and improves colour stability, fat stability and consistency. Its natural protective function contributes to the microbiological safety of the product. Combination of lactobacilli and staphylococci.
25 g bag for 100 kg of sausage mass. Other package sizes are available on request.

BITEC LS-25-2

Art. Code 813/10

Starter culture for raw fermented sausage produced with nitrite curing salt. Creates a rapid acidification process and contributes to a clean fermentation aroma, accelerates colour formation, and improves colour stability, fat stability and consistency. Its dominant microbiological culture sets a barrier to the growth of contamination bacteria. Combination of lactobacilli and staphylococci.
25 g bag for 100 kg of sausage mass. Other package sizes are available on request.

BITEC SK-10

Art. Code 850/10

Fungal culture for raw fermented sausage and raw cured meat products. The microorganism used is Penicillium nalgiovensis.
50 g bag for 50 litres of water

BITEC SM-96

Art. Code 822/30

Starter culture for fermented meat products that are produced with common salt and curing salt or with nitrite curing salt. SM-96 arom is a non-acidifying culture that is especially suitable for products manufactured using maturing agents containing nitrite curing salt or GDL. Combination of staphylococci and micrococci.
25 g bag for 100 kg of sausage mass. Other package sizes are available on request.

BITEC LK-30

Art. Code 815/10 0001

Starter culture for raw fermented sausage produced with common salt and curing salt or with nitrite curing salt. LK-30 produces a harmonious acidification process with an even fermentation aroma, accelerates colour formation, and improves colour stability, fat stability and consistency. This culture's natural protective function contributes to an increase in the microbiological safety of the product. Combination of lactobacilli, staphylococci and micrococci.
25 g bag for 100 kg of sausage mass. Other package sizes are available on request.

Raw fermented sausage and biotechnology

Raw fermented sausage production is a classical example for a food fermentation form that involves various kinds of microorganism acting in concert to reach the desired end product. Raw sausage types such as salami, Mettwurst or Teewurst are without doubt some of the noblest products that the meat industry has to offer; there is no question that these products simply stand for eating pleasure. Since raw sausage is a fermentation product, it has an additional reputation as a „natural" foodstuff. Although sausage was first produced in Italy, by far the widest range of sausage products is currently to be found in Germany. Although the complex interaction between microbiological, chemical, and physical reactions during raw fermented sausage fermentation and maturing is fully spontaneous and can lead to excellent sausage products, sausage production is an art in itself that is influenced by many different factors. Here is a brief summary of the main goals of fermentation:

- Elimination of pathogenic and spoiling microorganisms
- Formation of the typical red colour
- Development of slicability in slicable sausage products
- Assurance of the required shelf life
- Development of the typical fermentation taste

Reaching these goals directly or indirectly involves the activity of microorganisms that fulfil the following roles:

Acidification

The sugar contained in the sausage mass is turned into lactic acid through the activity of lactobacilli resulting in an acidification of the sausage, which means a decrease in pH value. This process hinders the growth of undesired microorganisms, the reddening effect is encouraged, water solubility is reduced, and the animal proteins are slowly converted into a gel so that the sausage develops its slicability in the drying process.

Nitrate reduction

In the reddening process, the nitrite oxides dispersed in the sausage emulsion have to be released in order to react with the muscle colouring (myoglobin) to form nitrosomyoglobin. In this process, a certain quantity of nitrites is turned into nitrates. To be included in the reddening process, these nitrates have to be turned back into nitrites; this is also necessary for sausage that is produced with common salt and curing salt. This conversion from nitrate to nitrite in the sausage is only possible with the involvement of microorganisms that produce a certain enzyme known as nitrate reductase.

Destruction of hydrogen peroxide

Various microorganisms existing spontaneously in the sausage mass can form hydrogen peroxide that may impair colour formation and colour stability as well as the taste of the raw sausage product. The catalase enzyme produced by the appropriate microorganisms can reduce hydrogen peroxide into harmless water and oxygen.

Taste and aroma formation

Although little is known about the exact processes involved in taste and aroma formation, we do know that in additional to the usual processes taking place in the sausage itself, microbial enzymes are involved. Here, lipase and protease enzymes break the fat and protein molecules down into compounds and their precursors, giving the sausage its aroma. In traditional raw fermented sausage production, these processes were initiated through the activity of microorganisms spontaneously present in the sausage mass; however, this approach is no longer compatible to modern production methods. Today, manufacturers make far more use of starter cultures that combine specifically selected and cultivated microorganisms, thus ensuring that the desired effects are reached consistently and reliably. The purpose of using starter cultures can be summarised into the advantages they present:

- A high-quality production process is ensured
- Predefined fermentation times are kept
- Shorter fermentation times lead to more economic production
- Residual nitrite and nitrate content is kept sufficiently low
- The hygienic risk is kept to a minimum

The qualitatively high standard of today's starter cultures in functional and practical terms has led to their position as a standard in modern production in both industry and trade.

