terra®
FOOD·TECH

TERMS FROM THE CANNING WORLD

DICTIONARY

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A

Acidification of food products

A process carried out naturally or artificially to reduce the pH of any food product to prevent the development of microorganisms. Acidification is a way of preserving food by controlling bacterial growth while retaining the food product organoleptic and nutritional features.

According to the European Food Information Council (EUFIC), some food acidity correctors permitted in the European Union are citric acid, lactic acid, acetic acid, calcium acetate and fumaric acid.

Acidity in food

The degree of acidity of a food product reveals their content in free fatty acids and is an important quality parameter since it conditions the growth of microorganisms. In general, it will be more difficult for microorganisms to grow in acid media. Therefore, acidiy indicates the percentage of acid predominant in a food product.

In fatty foods it shows free fatty acids, and in dairy, citrus and acetic foods, such as vinegar, it shows organic acids. For example, in oils it indicates the percentage of oleic acid, in fruit juices that of citric acid and in milk that of lactic acid.

Acidity is usually measured by titration with a basic reagent, with a pH-meter or with a test strip.

At an industrial level, two types of acidity are considered:

- Natural acidity: that of the food or of the solution.
- Developed acidity: acidity caused by applying a thermal process, due to the effects of enzymes or those caused by the growth of microorganisms.

Autoclave

An autoclave is a device that allows cooking, pasteurization, or sterilization of hermetically packaged foods to destroy microorganisms and spores present in the food and extend its shelf life.

It is a thick-walled metal pressure vessel with an airtight seal that, using steam at high temperatures and subsequent rapid cooling, can pasteurize or sterilize canned or ready meals.

There are hundreds of types of autoclaves for multiple applications, from those used in dental clinics for medical purposes to those used in laboratories for sterilizing laboratory waste bags. To produce preserves, they must have cycle regulation by Fo/Po values, back pressure, and rapid cooling.

TERRA Food-Tech® has 2 types of autoclaves:

- **Horizontal or benchtop autoclaves**: with a capacity of 21 to 75 liters and especially indicated for feasibility studies, quality control in research and development centers, as well as for the production of pilot batches in the food and packaging industry.
- **Vertical or top-loading autoclaves**: with capacity from 33 to 175 liters and designed for cooking, sterilization and pasteurization* of ready meals and preserves for entrepreneurs, restaurants and training in professional food and cooking centers.

*Pasteurization requirements may vary depending on the acceptance criteria of each country. Check local regulations to determine the suitability of our equipment for your specific application.

B

Best-before and expiry dates

The expiration date indicates the date when a food is no longer safe to consume and therefore should not be eaten. The expiration date is indicated in products that are highly perishable and with microbiological risk: raw and fresh meats and fish, which last a few days and where pathogenic bacteria may be present. Once the expiration date has passed, the product should not be consumed, as there is a risk that it may be in poor condition, spoiled and may even be dangerous due to the presence of pathogenic bacteria.

On the other hand, the best-before date applies to products that are much more durable and stable. Once this date has passed, they may have lost some of their properties, such as a somewhat rancid taste, less or strange aroma, change of texture, color... but there is no microbiological risk.

Therefore, in general, sterilized foods will have a best-before date, a date from which time there may be changes in color, brightness, texture, etc., but not the appearance of microorganisms, since they are sterile.

Pasteurized foods, on the other hand, generally always have an expiration date and usually require refrigeration.

C

Canned food

Food handled and prepared to be later hermetically packed through a thermal pasteurization or sterilization process, in order to eradicate, partially or totally, any type of microorganism and delay the oxidation of fats that cause its rancidity, in order to guarantee its quality and nutritional values at all times.

Clostridium botulinum

Clostridium botulinum is the name of a species of bacteria that produces botulinum toxin, the toxin responsible for botulism, a rare but potentially fatal disease. It is a species of bacteria capable of forming spores and particularly resilient, it can survive in a dormant state in most environments even after being subjected to long periods of intense heat as they are heat-resistant.

They can appear in any food of animal or vegetable origin, being canned food, especially homemade ones, the places where practically all outbreaks appear. That is why in the food industry this microorganism takes special relevance and is one of the bacteria against which more security measures are taken to minimize their appearance.

