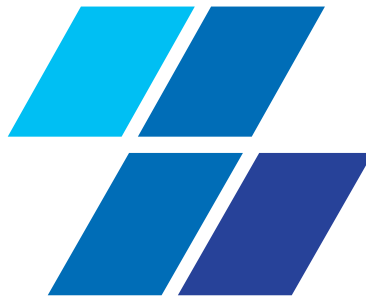


HYGIENE CONCEPT OF THE SUGAR INDUSTRY



VEREIN DER ZUCKERINDUSTRIE

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**VEREIN DER ZUCKERINDUSTRIE
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PREFACE TO FIRST EDITION

In the last few years, questions of food hygiene have gained significance as efforts of providing more systematic food safety intensified. This is reflected, in particular, by the papers of Codex Alimentarius and also the different hygiene directives of the European Union.

These regulations account for the more stringent requirements on consumer protection in the face of a constantly growing international goods trade in as much as, more than in the past, business operators themselves will be called upon to implement and give shape to the requirements of food hygiene principles and practices as forth in these regulations; at the same time, however, implementation can take a more direct bearing on practical necessities. The fact that measures designed to guarantee safe foodstuffs are formulated by business operators themselves will be a central aspect in the future.

The present Hygiene Concept reflects this situation, which translates the requirements of the Community Hygiene Directive (93/43/EEC) into the sugar industry's own specific hygiene requirements. Because of the production process involved and its properties, sugar is a safe foodstuff in itself, and the hygiene directive and implementation of the hygiene Concept give additional systematic and comprehensive support.

If not already integrated into the quality management systems of business operations, the Hygiene Concept will now gradually be translated into the practical work of production plants.

Bonn, March 1996

PREFACE TO SECOND EDITION

The Hygiene Concept of the Sugar Industry of 1996/1997 has been systematically implemented in all companies in the German sugar industry and has found great acceptance from many sides in the past few years.

The concept has proved to be appropriate for satisfying the requirements of Directive 93/43/EEC on the hygiene of foodstuffs with regard to the needs of the sugar industry.

The extensive reform of European Hygiene Law has now rendered it necessary to adapt the concept in view of changes to the general legal conditions.

The objective of this reform is the implementation of the concept "From Farm to Fork", as well as the consolidation and simplification of the existing hygiene provisions.

Of relevance to the sugar industry is Regulation (EC) No. 852/2004 of the European Parliament and the Council dated 29 April 2004 on the hygiene of foodstuffs, which came into force on 20 May 2004 and has been in practice since 1 January 2006. This regulation replaces Directive 93/43/EEC on the hygiene of foodstuffs.

Significant changes in comparison with the previous provisions are the inclusion of primary production and compliance with the principles and concepts of Regulation (EC) No. 178/2002 laying down the general principles and requirements of food law.

Based on the new legal position the Hygiene Concept of the Sugar Industry has been revised and is now available in a second edition.

Bonn, March 2006

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1. INTRODUCTION

With this Hygiene Concept the companies of the sugar industry in Germany have presented a joint approach to the implementation of Regulation (EC) No. 852/2004 on the hygiene of foodstuffs.

Each company is itself responsible for the implementation of the requirements of European Hygiene Law – including the application of the HACCP concept – whilst at the same time taking into account its own specific conditions on site.

However, the products of the sugar industry and their properties, the manufacturing processes and the procedures involved in the sugar factories are comparable so that a sector-wide interpretation of European Hygiene Law is possible. In all companies the implementation is integrated into the structure of a quality management system.

2. SCOPE OF APPLICATION OF THE HYGIENE CONCEPT

Regulation (EC) No. 852/2004 formulates general hygiene provisions for food companies at all levels of the food chain, including primary production.

The main focus of the Hygiene Concept comprises both the sugar extraction process as well as the manufacture of spe-

cial sugar products and also includes storage and transportation.

The HACCP concept of the sugar industry, which is described in a separate volume, has also been updated because of the changes to the European Hygiene Law.

3. PRIMARY PRODUCTION

Regulation (EC) No. 852/2004 on the hygiene of foodstuffs first formulates hygiene requirements for food business operators at the level of primary production. In this regard, Annex I contains general hygiene requirements that must be observed in the context of primary production. These requirements refer particularly to cultivation, transportation and record-keeping.

Even though the provisions listed in Annex I do not apply to the sugar industry but to every individual beet grower, the points that are characteristic for cooperation between the sugar industry and the beet growers will be addressed below.

The basic principle of this cooperation is the contractual relationship (beet delivery contract, sector agreement) that exists between every beet grower and the sugar industry.

