HACCP - Basic notions
General Objectives

- Conhecer a necessidade de efectuar procedimentos de controlo e monitorização;

- Reconhecer a importância de implementar programas de pré-requisitos;

- Compreender o sistema HACCP e o autocontrolo como ferramentas de segurança alimentar.

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HACCP is a preventive control system that aims for food safety. It’s an organized, systematic and scientific method, as well as a documented and verifiable contribution to the implementation of surveillance systems in manufacturing processes. This system is internationally recognized which allows it to be applied to food industries worldwide, as well as to other sectors at input and output ends. Furthermore, it also permits the identification and analysis of hazards related to the different states of the food manufacturing process, the definition of the means necessary to control these hazards and the guarantee that those means are efficiently applied.

The HACCP system first emerged in the sixties by joint effort of the Pillsbury Company, the USA army laboratories and NASA (National Aeronautics and Space Administration) which intended to develop safe food for cosmonauts of the American Space Programme. A 100% guarantee that these products were not contaminated with microbiological, physical and/or chemical hazards that could cause health disturbances to the consumer was demanded. Therefore, the Pillsbury Company introduced and adopted HACCP as a system to guarantee maximum safety of products at the same time that it reduced its dependence on product inspections. The part related to hazard analysis was adapted to food industries needs based on techniques that were already developed for by other industries. Other concepts, such as the definition of critical points were progressively added. So, HACCP is a systematic approach to prevent and control potential health hazards in food operations. It acts as an identification and analysis tool of the critical points in different process stages, permitting simultaneously the establishment of the means necessary to control those points and the application of a proactive instead of reactive surveillance. From that point on, the Pillsbury Company Factories implemented HACCP and between 1971 and 1980 helped other companies develop this kind of self-control. But only after 1985 was it possible to witness great
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1 Advantages and disadvantages of the HACCP system

In Europe, the HACCP system only became relevant after 1990 with the formulation of legislation derived from the alterations of hygiene regulations. The transposition of HACCP to the European community was officially done with the publication of Directive 93/43/CEE of 14 June 1993 and the transposition to national juridical order was achieved by Decree-law n. ° 67/98 of 18 March, by mandatory self-control, afterwards amended by Decree-law n. ° 425/99 of 21 October. In 2004, the European Community promulgated Regulation (EC) n. ° 852/2004 of the European Parliament and Council of 29 April, which lays down the general rules regarding foodstuffs hygiene.

Advantages of the HACCP System
- Optimizes technical and human resources used asides from guiding them to critical activities;
- Facilitates more efficient self-control actions, mostly with a less probability of occurring flaws/accidents and frauds;
- Establishes a confident environment before official authorities, economical agents and consumers in general in terms of food safety;
- Motivates personnel training;
- Gives a global and objective vision of what effectively goes on in the company;
- Permits the reduction of no quality costs, since it is based on a preventive philosophy of reducing costs and waste;
- It is recommended by the World Health Organisation (WHO), International Commission of Microbiological Specifications for Food (ICMSF) and the Food and Agriculture Organisation (FAO);
- It can be used as defence evidence against legal actions;
- It’s a complement to other management systems, namely quality management systems;
- It’s applicable to the whole food chain;
- It can be used to introduce food safety in the development of new products;
- It’s an internationally recognized and considered efficient system;
- Promotes change in company politics and practices from retrospective quality control to preventive guarantee of quality.
Disadvantages of the HACCP System

- Requires technical, human and material resources not always available at the company;
- Requires sincere effort and involvement of all elements of the organisation;
- Demands time availability;
- Implicates a change in attitude;
- Requires detailed technical data and constant updating;
- Requires conserving information for a simple way of interpretation;
- Requires concentrated actions of all participants of the food chain.

Health safety is the result of the implementation by food business of pre-requisite programmes and procedures based on HACCP principles. Pre-requisite programmes are the basis for an effective implementation of HACCP and should be implemented before the HACCP system is established.

Pre-requisite programmes are defined as universal procedures or stages that control operational conditions inside a food business, allowing the installation of environment conditions favourable to the manufacture of safe food. When one intends to implement HACCP to a company the first step is to assess existing programmes and to verify if all requirements are met. It is also necessary to verify if all controls are carried out and if the correct documentation exists and is used. It’s important to keep evidence that validates the effectiveness of these programmes and compliance with requirements.
3 HACCP system principles

The HACCP system consists of 7 principles:

**Principle 1** - Identify any hazards that must be prevented, eliminated or reduced to acceptable levels;

**Principle 2** - Identify the critical control points (CCP) to control identified hazards;

**Principle 3** - Establish critical limits that should be respected to ensure that each CCP is under control;

**Principle 4** - Establish a monitoring system to assure that CCP are under control;

**Principle 5** - Establish corrective actions when monitoring indicates that a critical control point is not under control;

**Principle 6** - Establish verification procedures that confirm proper functioning of the HACCP system;

**Principle 7** - Organize documents regarding all procedures and records related to these principles and to their application.