In fact, when choosing the combination of time and temperature at which a canning process is to be produced (F_0 value), the minimum safety level used as a reference is that combination that ensures the total destruction of this microorganism, both its live form and its spores and botulinum toxin.

For illustrative purposes, see the following table prepared by the Spanish National Center for Food Technology and Safety (Centro Nacional de Tecnología y Seguridad Alimentaria de España):

Form of *Clostridium botulinum*	Processing temperature	Time required for total destruction
Vegetative	60 °C	10 minutes
Toxin	80 °C	6 minutes
Spore	100 °C	375 minutes
	105 °C	120 minutes
	110 °C	38 minutes
	115 °C	12 minutes
	121 °C	3 minutes

In case of doubts about the origin, quality or condition of a canned food, it is always advisable to discard it due to the risk of presence of this microorganism and its toxin.

Some of the aspects that can make us suspect are:

- The container leaks or is bulging or swollen.
- The container appears damaged, cracked or abnormal.
- The container leaks liquid or foams when opened.
- The food has changed color, is moldy or smells bad.

Counterpressure or pressure support

Compensation of the pressure to which canned foods are subjected in the thermal processes of pasteurization and/or sterilization to avoid deformation or breakage of the containers during the sterilization and rapid cooling phases. For this reason, any autoclave designed for canning has an air compressor that controls the pressure inside the chamber and adds pressure when necessary.

In the case of screw-type containers, depending on the degree of counterpressure programmed in the autoclave, the vacuum inside the containers will be greater or lesser and, therefore, opening the lid will require more or less effort.

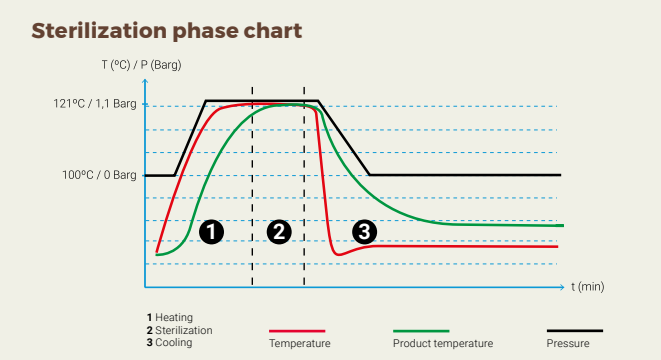
Cycle time

The duration of the heat processing or heat treatment cycle is defined as the time that elapses between when the start button is pressed with the canned goods already inside the autoclave and when the autoclave can be opened to remove the canned goods.

The duration of the cycle includes several phases:

1. Heating phase: time elapsed until the canned products reach the pasteurization or sterilization temperature.
2. Pasteurization or sterilization phase: Time elapsed from the time the flexible core probe located in the center of the reference sample detects that the pasteurization or sterilization temperature has been reached until the programmed pasteurization or sterilization time is exceeded.
3. Rapid cooling phase: Time elapsing between the pasteurization or sterilization temperature and the programmed safety temperature, i.e., the temperature at which it is safe to handle the food.

Optionally, in research environments and for more advanced users, they can be programmed more subphases within phase 1 and phase 3. In this case, there will be additional time segments employing ramps where different temperatures or pressures are required during certain times.



D

Drilling kit

Specific kit to pierce the lids of canned food and ready meals containers when they are pasteurized and/or sterilized in an autoclave in order to be able to determine the temperature of the packaged food during the whole process.

TERRA Food-Tech® autoclaves have 2 types of perforators:

- Lid perforator kit: specific for containers with metal lids, screw on or twist off type.
- Tray perforator kit: specific for tubs or plastic containers.

F

Fast cooling

Cooling process, generally by means of a water shower, which is carried out after pasteurization or sterilization of ready meals or canned food to avoid overcooking the packaged food and minimize organoleptic changes.

TERRA Food-Tech® canning retorts allow the user to choose the number of water showers and the duration of the showers, so that each product is cooled as fast as the user prefers or the product needs.