The following points assist the beet growers with the implementation of the requirements of Annex I¹⁾.

Advice:

Advice is provided to beet growers in cooperation between the sugar industry, growers' associations, working groups held jointly by both groups and also the official agricultural advisory agencies.

The tests carried out by the working groups form the basis for advice on plant protection, the use of fertilizers and variety selection (Chap. II No. 5).

Plant protection:

The companies of the sugar industry and the growers' associations work out joint recommendations for tackling weeds and pests as well as for the treatment of foliar diseases (Chap. II No. 3 a).

Field documentation:

The beet growers have a contractual obligation to maintain a system of field documentation in which the seed used, the application of fertilisers and plant protectants are documented, as well as, where applicable, additional measures that have been taken, e.g. for soil cultivation (Chap. III Nos. 7 and 9).

Beet cleaning:

In order to reduce the amount of soil residue the sugar beets are usually pre-cleaned at the edge of the field before loading (Chap. II No. 5 b).

Transportation of sugar beets:

Contractual agreements require that vehicles are suitable for the transportation of sugar beets and, where necessary, are cleaned before loading (Chap. II No. 5).

¹⁾ Where the law is referred to in this chapter, reference is made to the relevant passages in Annex I (Primary Production) of Regulation (EC) No. 852/2004.

4. SUGAR EXTRACTION

4.1 PRODUCTION PROCESS

The aim of sugar extraction is to extract the sucrose from the sugar beet in a crystalline, pure form.

Preparation of beets:

The sugar beets, which have already been pre-cleaned in the fields, are stored temporarily in the sugar factories on beet storage units. On conveyor belts or flumes the beets are transported to the beet washer, where any remaining soil is removed and any tops and stones are separated off. Soil, tops and stones are removed from the wash water and fed to further use. The beets are sliced into small pieces in the slicing machines.

Extraction:

In a continuous counter-current extraction process using water the thin slices of beet (cosettes) heated to around 70 °C are desugarized. This creates a 15 % sugar solution that is known as raw juice. The desugarized cosettes (beet pulps) are marketed as animal feed.

Juice purification:

The raw juice contains apart from sugar other components of sugar beet. Some of these components precipitate by adding milk of lime and carbon dioxide. The generated calcium carbonate surrounds the precipitated non-sugar components

that can then be separated off by filtering. This leaves a clear, light yellow liquid, the thin juice. The residue that has been filtered off is pressed to carbonation lime and marketed as fertiliser.

Juice thickening:

Water is then extracted from the thin juice in a multi-stage evaporation station under pressure and at high temperatures (120 to 130 °C) until the sugar content of the resulting juice is between 70 and 75 %.

Crystallisation, drying, sieving, storage:

Solid sucrose is extracted from the thick juice by means of crystallisation.

In the first stage the thick juice is reduced at temperatures of around 80 °C and under a light vacuum to a given dry substance content. The mixture is then inoculated with small sugar crystals as seed crystals which grow in the course of the crystallisation process. When the crystal content reaches approximately 55 % the process is interrupted. The mixture of crystals and syrup is passed via intermediate tanks into the centrifuges where crystals and syrup are separated. This sugar – white sugar – is dried, sieved and then stored temporarily in the silo to await further processing.

Then in two subsequent crystallisation stages the syrup is further desugared. The so extracted sugar is dissolved and crystallised again. Refined sugar is the product of this second crystallisation stage. This too is dried and sieved and put in storage in the designated silos to await further processing. In the third crystallisation stage the syrup obtained is molasses, which is used for example

in the production of animal feed, yeast and alcohol. The sugar stored temporarily in the silos is sieved according to customer requirements and distributed either as loose or packaged goods.

Further processing:

Some of the sugar is processed to make cube sugar, icing sugar, jelly sugar or other specialities.