4 Stages for implementing the HACCP system

Applying HACCP principles consist of the following stages:

**1st stage**
Assemble HACCP team;

**2nd stage**
Describe product;

**3rd stage**
Identify intended use;

**4th stage**
Construct process Flow Diagram and Plant Schematic

**5th stage**
On-site verification of Flow Diagram and Plant Schematic

**6th stage**
List hazards associated with each step, conduct a hazard analysis and consider measures to control the identified hazards;

**7th stage**
Determine CCP;

**8th stage**
Establish critical limits for CCP;

**9th stage**
Establish monitoring procedures for each CCP;

**10th stage**
Establish corrective actions;

**11th stage**
Establish verification procedures;

**12th stage**
Establish record keeping/documentation for principles
4.1 Assemble HACCP team
The first stage for implementing HACCP is assembling a HACCP team. This team is responsible for the development, implementation and maintenance of the system in the business. The team should be multidisciplinary, made up of technicians specialists in the various areas important to the industrial transformation of food, such as: microbiology, chemistry, quality, production, maintenance and technology. It is extremely important when assembling a team that at least one person that works in production is part of it too, this is essential to implement a perfect HACCP system since these persons know how the productive process works best. If the business does not have such technicians with a degree or knowledge of the above referred areas, then it should resort to external technicians that have the knowledge about possible health risks.

The HACCP team is responsible for:
- Developing a HACCP plan;
- Supervising the functioning of the system;
- Keeping documents (system records);
- Writing up periodic information for the board of directors;
- Modifying and revising the plan;
- Motivating and training all personnel involved;
- Marking and carrying out internal audits.

4.2 Describe product
Describing the product is important for implementing the HACCP system, not only because it contributes to the familiarization of the product in studies by the HACCP team, but also because it represents an introduction and a reference point for the HACCP plan. For an efficient implementation of the system all data on the product must be collected so that it is possible to know every detail about it, this will enable the identification of possible hazards inherent to the ingredients used for producing a product or packaging materials. The description of the product must contain several aspects, such as:

- Composition (raw materials, ingredients, additives, etc.);
- Structural, physical and chemical characteristics essentially those that may
promote its safety (available water, pH, etc.);
- Processing (freezing, heating, drying, smoking, etc.);
- Type of package, including material and packaging conditions (modified atmosphere, vacuum, etc.);
- How it is to be used and distributed (ready to eat, posterior processing, cook before eating, etc.);
- Expiring date;
- Storing and transport conditions (temperature, humidity, etc.);
- Label instructions (instructions on how to handle and use);
- Special distribution control;
- Any microbiological or chemical criteria applicable.

4.3 Identify intended use
The HACCP team must define how the consumer should normally use the product and what target groups is the product intended for. The place where the product is to be sold and target consumers should be specified on the product, especially if we are dealing with risk groups (pregnant women, elderly, infants, etc.).

4.4 Construct process Flow Diagram and Plant Schematic
A flux diagram of the process should be developed with an exact sequence of all production stages and time/temperature conditions along the whole process. This diagram should be based on interviews, observation of operations and other important sources of information. The diagram must indicate all steps of the process (from reception to expedition) used to produce the product at hand and its sequence, as well as the stages in which they occur:
- Reception of raw materials and intermediate products;
- Reusing or recycling of raw materials/product;
- Removal of intermediate products, sub-products or waste;
- Potential ways of cross contamination.

A plant schematic should also be developed to show the flux of the product and the traffic that occurs inside the factory by the collaborators. Personnel flux must indicate the collaborators movements inside the factory, including dressing rooms, W.C and canteens. Localization of faucets and bait points should also be identified.
4.5 On-site verification of Flow Diagram and Plant Schematic

The flow diagram and Plant schematic should be verified on-site after being concluded, so that it is possible to correct or add details that are considered important. The Flux diagram should be confirmed alongside the whole process, many times along working hours, covering all operations and involving all members of the HACCP team.

4.6 List hazards associated with each step, conduct a hazard analysis and consider measures to control the identified hazards

The HACCP team must analyze hazards that are reasonably expected to happen by identifying them and eliminating or reducing them to acceptable levels which is essential for obtaining safe food. Before analyzing hazards it is recommended to do some bibliographical research first. It is important to be as much up to date as possible in terms of available information, existing studies or databases. During hazard analysis some questions must be considered:

- The probability of occurring any hazards and its severity on health;
- Qualitative/Quantitative assessment of the presence of hazards;
- Survival and multiplication rate of pathogenic microorganisms and unacceptable levels of chemicals in intermediate or finished products;
- Production or presence of toxins on food and other unwanted products that derive from microbial metabolism, chemicals, physical objects or allergens.
- Contamination (or recontamination) of a biological (microorganisms, parasites), chemical or physical nature from raw materials, intermediate or finished products;
- Points where incorrect handling may occur;
- Identification of frequently contaminated vehicles;
- Factors that contribute to contamination of food.
The above questions can be implicitly approached on a risk matrix. This tool allows hazard analysis to be based on the probability of occurring and the related severity.