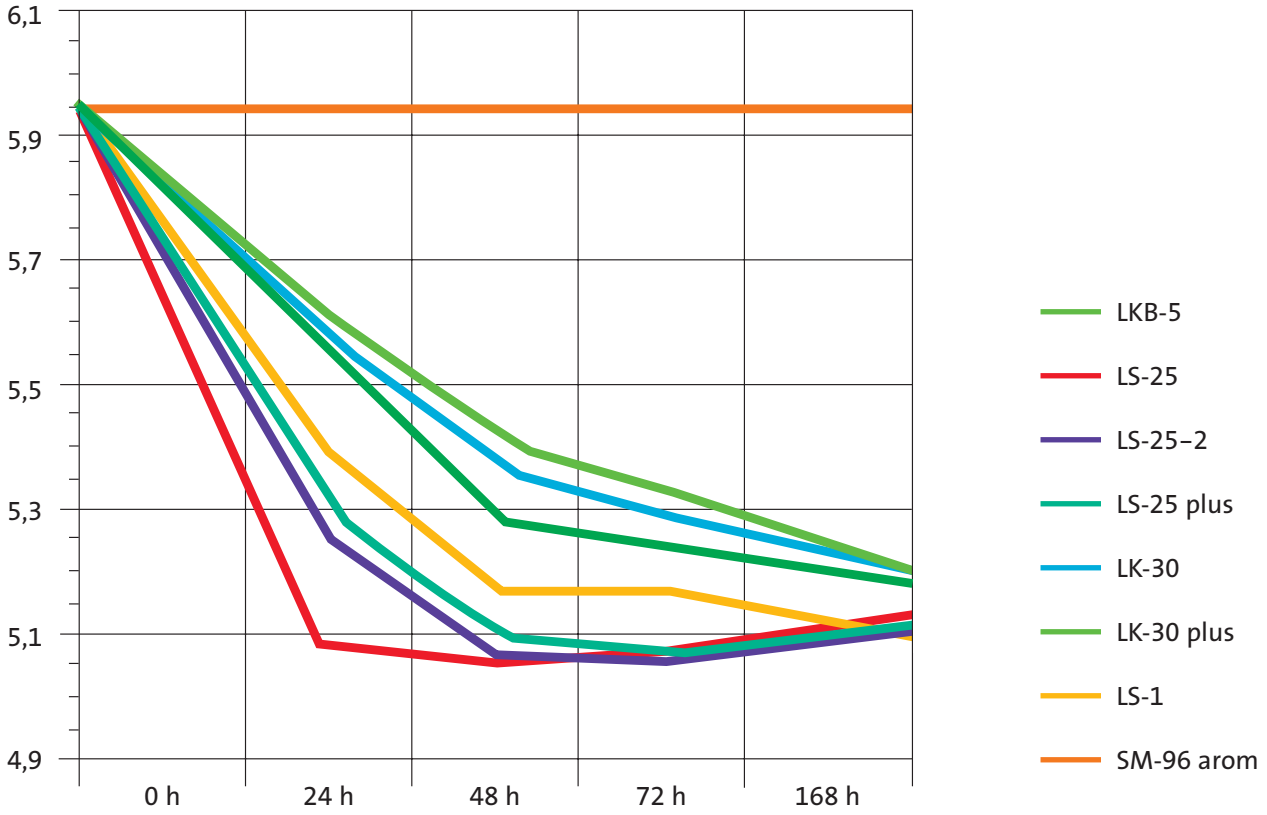
Mould cultures for certain specialities

In the production of various types of noble sausage and some raw cured-meat products in „lump" form, there is a special attraction to using mould cultures that grow on the surface of the product. Like the microorganisms inside the sausage, this mould covering fulfils certain roles. A certain mould covering the whole product produces the following effects:

- It reduces the settlement of undesired microorganisms on the surface of the product
- It reduces the entry of oxygen, thus slowing down the oxidation process leading to rancidness
- It gives the product the desired external appearance
- It contributes to the formation of the product's typical aroma through enzymatic processes

Since there will always be certain types of spontaneously occurring moulds that can produce mycotoxins (fungal toxins), the meat industry is supplied with certain selected and tested mould strains that can reliably fulfil the requirements set, provided they are securely attached to the product surface.

Acidification performance of starter cultures at 24°C over a period of 48 h



Recommended use of BITEC starter cultures

		NITRITE CURING SALT	COMMON SALT AND CURING SALT	RAW SAUSAGE				RAW CURED-MEAT PRODUCTS
				Fresh		Slicable		
				Spreadable	Sliceable	Fast matured	Slow matured	
	LKB-5	xx	xx	xx	xx	–	x	
	LS-25	xx	–	O	x	xx	–	–
	LS-25-2	xx	–	O	x	xx	–	–
probiotic	**LS-25 plus**	xx	–	O	xx	xx	x	–
	LK-30	xx	xx	xx	xx	x	xx	O
probiotic	**LK-30 plus**	xx	xx	xx	xx	–	xx	–
	LS-1	xx	xx	xx	xx	x	xx	–
	SM-96 arom	xx	–	xx*	xx*	xx*	–	xx
	RP 3	xx	xx	–	–	–	–	xx

x Recommended
xx Highly recommended
O Possible

* In connection with GDL-based maturing agents
– Not recommended

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BITEC Starter cultures

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