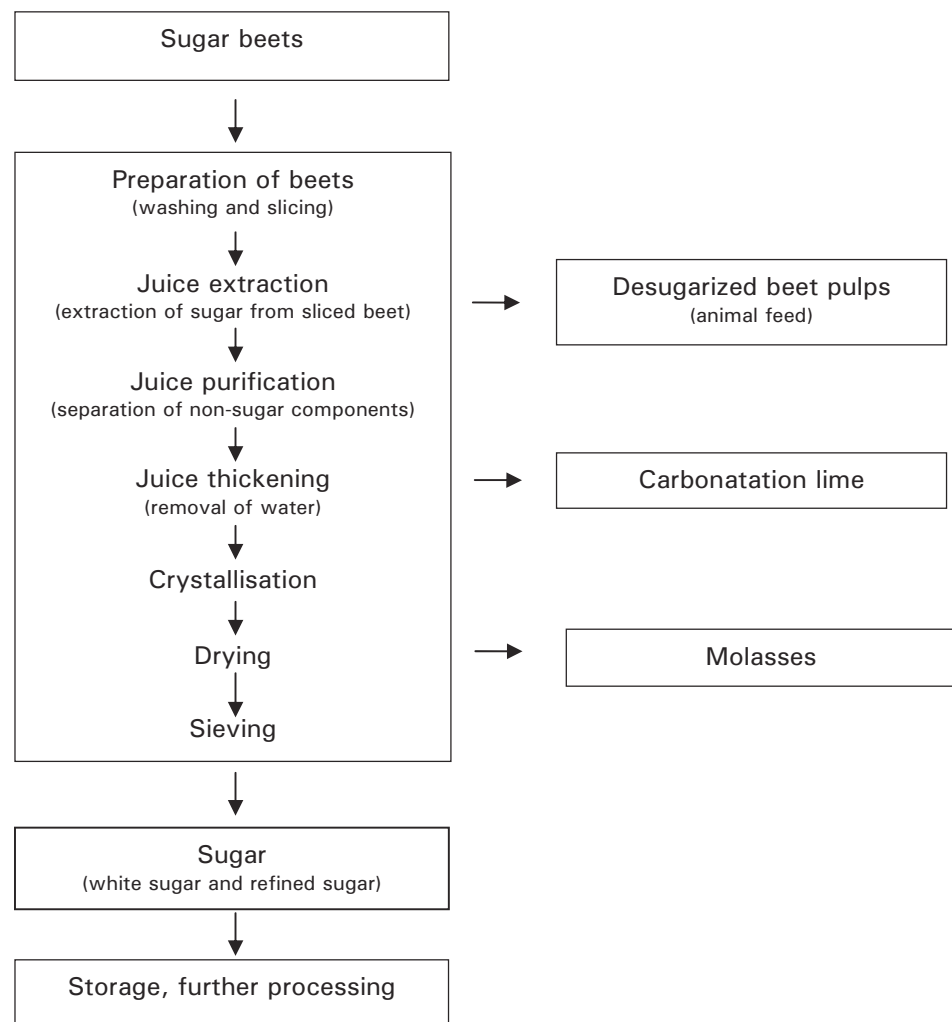


Figure: Simplified diagram of sugar extraction

Because of this production process the quality of the sugar beet has no effect on the sugar quality that is obtained with a high level of constancy. This is a significant difference in comparison with many other foodstuffs (vegetables, fruit, salads, meat, milk), which can usually be consumed immediately, or after only minimal preparation, meaning that the quality of the raw materials is crucial to the quality of the end product.

The sterilization conditions during sugar production and especially throughout the crystallization process ensure that the product sugar is produced to a high level of purity (minimum 99.7 % according to the EC-Sugars Directive) and microbiological safety, so that it can be kept for an unlimited period when stored appropriately.

4.2 SPECIAL SUGAR PRODUCTS

Sugar is used by the food processing industry and by the final consumer; it is also a raw material for products of further processing manufactured by the sugar industry itself. The methods for the manufacture of products of further sugar processing include the milling, pressing

and dissolving of sugar, the mixing of sugar with ingredients and special crystallisation procedures. These products are, for example, icing sugar, cube sugar, liquid sugars, jelly sugars, fondant, brown sugars, candy sugars and fructose.

5. HYGIENE REQUIREMENTS OF SUGAR EXTRACTION

In the following is described how the sugar industry is satisfying the requirements of Annex II of Regulation (EC) No. 852/2004 on the hygiene of food-stuffs²⁾.

The concept is divided into general requirements and special requirements for factory hygiene as well as into personal hygiene measures.

5.1 GENERAL REQUIREMENTS FOR FACTORY HYGIENE

5.1.1 Premises/environment

Industrial premises are kept clean. In order to achieve this maintenance and cleaning measures are implemented (see 5.1.3) (Chap. I Nos. 1 and 2 a).

For processes which take place in non-closed or only partially closed systems, action is taken to protect against negative effects. Doors and windows are kept closed to prevent the penetration of dirt and pests. Where necessary, windows are provided with insect-proof screens (Chap. II No. 1 d).

All buildings have either natural or artificial lighting. Where light fittings are located in rooms containing open product-carrying sections of the plant then these are fitted with protection against shattering glass (Chap. I No. 7).

5.1.2 Sanitary facilities

Toilets for employees are located within easy reach of the work station. In areas dealing with the post-crystallisation stage the structure of the building is always

such that there is no direct access from the toilets to the production rooms.

