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**Sausage
fermented
with Kimchi**

**Dynamism
determines
the decade**



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not exhausted in practice.

A diploma thesis at the TFH Berlin showed the following results for the use of phosphates in boiled ham already in 1993:

- even just a slight dose of phosphates would have a positive effect on the yield,
- for PSE meat the phosphate dose was particularly expedient,
- the pH value of the phosphate type used was largely insignificant for the quality of the boiled ham (GATZEMEIER, 1993).

Examinations with fresh pork ham showed that the assessment of phosphate additives solely on the basis of the P-number boundary values of 2.4 is not possible with legal certainty (ERDMANN et al., 2006).

Lactates are used worldwide. In Germany, this additive is viewed with some reservations. Lactate additive allows longer stability times of packaged products. High concentrations are necessary to achieve this (over 30 g lactate per kilogram) and the question of flavour impairments

arises. Lactate mixtures with diacetate are reportedly better for flavour.

The addition of plant protein products to meat products is allowed by law. In Germany, however, this is rarely used. Lean meat can be replaced by processing plant protein, e.g. soya protein.

Literature

Details of the literature references can be requested from the editor or the author.

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Prof. Dr. Herbert Weber teaches Food Technology at the TFH Berlin.

Using CO with MAP has no greater risk

Several members of the Institute of Food Technologists (ift) have stated, that concerns about the application of carbon monoxide (CO) with modified atmosphere packaging (MAP) of meat are scientifically unfounded. Supported by the FDA declaring, that CO is a colourless, odourless, 'invisible' gas and therefore can not directly transfer colour to meat, they even conclude, that there is no deception for the consumer arising. It seems relevant to consider that the CO reaction with meat is the same as that of oxygen. Because there has been no claim that oxygen is a colour additive, it seems inconsistent to claim that CO should be a colour additive. The authors SEBRANEK et al. (SEBRANEK, M.C. HUNT, D.P. CORNFORTH and M.S. BREWER [2006]: Carbon Monoxide

Packaging of Fresh Meat. Food Technology 60 [5], 184) consider CO as useful for fresh meat packaging because the gas binds with the muscle pigment myoglobin to produce a bright red colour, which is preferred by consumers. Critics argue, that this colour looks even fresh, if bacteria have grown on the meat. Hence, consumer and product safety could be at risk. SEBRANEK et al. explain that there is no greater risk associated with bacteria growth using CO technology than with any other packaging system. They are convinced that CO packaging is suitable to increase product safety and it has the potential to lower antioxidants. They point out that the presence or absence of bacteria of public health significance on meat is independent of meat colour.

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Fig. 5: Vitamin additives for meat products. These products are targeted at children.

are also additives that have been tried, tested, and licensed throughout Europe.

Colorants

The colour of foods is an important orientation when shopping and important for acceptance of foods. For meat products the colour red dominates. When it comes to dyestuffs it is possible to distinguish between natural and synthetic colorants. Natural colorants are mainly extracted from colouring foodstuffs. The goal is to extract as much dyestuff and as few flavour components as possible.

Carmine is obtained from the shell back of the insect *Dactylopius coccus* (cactus louse) native to South America. The colouring pigment is the carmine acid and carmine represents the further processed pigment colour. This colorant has excellent heat and light stability and produces an intensive red colour in meat products that is also largely heat stable. According to the additive licensing regulation, the addition of genuine carmine (E120) is limited to a maximum of 100 mg/kg.

Cochinille red A (E124) is only licensed to a limited extent for Chorizo sausage (max. 200 mg/

kg) and Salchíon (max. 250 mg/kg). These Spanish specialities can be encountered on the German market with appropriate labelling (Fig. 8).

Sudan colorants are synthetically produced red azo colorants. In May 2003 the EU issued a warning against Indian chilli products containing Sudan red for the first time. These colorants have been detected in the meantime in seasonings, tomato sauces, pasta and sausage products, as well as in palm oil. The colorants Sudan red I, II, III and IV that are classified as carcinogenic are dyestuffs that are not licensed in the EU for colouring foods. Accordingly, they may not be used in foods. Foods containing these colorants may not be brought into traffic in the EU. Despite this, products containing this colorant (mainly of Asian provenance) have been found in food controls in Germany too.