F_0 and P_0

F_0- P_0 values are used to quantify the degree of sterility of a food.

F_0 is the thermal value obtained after calculating the evolution of the temperature and time to which a food is exposed above 100 °C.

Po is the same as above, but for pasteurization processes, being the temperatures to which we expose a food below 100 °C.

The exact formula with which these values are calculated is very complex and very technical, since it takes into account the thermal processing temperature, the thermal processing time and the thermal resistance of the species of microorganism taken as a reference.

In order not to overwhelm the reader, it is enough to read the following table, as you can see, the degree of sterility that we will achieve by treating a food for 2 minutes at 121 °C has nothing to do with 2 minutes at 110 °C.

Form of *Clostridium botulinum*	Processing temperature	Time required for total destruction
Vegetative	60 °C	10 minutes
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In fact, each type of food will require a different minimum F_0/P_0 value. Finally, another aspect that becomes clear by analyzing the table is that the final F_0/P_0 value will be the sum of all the F_0/P_0 values achieved in each minute of the chosen thermal process.

Incubation

Sample culture process using a laboratory incubator (microbiological oven) to quantify the microbiological stability of a canned product. The number of samples to be analyzed and the protocol to be followed is defined in food safety regulations.

After these tests have been carried out in a laboratory certified for this purpose, the temperature at which a food can be safely stored will be known with certainty and the expiration date can also be determined.

Internal vacuum

In the case of canned food, the internal vacuum is the difference between the atmospheric pressure of the environment and the pressure inside a hermetically sealed container, at the same temperature.

If we are producing canned food with screw-on lids, depending on the degree of counterpressure programmed in the autoclave, a greater or lesser vacuum will be obtained and therefore the opening of the lid will require more or less effort.

M

Microorganisms

Microorganisms are microscopic living beings capable of developing and multiplying in a medium that meets the right conditions, such as packaged food because it provides them with the nutrients and moisture they need to grow.

- Most bacteria are harmless and even useful because they give rise to the flavors and aromas of certain foods: w, yogurt, sausages, etc. They are also part of some organs, such as the flora of the intestine which, in addition to protecting it, helps it in its functions.
- Other bacteria are harmful, cause alterations in foods and make them unsuitable for consumption: they cause putrefaction of meat and fish or sour milk. These are the so-called spoilage bacteria, which spoil the food and limit, with the help of physicochemical reactions, the shelf life of the product.
- Pathogenic bacteria are those capable of causing disease and constitute a small group. These microorganisms do not cause alterations or transformations of the food (normal appearance, color and flavor), so their presence is difficult to detect. They are the most dangerous group of microorganisms and the ones against which most safety measures are taken to prevent their proliferation in food.

Among the pathogenic microorganisms, the dreaded *Clostridium botulinum*, a bacterium that produces spores that survive at high temperatures and that also produces botulinum toxin. The human consumption of this toxin, even in very small quantities, can cause serious intoxication. Hence, the need and the sanitary obligation to always submit canned food and ready meals to rigorous pasteurization and/or sterilization processes so that their commercialization is safe until their expiration date in the case of pasteurized or always in the case of sterilized.

N

Nutritional characteristics

Nutritional characteristics refer to the properties of food at the nutritional level, that is to say, the quantity and quality of its proteins, carbohydrates, vitamins, etc...

Foods are usually structured into five groups according to their nutritional composition, amount of proteins, lipids (fats), carbohydrates or water. These groups are:

1. Cereals, derivatives and pulses
2. Dairy products and derivatives
3. Vegetables and greens
4. Meat, fish, eggs and fats
5. Fruit, nuts and sugars

O

Organoleptic properties

They are the physical characteristics of a matter, in our case a food and/or substance, that can be perceived by the senses, such as its taste, texture, smell, color or temperature.