The toilets are fitted with flushing, separate ventilation and hand-washing facilities (Chap. I No. 3).

All washhand basins have hot and cold running water plus everything required for the hygienic washing and drying of hands (e. g. liquid soap, disinfectant, disposable hand towels) (Chap. I No. 4).

5.1.3 Cleaning

Cleaning is carried out with the appropriate equipment in different ways and with varying degrees of frequency in the individual areas. In this respect consideration is given to, for example, the extent to which the machinery and equipment in use in the rooms in question can affect the hygiene of the end products.

The cleaning measures carried out are of a preventive nature to avoid build-up of dirt before any pests and micro-organisms can become established as a result.

²⁾ Where the law is referred to in this chapter, reference is made to the relevant passages in Annex II of Regulation (EC) No. 852/2004.

The type of cleaning is stipulated in cleaning plans. At sugar extraction in post-crystallisation areas special consideration is given in cleaning plans to places where dirt could collect or condensation water could form. Dry, damp or wet cleaning methods are used if necessary.

Checks are performed to see that cleaning plans are being observed and plans updated if need be:

- areas (and equipment) to be cleaned,
- type and frequency of cleaning to be carried out,
- responsibilities for carrying out the cleaning,
- arrangements for monitoring.

Where cleaning or disinfection agents are used for special purposes, adequate rinsing of the machinery is carried out to ensure that any residue from the agent used does not affect the product (rinsing programme). Such agents are stored outside the production rooms (Chap. 1 Nos. 2 a, b and c, Chap. II No. 2, Chap. V 1 a, c, d).

5.1.4 Pest control

Factory sites and buildings undergo, if necessary, systematic preventive pest control measures by special companies from outside. The action taken is according to the requirements of the individual areas. Pest control measures mainly concern rodents and insects (Chap. 1 No. 2 c).

If necessary, steps are taken to eradicate any pests. In this case authorised pest eradication agents are used. These preparations are only used by people who are familiar with the correct way to handle them. They are used according to a specific plan and the process is documented (Chap. IX No. 4).

These measures are implemented in such a way that any detrimental effects on the foodstuffs are avoided (Chap. IX, No. 4).

5.1.5 Water supply

During the sugar extraction process large quantities of vapour condensation occur in the heating and thickening stages, which is then piped in circuits and re-used. The vapour condensate is a distillate that, because of the high process temperatures of up to 125 °C, is safe from a microbiological point of view.

When the external and internal systems are filled initially water is obtained from an external supplier or the company's own well. Because of the nature of the production process it is not necessary to use drinking water (Chap. VII No. 3).

Water of drinking water quality is used for the manufacture of special products. If need be this water is treated for special purposes (e. g. demineralised) (Chap. VII No. 1 a). Exceptions may be made to this rule provided the perfect hygiene quality of the end product is guaranteed.

5.1.6 Waste water

Waste water is drawn off in such a way that a contact with the product is impossible (Chap. I No. 2, 10).

5.1.7 Waste

As the entire sugar beet is used there is no waste from the sugar extraction process.

Other waste is collected in the production rooms in the containers provided – closable if necessary – and placed at designated locations for collection (Chap. VI Nos. 1-4).

5.2 SPECIAL REQUIREMENTS FOR FACTORY HYGIENE

The hygiene requirements listed below are supplementary to the general requirements, and where necessary provide more precise details.

5.2.1 Requirements for juice extraction, purification and thickening

The process stages of juice extraction, juice purification and juice thickening are fully automatic and take place to a great extent in closed systems. Because of the high pH values and temperatures involved in these processes the juice has been sterilised by the time it is passed on to the crystallisation area.

Due to the continuous manufacturing process systems carrying the product can only be cleaned at the start and the end of a campaign (Chap. 1 Nos. 1 and 2).

5.2.2 Requirements for crystallisation, drying, sieving, further processing and storage

After centrifugation the sugar is present in its crystalline form. As the rest of the process is not carried out exclusively in closed systems, it is necessary to take

steps to protect the product hygienically from impairment, in particular by the ambient air (Chap. 1 No. 2 c). Floors are kept perfectly clean. Wet cleaning is possible in the entire area; however the drying area as well as the silos and the production rooms for sugar sieving and for the manufacture of products for further processing should only be wet cleaned in exceptional circumstances (Chap. I No. 2 and Chap. II No. 1 a).

Equipment, windows, doors, walls and ceilings are designed to avoid dirt collecting and to be easy to clean. In places where moisture can be deposited on walls, checks are carried out to see if mould is forming and if necessary action is to be taken to treat the area (e. g. with fungicidal paint) (Chap. II No. I b-f, Chap. V No.1 b).

