

## **Starter and protective microbial cultures to ensure safe and standardised raw fermented sausages – Lothar Kröckel**

Desirable microorganisms are the implicit factors that together with skillfully and reasonably adjusted endogenous and exogenous factors decide over the successful production of safe and tasty raw fermented sausages. Nowadays, starter and protective cultures are widely used to ensure their safe and standardised manufacture. The lecture addresses the common microorganisms currently applied for this purpose, as well as less known microorganisms important in this context. Reference is made to 'the early studies' suggesting the application of pediococci and/or lactobacilli and, a time line elicits the milestones in the development of starter cultures, including GRAM-positive, catalase-positive cocci such as certain coagulase-negative staphylococci. While scientific publications covering starter cultures in raw sausage production were quite rare up to 1970, and only slowly increased in number up to 1980, the advent of improved analytical possibilities initiated new fundamental work in this field. The last 20 years have seen a worldwide explosion of the interest in microbial cultures for raw sausage fermentation and safe-guarding. The endogenous and exogeneous factors applied in the process favour the development and survival of psychrotrophic salt- and acid tolerant lactic acid bacteria, but not all are equally suited. Microorganisms to be used as starter and protective cultures must fulfill well defined criteria. In the first instance, they must be safe for human consumption. One of several undesirable activities is the production of biogenic amines such as histamine and tyramine. Bacteriocin-producing protective cultures antagonistic against listeria have become a major issue in recent years. GRAM-positive, catalase-positive cocci as well as 'noble'-molds and yeasts are applied because they can make important contributions to colour formation, aroma, product appearance and shelf-life. Nucleic acid-based techniques have greatly improved the accurate identification of the microorganisms involved and, the 'omics' aera is expected to deliver new insights and a better understanding of the microbial ecology and diversity in fermented sausages worldwide. Starter and protective cultures can make important contributions to ensure the microbiological quality of raw fermented sausages, including the control of pathogenic bacteria. However, it is important to note that endogenous and exogenous factors remain important.