Improvement of meat tenderness

Recently agents on a citrate and carbonate basis have been increasingly offered for sale for improving the pH value in meat. Some years ago these additives were promoted as cutting aids and as an addition for preliminary grinding of meat. The newly designed products reportedly contribute to improving the tenderness of meat. In experiments within the context of a thesis for a diploma at the TFH Berlin (LOPP, 2005), the positive effects of these additive preparations were confirmed under shear force measurements and in sensory tests. Generally, common salt is also added at the same time (<1% in the finished product). The effects on the connective tissue are much less pronounced with these preparations than on the muscle meat. It should be pointed out that carbonates and citrates are additives that are generally admitted for foods without any quantity limitation (annex 4 of ZZuIV). The additive preparations with softener effect are offered under names such as "Zart und Soft", "Meat Love", "Zartlin" and "Zartling® Power liquid". These can be used as follows. After dissolving, the additive preparations are massaged



Fig. 6: Products with whey additive, additionally enriched with ballast materials.



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INGREDIENTS AND ADDITIVES

well into the cut meat. Roasting joints are injected and tumbled. Steaks, schnitzels and roasting joints should be left to steep over night.

Hydrocolloids

Thickening and gelling agents are generally polysaccharides as regards their structure. They can



mainly used. The concentration is generally about altogether 0.3%. The product is added in dry form. In experiments it was ascertained that the spreadability of these products can be improved by adding hydrocolloids.

Falsifications of cooked cured products

products in the meaning of the principles for meat and meat products. The lowest meat component determined in imitation ham was 39.5%.

Effect of phosphate

According to the additives licensing regulation, phosphates are allowed in all meat products

Useful helpers for flavour and more

Potentials and new developments of technological applications

by Herbert Weber

This overview summarises the most recent developments concerning ingredients and additives for meat processing and presents the most interesting application potentials.

The reorganisation of the law governing additives in 1998, in other words the conversion of the EU Directives on dyestuffs, sweetening agents and other additives into national law, included an expansion of the possibilities of use of additives and ingredients. Interesting applications have been developed in the meantime for meat products too. These focus on wellness and functional foods especially. For these products the health-wellness effect is stressed. Furthermore, there have been further developments in the technological sector. An overview of current developments in the meat sector is set out below. As the developments are very complex, this summary lays no claim to completeness. In addition to positive developments resulting from the reorganisation of the law governing additives, negative developments can also be observed, especially in the case of cooked cured goods. The overview is prefaced by a few topical remarks on functional foods.

The European workgroup in the EU project "Functional Food Science in Europe" defines functional foods as follows: "A food can be seen as functional if it could be demonstrated satisfactorily that it influences one or more body functions positively beyond its nutritional value, in a manner that is relevant for well-being or the reduction of an illness risk."

According to present law, functional foods (as well as all other foods) may not be promoted with ambiguously illness or health-related claims (health claims). Furthermore, indications of preventive effects are not allowed either. General health-related statements such as e.g. "promotes

well-being" or "supports digestion positively" are possible. It should be pointed out that a new EU Regulation for regulating nutritional value and health-related data for foods is being prepared.

There is now a great variety of functional foods in practically all programme areas. Market observations show that health and wellness are advancing steadily in nutrition too (see box). The developments currently becoming apparent for meat products are summarised in a further overview.

Health aspects

Developments in meat products focusing on health aspects are set out below.

Yoghurt addition for cooked sausages

Initially these products were not undisputed under the aspect of food law, but in the meantime these doubts have been eliminated. A large number of products with yoghurt additives were presented at this year's DLG quality test competition too, in some cases fat-reduced (Fig. 1). The pH value setting is partly achieved by adding carbonate.

Vegetable oils as an ingredient in meat products

Here e.g. olive oil and rapeseed oil are used (Fig. 2). For these products too concerns were voiced under food law aspects in the originating phase. In 1980 the



Fig. 2: Meat products with vegetable oils as ingredient. Olive and rapeseed oils, and others are used.



Fig. 1: Cooked sausage with yoghurt additive (photo: firm Hagesüd)

German Ministry of Health declared the exchange of fat to be inadmissible. On 13 January 1992, however, the suitability of such products for traffic was established in a judgement by the administrative court. When sausage products with vegetable oils as an ingredient are brought into traffic, the notices of the work group of experts working in the field of food hygiene and foods of animal provenance (ALTS) from the year 2005 must be observed:

- Sausage products produced with vegetable oil do not conform with the general notions concerning traffic.
- The deviation is so substantial that simply stating the ingredient "vegetable oil" in the list of ingredients is not sufficient.
- An additional clear reference to the vegetable oil is necessary in order to avoid any misleading.
- The data must show the quantity of vegetable oil processed.