According to a study carried out by the University of Zaragoza (in Spanish), the basic organoleptic parameters in food are:

- **Color**: an indicator of the nutritional quality of food.
- **Taste**: a sense that is concentrated in the taste buds of the tongue, which can identify five types of basic flavors: sweet, salty, bitter, acidic and umami (responsible for distinguishing the distinctive taste of foods such as asparagus, tomatoes, cheese or meat). The word umami is Japanese and means tasty.
- The **smell** of a product is perceived by the volatile molecules that it releases and that are captured through the olfactory epithelium, located at the top of the nasal cavity and above the cornets. It is estimated that humans can discriminate about 10,000 different odors because we have about 5 million olfactory receptors. On the other hand, dogs have between 200 and 300 million olfactory receptors and an olfactory sensitivity between ten and a hundred thousand times more potent than people.
- The **texture** is analyzed by rheological tests that serve to determine aspects such as hardness, viscosity, granularity, consistency, density, cohesiveness, adhesiveness, or rigidity.

P

Pasteurization

Pasteurization is a physical process based on the heat treatment of liquid and solid foods to substantially reduce their microbiological load by controlling temperature and time. This technique allows the substantial reduction of the populations of microorganisms in the product that can cause food spoilage or are a problem for food safety.

Unlike sterilization, neither the total elimination of microorganisms nor the elimination of spores is achieved. That is why pasteurized foods usually have special transport and storage conditions (refrigerator) and have short expiration dates.

pH

The pH (Potential of hydrogen or hydrogen ion potential) indicates the degree of concentration of hydrogen ions in a food or any other type of solution and is used to determine the level of acidity of a compound.

The pH scale ranges from 0 to 14. The lower the value, the higher the acidity and vice versa. Products with a value of 7 are considered neutral, neither acidic nor basic, and those above 7 are alkaline or alkalinizing. This parameter is very important in canned food because the lower the pH of the food, the more difficult it will be for microorganisms to grow and perhaps a lower Fo/Po will be needed.

Prepared / Precooked dish

Prepared food to which has been applied a thermal and technological treatment, pasteurization, sterilization, cold or ultra-freeze, to extend its useful life.

Prepared food is understood as the "culinary preparation resulting from the raw preparation or from the cooking or pre-cooking of one or more foodstuffs of animal or vegetable origin, with or without the addition of other authorized and, where appropriate, seasoned substances. It may or may not be packaged and prepared for consumption, either directly or after further heating or cooking".

Ready meals can be classified as follows:

- Sterilized ready meals (II range)
- Frozen ready meals (III range)
- Vegetables (IV range)
- Refrigerated ready meals (V range)
- Ready meals (VI range)

Production capacity

It is the level of production that can be achieved for the production of canned and ready meals. It will depend on the type and format of the container and the size of the autoclave.

The larger the chamber of an autoclave, the more containers we will be able to place per cycle and the greater our production capacity. We can also improve production capacity by making better use of the chamber space, either by having special baskets that allow more layers of containers to be placed in the chamber or by changing the shape of the container to fit more containers on each floor.

TERRA Food-Tech® offers you a free online calculator that will allow you to know your production capacity per cycle, that is, the amount of containers that you can process per cycle according to each model of our autoclaves, using our standard baskets. For those customers who need to know more about your case, we recommend that you contact our sales department.

Production cycle

The set of phases or processes to be carried out to produce your canned and/or ready meals. It includes both the preparation of the food, the filling of the containers and the thermal processing. In the case of working with an autoclave, the most important limiting factor to take into account when estimating the production cycle is the capacity of the autoclave chamber, since the more containers we can place for each thermal processing, the more containers we will produce per production cycle.

S

Shared cooking workshop

Shared Workshop or Collective Workshop is a fully equipped space with relevant health records where different people or companies can prepare their preparations and then market them.

This is an initiative promoted by public or private entities and made available to small producers or micro-enterprises to carry out their projects related to the agri-food sector without having to bear the costs of the permits, the construction of infrastructure or the purchase or rental of machinery.

Through the shared works the town halls, institutions, cooperatives and associations seek to dynamize socioeconomically a territory as a nursery for businesses.

Spores

Just as a caterpillar transforms into a butterfly, some microorganisms can transform when their environment is stressed by producing specialized cells called spores, resistant forms produced by certain fungi, plants and bacteria. When the environment is unstressed, the spores return to normal. In general, spores are much more resistant to high temperatures and other environmental conditions. That is why when we are producing preserves we must always take them into account.