Ceilings are kept in good condition. This applies especially to areas above open transportation elements after centrifugation. Where condensed water forms on ceilings and beams action taken involves, for example, covering, ventilation and cleaning (Chap. II No. 1 c).

The cleaning and, if necessary, also disinfection of machinery and equipment (such as transport elements and magnetic separators) is stipulated in cleaning plans. Care must be taken during cleaning to ensure that there is no negative effect on the next production step. When cleaning around equipment particular care must be taken to clean the spaces and corners behind and between equipment (Chap. V No. 1 and Chap. I No. 2).

The formation of condensed water inside silos is prevented by the provision of insulation, heating and ventilation for the silos. The air used for heating and ventilation is passed through filters. The filters are serviced and the filter material replaced if necessary. The filters in the sugar drying and dust removal equipment are also serviced or replaced (Chap. I No. 2 and No. 5).

In addition special company requirements apply depending on the product and the equipment.

For instance, storage tanks for liquid sugars are cleaned after emptying. The frequency as well as the cleaning and disinfection procedures are specified.

The filters in the tanks are cleaned, disinfected and replaced at set intervals (Chap. I No. 2 a, Chap. V No. 1).

5.2.3 Requirements of packaging and storage of products for sale

Products for sale and packaging materials are stored in such a way as to avoid any contamination of the product (Chap. I No. 2 c, Chap. X No. 2).

The storage rooms are kept clean and dry (Chap. I No. 1).

The temperature and humidity in the storage rooms is kept at an appropriate level (Chap. I No. 2 d).

Doors to the outside, including loading ramps, are kept closed as far as possible (Chap. I No. 2 c).

5.2.4 Reprocessing/Rework

Sugar that accumulates in various places after the crystallisation process and also in the packaging and storage area (e. g. sugar incrustations from the silo, sugar accumulating on packaging machines) is collected in marked bins and reintroduced into the production process – after first being cleaned if necessary.

5.2.5 Requirements of loading and transportation

Sugar and products of further processing are transported both loose and packaged.

The loading station for both solid and liquid products for sale plus the surrounding area is kept clean, dry and tidy (Chap. I No. 1).

Loose intermediary products and products for sale in solid and liquid form are transported in silo lorries and tankers that are intended exclusively for the transportation of foodstuffs and are permanently marked with the notice "for foodstuffs only" (Chap. IV Nos. 2, 4).

When a vehicle switches to carrying loose sugar products after transporting other

foodstuffs it must undergo appropriate cleaning before it is filled. Information is provided about the goods carried and the cleaning operations that have been carried out (Chap. IV No. 1, 5).

Packaged goods are to be transported in such a way as to keep the risk of contamination to a minimum (Chap. IV, Nos. 1, 6).

Where transportation is carried out by third parties they are obliged to observe the food law provisions. Random inspections are carried out to check that the requirements are being observed. Vehicles that do not comply with the requirements are rejected.

5.3 PERSONAL HYGIENE

Personal cleanliness and an awareness of the hygienic behaviour of the employees in a factory have both a direct and indirect influence on the hygienic status of the factory and the product. Microorganisms are also brought into the factory and spread by employees (e. g. on skin and hair).

5.3.1 Personal hygiene measures

The requirements of personal hygiene are determined by the needs of the individual areas, with special requirements in

the areas for crystallisation, storage, manufacture of further processing products, packaging and loose loading (Chap. VIII No. 1).

Employees wear clean, appropriate work clothing and headgear (Chap. VIII No. 1). Changing rooms are provided for this purpose where necessary (Chap. I No. 9).

Special regulations that are determined on site apply to certain areas.

Employees are given instructions each time before entering a silo and must wear the clothing provided.

Food and drinks are only kept and consumed in the rooms or areas provided for that purpose.

Smoking is only permitted in designated rooms.

Personal hygiene measures include amongst others, washing hands before starting work, after breaks, after using the toilet and after performing tasks in which the hands become dirty, as well as before carrying out repairs and handling the equipment (Chap. VIII No. 1).

Lesions on the skin and wounds are covered immediately with a suitable dressing (Chap. VIII No. 2).

5.3.2 Hygiene training

Employees are given regular training in matters of food hygiene (Chap. XII No. 1).

Hygiene training for employees involved in the areas of crystallisation, storage, preparation of different commercial grades, manufacture of special products, packaging and loose loading basically includes the following:

- general information on the subject of food hygiene,
- principles of staff hygiene,
- special behaviour for hygiene in one's own work area,
- hygiene and cleaning measures in the factory.

Regular inspections are carried out to check that these and other internal company hygiene instructions are being observed.

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