Microbiological Control Policy

1. Microbiological control

The microbiological control in the manufacture of products intended for human and/or animal consumption aims to detect any anomaly in the product as early as possible, in order to enable a preventive response that prevents any unfavorable evolution in quality.

Two aspects of quality are subject to microbiological control in order to guarantee consumers safe and stable food products.

1.1.Hygienic quality

The hygienic quality of a food product is the absence of pathogenic microorganisms or their toxins likely to harm the consumer's health. These must under no circumstances be present in the raw material, and it is then a matter of controlling the absence of contamination during the processing procedure.

The presence of such microorganisms and their toxic compounds leads to foodborne illnesses. Depending on the nature of the microorganisms involved, three types of illness can occur:

- **Foodborne infections :**

The set of symptoms following the ingestion of a quantity of live spoilage microorganisms present in the food product or in water.

This is the case, for example, of enteropathogens or viruses: *Salmonella enterica* (salmonellosis), *Shigella* spp. (bacillary dysentery), *Yersinia enterocolitica* (yersiniosis), enteropathogenic *E. coli*, and viral infections.

- **Foodborne toxico-infections :**

Set of symptoms following ingestion of a quantity of living pathogenic microorganisms in the food product andthe secretion of a toxin after ingestion. .

This is the case, for example, of: *Clostridium perfringens* and *Bacillus cereus* (gastroenteritis) and *Vibrio cholerae* (cholera).

These last two manifest with diarrhea, vomiting, abdominal pain and are associated with fever and symptoms appearing after a medium to long incubation period.

- **Foodborne intoxications :**

The set of symptoms following the ingestion of a quantity of a toxin present in the food product. The product is dangerous to consume, even if the pathogenic microorganism is no longer alive in the product.

This is the case, for example, with *Staphylococcus aureus*, *Clostridium botulinum* (botulism), *Aspergillus flavus*, and *Penicillium citrinum*.

This foodborne intoxication is manifested by diarrhea, vomiting, abdominal pain, and neurological signs. However, it is without fever, and the symptoms appear rapidly.

The microbiological control of hygienic quality aims to prevent the presence of pathogenic microorganisms in the food product, in order to avoid risking its hygienic quality, or at least to detect these microorganisms if they are present before its commercialization.

1.2.Technological (marketable) quality

The microbiological control of technological quality aims to detect the presence of microorganisms that could compromise the marketable quality of the finished product, and to verify the effectiveness of the technology after its application, in order to store and commercialize microbiologically stable food products.

- **The activity of microorganisms**

The number of microorganisms in a food product cannot necessarily be considered an indicator of poor sanitary quality.

Useful germs,

Certain microorganisms are useful and even essential: they participate in the production or transformation of food, ensuring the development of specific organoleptic qualities or contributing to preservation, and promoting hygienic quality by preventing the growth of dangerous germs.

Yeasts and lactic acid bacteria primarily, but also acetic acid bacteria, propionic acid bacteria, and certain molds, are very rarely involved in health incidents. However, they can still lead to industrial accidents if their use is poorly controlled.

Common germs

Other germs are detrimental to food quality at the manufacturing or preservation stage. These are common contaminant germs, which can cause serious problems in the industry.

Certain microorganisms are very dangerous from a sanitary perspective and can cause serious disorders in consumers: these strictly pathogenic germs are dangerous even in small quantities.

2. Microbiological Control Policy

2.1. Control levels

There are three levels of control: before, during, and after the product's manufacture.

2.1.1. Preventive control (Raw material control) :

Ce contrôle effectué, avant la fabrication, sur les matières premières et les adjuvants, permettre de vérifier le niveau de contamination général et la présence des microorganismes particulières susceptible de gêner la fabrication ou d'altérer le produit fini lorsqu'ils ne sont pas détruits mors de la fabrication (cuisson, salage….). La qualité microbiologique des matières premières doit donc être conforme au cahier des charges. Celui-ci pourra être différent pour une transformation mettant en jeu une fermentation, dans ce cas, on peut tolérer un milieu faiblement contaminé.