The shaded areas correspond to significant hazards. Therefore, a high severity hazard but less likely to occur is considered a significant hazard.

This analysis should be conducted for each existing product/process and for each new product. Additionally, this analysis should be revised in case process alterations occur regarding raw material, reformulations, etc.

For each identified hazard, the control measures that can be or are put into practice should be considered and described, if they exist.

One or more hazards can be controlled by one measure (for example: sterilization or heat treatments that reduce the contamination level of pathogenic microorganisms). Control measures should be based on detailed procedures to guarantee an effective implementation.

**4.7 Determine CCP**

The identification of a Critical Control Point of a hazard requires a logical approach. This approach can be facilitated by using the Codex Alimentarius decision tree. Determining CCP’s is based on the assessment of severity and probability of a hazard to happen and on what can be done to eliminate, prevent or reduce hazards in a certain step. It is not necessary to have a CCP for each identified hazard; in the meantime,
actions should be taken to ensure the elimination, prevention or reduction of all hazards.

**Question 1**
This questioned can be answered as “yes” even if control measures don’t exist but can be implemented. If yes is the answer then the measure considered for this question must be documented. If no is the answer then the whole process needs to be reformulated in order to include these measures. Many of these measures can be associated to pre-requisites or to good practices.

**Question 2**
This question refers to the probability and severity of an occurrence and should be judged based on previously collected data. In any case, it is always interesting to document the basis of a decision, at least for future references.

**Question 3**
This question assesses the probability of occurring contamination in each specific step.

**Question 4**
This question assesses the capability of the process to eliminate or reduce existing hazards. The critical control points can be identified by using an alphanumeric combination. This combination refers to the order and type of CCP (B-biological, C-chemical and P-physical). For example: CCP-1B refers to CCP n.° 1 of the biological type. Like so, this identification is the first stage for developing the HACCP plan.
Q1 - Are preventive and control measures possible for the hazard?

Yes

Q2 - Does this stage eliminate or reduce the hazard to an acceptable level?

Yes

Q3 - Can contamination occur by the hazard or by the increase of the hazard to unacceptable values?

Yes

Q4 - Is there a next stage that eliminates or reduces the hazard to acceptable levels?

Modify stage, process or product

Yes

STOP

Not CCP

STOP

STOP

CCP
4.8 Establish critical limits for CCP

Each control measure associated to a critical control point should originate a specific critical limit. The critical limit corresponds to the maximum acceptable value considering product safety and separates acceptability from unacceptability. These criteria must be in concordance with applicable laws, sector or internal regulations or any other scientific information. One or more limits can be established to control each hazard. These limits can be established over various factors (Examples: temperature; time of exposure; size; water availability; humidity; pH, etc.).

Therefore, they should be able to give real time information in order to make decisions about acceptability or not of a product at that stage of the process. Monitoring procedures should be able to describe methods, frequency of observations or measurements, associate records and identify critical points, as well as determine who proceeds with the monitoring and recording. Records of all monitoring activities for each critical control point should always exist and should be signed by the person who carried out the monitoring.

4.9 Establish monitoring procedures for each CCP

An essential part of a HACCP programme is to delineate monitoring procedures to assure compliance with the established critical limits for each CCP. Normally, these procedures refer to activities that are undergone during the process or to tests that can be quickly carried out. Monitoring should always allow operation follow ups and rapid actions in case of any deviation.

4.10 Establish corrective actions

Corrective actions planned by the HACCP team should exist for each CCP to be put in practice when a deviation of the critical limit is detected by monitoring. These corrective actions should include:

- Identification of the person responsible for implementing corrective actions;
- Description of means necessary and of the corrective action to correct the observed deviation;
- Actions to put into practice on products that were processed during the time the process was out of control;
Written records of measures taken indicating all relevant information.

One or more corrective actions can be defined for each CCP. In situations where corrective actions have to be repeatedly put in practice for the same CCP, certain control measures should be considered to impede its occurrence.

4.11 Establish verification procedures
This procedure is to verify if the HACCP plan is valid and operational. These activities can include, for example, microbiological analysis, HACCP plan audits, HACCP system audits, analysis of deviations and corrective actions carried out, gathering of samples, etc.

4.12 Establish record keeping/documentation for principles
Records are essential to determine compliance or not with the HACCP plan. These records should be defined (can be in any format) and a maintenance and conservation methodology for these should be established.
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