Ballast materials (polyfructosans and other polysaccharides) are used as an ingredient in functional food. Their use is justified under the aspect of physiology of nutrition. Oligofructose and inulin are indigestible food components that are intended to promote the growth of bifido bacteria in the large intestine (bifidogenic effect). Under the designation "Wurst(b)engel", cooked sausages with the addition of inulin are on the market, targeted specifically at children (Fig. 3). Raw sausages are now also available with ballast material additives (Fig. 4). Frequently these are mixed with other wellness ingre-

dients, for instance whey.

Vitamin additives in meat products are encountered relatively rarely by comparison with other foods. Under the designation "Ferdifuchs", the firm Stockmeyer has developed mini sausages that contain vitamin additives.

Vitamin E, vitamin B₁, vitamin B₁₂, vitamin B₆, folic acid, biotin and pantothenic acid are added (Fig. 5). It is very costly to furnish conventional evidence of vitamins in foods. The Institut für Produktqualität GmbH in Berlin has developed a quick vitamin test that is distributed worldwide. With this test it is possible to de-

Overview of functional ingredients:

• Probiotics

Bacteria that are more resistant to gastric juices than the lactic acid bacteria used for producing conventional sour milk products and fermented milk products. Large numbers of them reach the large intestine where they can influence the intestinal flora and the immune system.

• Prebiotics

Special indigestible ballast materials that promote the growth of certain intestinal bacteria (lactic acid bacteria) in the intestine and are thus intended to achieve positive health effects.

• Fatty acids and others

The best-known of these are the omega-3 fatty acids that are intended to provide protection against cardiac circulation illnesses, and stimulating substances, e.g. caffeine and taurine, also ballast substances, vitamins (e.g. ACE juices), mineral substances, plant additives and oxygen.

termine all water-soluble vitamins on micro-titration plates very precisely and quickly.

Whey is a by-product of curd and cheese production. Among other ingredients it contains lactic acid and milk sugar. From the point of view of physiology of nutrition, whey is important for metabolism and digestion. Meat products with a whey additive are partly also enriched with ballast materials (Fig. 6). Sausage made from poultry meat is now also processed with whey.

"Without..." label: for meat products it is customary to include "without" on the label, in other words the non-use of ingredi-



Fig. 3: Cooked sausages with indigestible food constituents (inulin).

dients (especially those with E-numbers, such as e.g. glutamate). It is also customary to indicate "without lactose" on the grounds of allergy problems and the obligation to label allergens. Furthermore, low fat contents and the addition of ballast materials are labelled (Fig. 7). These products focus on wellness and health. Some manufacturers have recognised the market opportunities of such products. Developments are to

be awaited, in particular acceptance by consumers too, as these products show altered sensory qualities. In the meantime, a glutamate substitute that can be used

without an E-number has been introduced.

Developments focusing on technological and sensory foundations are described below:

Use of enzymes

Viewed in legal terms, enzymes are additives and their addition is basically allowed. Enzymes are not ingredients that require licensing. The use of enzymes in foods has good technological reasons. For instance amylases are customary for degrading starches, as are pectin degrading enzymes in the fruit juice industry.

With meat products we now have interesting applications of the enzyme transglutaminase. This enzyme is produced in Japan by Ajinomoto. Transglutaminase leads to networking of muscle proteins (acyl transfer reaction, networking reaction, desamination). A bond is achieved between muscle lots joined together, and slice cohesion is improved. It is reportedly also possible to improve slicing processes by using

Activa® WM. The advantages are higher stability of inlay meat, pistachios etc. It is possible to cut extremely thin slices as well as at high speeds.

Capsaicin and dihydrocapsaicin replacement

The ingredients capsaicin and dihydrocapsaicin that occur in capsicum varieties are responsible for hot tastes. In addition to these compounds, there are always slight quantities of further compounds with an analogous structure in that also have a hot flavour, and in their entirety are described as capsaicinoids. Nonivamid (nonanoic acid vanillylamide) is a nature-like aroma substance with a pleasant hot taste that reportedly has better heat stability than capsaicin. It is fundamentally suitable for use in food production in order to lend foods a hot flavour. Noviamide (NVA) is produced synthetically with a controlled and standardised process. The result is a constant and reproducible quality



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with pre-determinable hot flavour. Depending on the degree of hotness desired in the final product, an average concentration of 10 to 300 SHU (Scoville Heat Units) is suggested.