- **Contrôle en cours de fabrication :**

Performed, before manufacturing, on raw materials and additives.

Permits verification of the general contamination level and the presence of specific microorganisms likely to hinder manufacturing or deteriorate the finished product.

Therefore, the microbiological quality of raw materials must meet the specifications. These specifications may differ for a process involving fermentation; in this case, a lightly contaminated environment may be tolerated.

- **Control during manufacturing :**

Performed on the product as well as on equipment, premises, and personnel.
It is necessary to identify the points in the manufacturing chain where the risk of contamination is highest. Which allows for quickly highlighting a manufacturing problem in order to modify part of the process and improve analysis results.

Example: Starter (Sourdough) control, when it is used for manufacturing, its quality is checked before inoculating the fermentation tank. The goal is to detect a contaminant, even if present in small quantities.

The manufacturing conditions themselves can be controlled. This concerns the premises, the very design of which must ensure good hygiene conditions (surface control, ambient air control). Carried out at regular intervals.

Manufacturing equipment must be designed to avoid areas of microbial proliferation (dead zones...).

Finally, the staff, a major source of contamination, must adhere to very strict hygiene rules.

- **Control on finished products :**

Performed on the finished product to determine its compliance with standards. (FTAM)

2.2. Frequency of controls

The frequency of controls is established based on experience and available resources, depending on the type of product (type of manufacturing), and even according to the type of plant (production unit).

Repeated controls allow for determining critical points (identifying the points in the manufacturing chain where the risk of contamination is highest).

2.3. Parameters to control

The microorganisms to be controlled vary depending on the technology and physicochemical characteristics of the product being manufactured and the finished product. However, they can be divided into two groups:

Microorganisms responsible for compromising hygienic quality:

Pathogenic bacteria:*Clostridium* spp., *Salmonella* spp., *St. aureus*, Fecal streptococci, *Escherichia coli*, *Shigella*, *Listeria monocytogenes*, *Bacillus* spp., *Yersinia enterocolitica*, *Campylobacter jejuni*.

Indicator bacteria of contamination: St. aureus (indicator of skin/mucous membrane contamination), Fecal streptococci, coliforms, and fecal coliforms (indicators of fecal contamination).

Microorganisms responsible for compromising market quality:

Yeasts in sweet or acidic products, molds in low-moisture products, lactic acid and acetic acid bacteria in acidic products.

2.4. Control methods

Control methods are divided into two categories:

- **Microbiological culture techniques**, which are lengthy, costly, and require a significant response time.
- **Microscopic techniques** (counting methods, simple staining: methylene blue and Gram staining) which are simple, rapid, and low-cost.

However, since the sensitivity of these methods is not always sufficient, it is recommended to perform, in parallel, a control using classical microbiological culture techniques.

2.5. Sampling, transport, and preparation of samples

It is important that the microbiological analysis laboratory receives a sample representative of the product batch, undamaged or altered during transport and storage. Therefore, it will be useful to provide the following definitions:

Product: the material to be analyzed.

Batch: the entire set of items of a product with uniform characteristics.

Sample: one or more sampling units collected.

Global sample: the entire set of sample units taken from the same batch.

Laboratory sample: a reduced number of units from the aggregate sample, of representative quantity necessary for laboratory analysis (five (5) units for microbiological analysis, and three (3) units for physicochemical analysis).

Undamaged or unaltered: The sample must be kept protected against any contamination from the environment, and even stored under conditions that minimize any change in the number of microorganisms present.

According to ISO standards and Algerian standards (NA), the majority of techniques used for sampling prepackaged products can be summarized into three techniques:

Percentage technique: for batches considered very large (1% for a large batch, 10% when it is a more or less small batch).