Sterilization of canned food

Canned food sterilization is the process of subjecting hermetically packaged food to high temperatures for a certain period of time in order to completely destroy any possible microorganisms, whether pathogenic or not, and their spores.

The selection of the processing conditions necessary to meet these criteria is based on experimental studies in which the rate of heat penetration is measured. The data from these tests are used by specialists to determine the temperatures and processing times required to make the canned product commercially sterile. The degree of sterility provided by a thermal process is expressed in terms of target F_0 values, where the F_0 value is a measure of the severity of the thermal processing. It is vitally important to select an appropriate F_0 value (which may be much higher than that required to reduce the probability of survival of *Clostridium botulinum* spores to an acceptably low level) to ensure the safety of a canned product and to comply with regulations governing canning production.

TERRA Food-Tech® has a network of specialists who can advise you on all these aspects and this service is included in the purchase of any of our autoclave models.

Surplus or shrinkage

These are the leftovers or excesses leftover from agricultural production or harvesting, or those products or foodstuffs that are not marketed due to lack of demand, alterations in their packaging, etc.

T

Temperature and pressure segments

A feature offered by some canning retorts that allows the programming of independently adjustable temperature and pressure segments.

For example, a canned meat stew canning cycle can be programmed as follows:

1. 40 minutes at 60 °C to cook the raw product at low temperature.
2. 10 minutes at 100 °C to finish cooking the product.
3. 5 minutes at 121 °C to sterilize the canned product.
4. Rapid cooling phase

Temperature probe

A temperature probe or thermal probe is a device that, by mechanical or electrical means, transmits from one place to another the temperature of the emitter.

TERRA Food-Tech® autoclaves have 2 types of probes:

- **Flexible core probe**: a flexible probe that can be inserted inside the product to determine the temperature to which the packaged food has been subjected during the entire pasteurization* and/or sterilization process, making it a very useful accessory.
- **Chamber probe**: probe located inside the chamber to determine the temperature reached during the pasteurization* and/or sterilization processes inside the autoclave.

*Pasteurization requirements may vary depending on the acceptance criteria of each country. Check local regulations to determine the suitability of our equipment for your specific application.

Thermal process

The thermal process or thermal treatment of food is aimed at the destruction of microorganisms through heat. Pasteurization is aimed at eliminating all microorganisms in a vegetative state that could cause disease and temperatures below 100 °C are generally used.
Sterilization aims at the destruction of all microorganisms present in the food in any form, vegetative or spores, and generally does so by the application of heat at temperatures above 100 °C, although for very acidic foods sterilization can be achieved at temperatures below 100 °C.

Thermowell

The thermowell is the part of the temperature sensor that is introduced into the product or packaged food. We could say that it is a sheath for the temperature probe that comes into contact with the food.

Traceability

Food traceability allows us to trace all the steps a food has taken from its origin, through its processing process (cooking, pasteurization and sterilization) and distribution until it reaches consumers.

In the canning world, an auditor will ask you to demonstrate that you produce your food in accordance with the regulations and therefore you will need to demonstrate that your batches have achieved an acceptable F_0 and P_0 target value.

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Σ

Σ % F_0 and Σ % P_0

The capital letter of the Greek letter Sigma Σ is used as a symbol for "summation". Therefore, Σ%F_0 and Σ%P_0 means the sum of the percentages of the values F_0 and P_0.

Let's put a practical case. You want to pasteurize or sterilize a canned food and when you start the cycle you ask it to reach a certain F_0 or P_0, for example, 10.

The autoclave program adds up the lethal effect at each instant and tells you whether it has already reached 25, 30 or 44 % of the value you have requested. If it shows 50% it means that you are halfway through the pasteurizing or sterilizing effect marked as 10. When you reach 100% the autoclave stops heating and starts cooling.

At the end, the percentage of F_0 or P_0 may be higher than 100%, for example, 115%. This happens because the autoclave stops at 100%, but there is still heat inside the can and the process continues until the can is cooled and does not reach 100°C inside. Below 100ºC, the percentage no longer fluctuates, since there is no longer any sterilizing effect.

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