Anti-oxidative and anti-microbial spice extracts

The demands made of foods as regards clean labelling, high enjoyment quality and the longest possible stability are growing constantly. Natural plant extracts obtained from rosemary, camomile or melissa are able to develop antioxidative and possibly even antimicrobial effects in foods. The products are also suitable for flavour-sensitive foods. In the meantime various natural plant extracts are available on the market that differ as regards the process used to obtain them and the isolated active agent. Special products with altered solubilities, e.g. oil-soluble variants are now also available. When plant extracts are obtained, the goal is to extract as many substances with



Fig. 4: Uncooked sausage with ballast material additive

antioxidative and antimicrobial effects as possible and to keep the proportion of seasoning components as low as possible. Origanox is a purely aqueous extract from oregano that is obtained without the addition of any chemicals. The product is produced in Israel. Stabiloton is

gained from rosemary by means of high pressure extraction. The main active agent and guide substance is carnosic acid.

Curing agents/antioxidants

Ascorbic acid and sodium ascorbate have reducing properties and support the formation of the curing colorant. The reduction of the nitrite to nitrogen oxide is accelerated. These substances also have a colour-stabilising effect by reducing metmyoglobin (brown) back to myoglobin (dark red). Isoascorbic acid and isoascorbate have the same technological effect as ascorbic acid and ascorbate. However, these substances do not have any vitamin effect in the human body. Isoascorbic acid and isoascorbate are used in isolated cases. The price advantage between ascorbic acid and sodium ascorbate is now slight, however. The admissible quantities of the additives must be observed. In the case of isoascorbic acid (E315) and sodium isoascorbate (E316), according to the law on additive licensing a maximum quantity of 500 mg/kg may be added to meat products. In the case of ascorbic acid and its salts the maximum quantity is quantum satis.

Products on the basis of ascorbic acid and ascorbate with changed solubility behaviour are new on the German market. In its original condition, ascorbic acid is water-soluble. Thanks to a patented process of Aquanova GmbH the solubility behaviour is changed. Novasol® contains tocopherol as an antioxidant and polysorbate 20 as carrier material. It is possible to increase the tocopherol component. The fat solubility of Novasol® leads to increased mobility of the active ingredient. Comparative examinations of cooked sausages and uncooked sausages came out in favour of Novasol®.

As regards the legal licensing of these antioxidants it can be ascertained that ascorbic acid, water and DL-alpha-tocopherol are tried and tested and licensed ingredients in the meat product industry. Polysorbate 20 is allowed as a carrier substance for fat-soluble antioxidants (EC Directive 95/2/EC). The other constituents

Developments in ingredients and additives in the meat sector

- Cooked sausage with yoghurt additive
- Cooked sausage production with oil additive, e.g. olive oil, rapeseed oil
- Vitamin additives for meat products, target group: children
- Calcium additive for meat products, target group: children
- Ballast additive for meat products, e.g. inulin and wheat fibres
- Addition of aloe vera
- Addition of whey
- Use of transglutaminase for meat products made of combining pieces
- Use of transglutaminase to improve slicing properties
- Alternative to capsaicin with better standardisability, e.g. Nonivamid
- Seasoning extracts for fat stabilisation, e.g. Origanox™, stabiloton
- Antioxidation agents: ascorbic acid and ascorbate with changed solubility, e.g. fat-soluble ascorbic acid Novasol®
- Isoascorbic acid and isoascorbate as substitute for ascorbic acid and ascorbate
- Use of colorants
 - E120 genuine carmine (allowed)
 - E124 cochineal red A (conditionally allowed)
 - Sudan red (prohibited)
- Agent for increasing the pH value in meat products, e.g. carbonate, acetate: use as cutting aid and to improve the tenderness of meat, e.g. Zart und Soft
- Phosphate additives in cooked cured goods
- Use of carrageenan and carboxymethylcellulose to boost yield of cooked cured products
- Falsifications of meat products by protein hydrolysates, in particular in cooked cured products

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