Square root technique (2√): for batches considered not very large (2√ of the batch size).

Cube root technique (3√): for batches considered fairly large (3√ of the batch size).

The global sample is collected in a systematic or random manner from different locations within the batch.

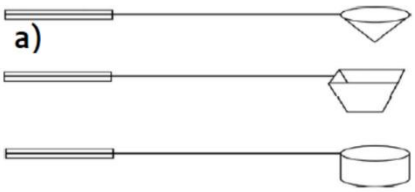
The collection of the laboratory sample is the final step of sampling, carried out from the aggregate sample.

However, **products are not always contained in their packaging**; they may be in bulk, either solid or liquid: wheat in silos or ships, oil in tanks.

Case of solid foods

Depending on the product, sampling will be performed with a scalpel, a probe (cheeses and soft products), or a harpoon pipette. The surface is often removed before sampling. If the product is

heterogeneous (prepared dishes, canned goods...), it is necessary to ensure the sampling is representative.



Sampling on a ship: carried out during the unloading operation in several locations and at determined time intervals, thus from the aggregate sample, the laboratory sample is prepared.

Case of liquid foods

The technique varies depending on the product, volume, and shape of the container. It is nevertheless always necessary to ensure perfect homogenization of the liquid (using stirrers) before sampling with a pipette (or with a sterile tested flask or other device) the volume required for analysis.

Sampling in tanks (rail wagons or trucks): carried out throughout the height of the layer using a cylindrical probe, at sampling locations in the center and approximately 50 cm from the walls (5, 8, 11 sampling points).

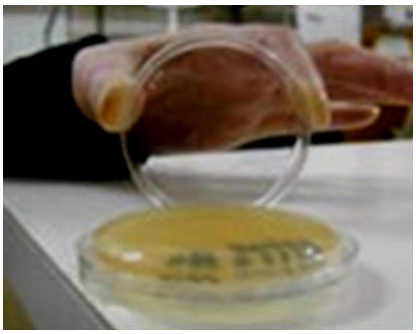
Surface sampling

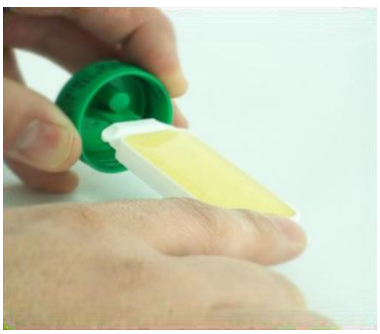
As a general rule, the surface to be analyzed is brought into contact with a sterile diluent, and then the microbial suspension is collected.

By swabbing the surface, using a swab which is then suspended in a sterile diluent, or directly spread on an agar medium.

Using contact plates (Rodac plates)

or immersion slides filled with agar medium, which are pressed against the surface to be tested.





Note:

Sampling must be performed aseptically, with clean hands or clean latex gloves, using clean and sterile containers or sterile bags.

Samples must be clearly and fully identified.

Samples must have rapid transport and brief storage;

The following temperatures are recommended during transport:

- Stable products: ambient temperature (below 40 °C);
- Frozen or deep-frozen products: preferably below −18 °C
- Other products not stable at ambient temperature: from 1 °C to 4 °C.

The following temperatures are recommended during storage:

- Stable products: ambient temperature (from 18 °C to 27 °C);
- Frozen or deep-frozen products: preferably below −18 °C;
- Other products not stable at ambient temperature: 3 °C ± 2 °C.

Dilution techniques

Once they arrive at the laboratory, the samples must be prepared for microbiological control.

For liquid samples

It constitutes the stock solution (SS) and, if necessary, decimal dilutions are prepared in a sterile diluent and used for the detection and enumeration of microorganisms according to enumeration methods.

As for the solid sample

This requires grinding in a sterile diluent using laboratory grinders. This mixture (sample and diluent) constitutes the stock dilution (SD), and if necessary, further decimal dilutions are made.