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Cork Stoppers

APCOR
Portuguese Cork Association

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CORK STOPPERS | production process

From the cork plank to the final product – the cork stopper – cork goes through a series of stages which depend on the type of stopper to be produced. Natural cork stoppers are punched from a single piece of cork, whereas technical stoppers are produced from a body consisting of agglomerated cork granules, to the ends of which natural cork discs may be applied.

Boiling of cork planks
The first step of the process is boiling. The planks are immersed in clean and without chlorine, boiling water in a temperature between 90 to 100ºC for at least an hour. The main goals of boiling are to:

- Clean the cork;
- Extract water-soluble substances;
- Increase thickness (around 3mm), thereby reducing density;
- Make the cork softer and more elastic.

Before boiling, the cork cells are compressed in an irregular shape, but during this process, the gas contained in the cells expands. As a result, the structure of cork becomes more regular and its volume increases by around 20 percent. Boiling is one of the operations prescribed by the International Code of Cork Stopper Manufacturing Practices. It is an operation which, in addition to improving the internal structure of cork, also contributes substantially to reduce the microflora contained therein. A number of cork stopper manufacturers use additional processes to achieve improved disinfection. For example, some have implemented boiling processes in an enclosed environment.

Stabilisation
After boiling, the cork will stabilise and after this period the planks selected. Planks should stabilise between 1 to 4 weeks maximum. However if the boiling is not made in the traditional method, the period may be less than one week and in some cases is only 24h. Stabilisation serves to flatten the planks and allows them to rest. This is the only way for cork to reach the necessary consistency to be transformed into stoppers. Stabilisation also enables cork to reach the ideal moisture content for processing – between 8 to 16 percent.

Selection of planks and slicing
The edges of the planks are prepared and the corners trimmed before initial manual assessment takes place. The planks are separated into quality categories based on their thickness, porosity and appearance. Then, they are cut into strips with a width slightly greater than the length of the corks to be manufactured.

Punching
Punching is the manual, semi-automatic or automatic process whereby cork strips are punched. The result is a cylindrical stopper of the required dimensions.
All waste from the punching phase is used for cork granulate. Cork which is not directly used for natural cork stoppers, the high end of the range, is turned into granulate to be used in technical stoppers (see item Technical Stoppers), or for products made of agglomerated cork for use as insulation and in civil construction.

Correction
After punching, the correction phase of the bottoms and the sides of stoppers serves to give the stoppers the final previously specified dimensions and a uniform surface.

Selection
Also known as sorting, this operation is intended to separate the finished stoppers into different classes, determined by an automatic control and an optical selection of their surface. In some cases, selection is also carried out visually and manually, relying on the human eye. During this phase, in addition to establishing quality classes, defective stoppers are eliminated.
In standard selection processes, the following categories are usually used, defined according to visual criteria: Flower; Extra; Superior; 1st; 2nd; 3rd; 4th; 5th.

Washing
The correction process is followed by washing, which can be done using hydrogen peroxide or paracetic acid. Washing serves to clean and disinfect corks, though other methods are also used, such as microwave or ozone.
After washing/disinfection, the moisture content of the stoppers is stabilized, ensuring optimal sealing performance while simultaneously reducing microbiological contamination.

Colmation
In certain cases, stoppers may be colmated. Colmation consists in sealing the pores on the surface of cork stoppers (lenticels) with a mixture of cork dust obtained from the correction of natural cork stoppers. In order to fix the dust in the pores (lenticels), a glue based on natural resin is used. A water-based glue is also currently used in this process.
Colmating has two main purposes:
- Improving the appearance of the stopper;
- Improving its performance.

Screening individual cork stoppers
Some companies developed different kind of technologies to screening individual natural cork stoppers. This methods can detect any cork with more than 0.5 nanograms of TCA per litre (parts per trillion) and eliminate the risk of any natural whole cork contaminated with releasable TCA reaching winemakers.

Marking or Branding
This operation is carried out in accordance with instructions from the client regarding the type of brand required. Printing methods available are food-quality ink, heat or laser branding.
After branding, the surface of the stopper is treated with paraffin and/or silicone to facilitate introduction into the bottle and subsequent extraction by the end consumer.

Packaging and Transport
When production is finished, the stoppers are packaged in plastic bags filled with SO2 (sulphur dioxide), a gas which inhibits microbiological development. Only then, the stoppers are transported to the bottling company to be used as closures for wine or spirits.

TECHNICAL STOPPERS | production process

For the production of technical stoppers, the process is divided into three distinct phases: production of the natural cork discs – placed on the ends of the stopper – production of the agglomerated cork body and assembly of the stopper.

Production of discs
Cork planks used for the production of discs are selected and boiled in steam, according to identical processes for the production of natural cork stoppers. The two sides of the planks (the rougher, the outer part of the tree and the part closest to the trunk) are removed in order to obtain soft, uniform sheets of cork with a thickness of around 6,5 mm.
These sheets are mechanically punched in circles - discs with the size of the ends of the stoppers to be manufactured. Then discs undergo optical selection in order to sort them into established categories, normally one of 4 quality classes.
For the cleaning of these discs, specialist companies have their own and different systems based on the following technics: steam, steam and alcohol, ethane solutions, hydrogen peroxide solution (at low concentration levels), solutions of sulfamic acid, ozone water, specific preparations involving enhancing agents of sporicidal action, disinfecting, cleaning, among others.
After washing, the discs are dried and stored in silos until they are used.

Production of the body
The bodies of technical stoppers are formed by granules obtained from the by-product of high quality cork products and punching of natural cork stoppers.
These by-products are transformed into granules measuring 0.5-7 mm by grinding machines. These granules are then agglomerated using food-grade polyurethane glue and the bodies are either individually moulded or extruded, resulting in rods which are cut in the desired length.

Assembly of the stoppers
The discs and agglomerated bodies are fed into assembly machines via silos. The discs pass in front of cameras which select the side of the disc to be in contact with the wine. A rectangular mark is printed by the machine on the opposite side of the stopper. This mark is detected by a camera in the assembly machine, indicating that this is the side to be glued to the body of the stopper. The discs are glued to the end of the agglomerated cork cylinder using a polyurethane glue which is approved for contact with foodstuffs by the FDA (Food and Drug Administration).
The assembled stopper is dried in order to ensure that the glue is completely dry, after which it is polished or corrected. Here, as for natural stoppers, the stoppers are corrected in order to give them the required dimensions. After this point, the washing, sorting, finishing (marking) and packaging processes are similar to those for natural cork stoppers.

KINDS OF CORK STOPPERS

The cork industry offers a complete range of stoppers, available in countless gauges and shapes to meet the needs of the enormous variety of bottles on the market, as well as all different types of wine. Cork stoppers can be grouped into the following categories:

- Natural cork stopper – single piece, obtained by punching a strip of cork;
- Colmated natural cork stopper – natural stoppers, which pores have been sealed with cork dust;

- Multi-piece natural cork stopper - manufactured from two or more halves of natural cork glued together with an adhesive approved for use with food;
- Technical cork stopper (1+1) – comprising a very dense body of agglomerated cork with natural cork discs glued to both ends;
- Agglomerated cork stopper - produced entirely from cork granules derived from by-products resulting from the production of natural stoppers;
- Micrograniulated cork stopper – new generation of cork stoppers with an agglomerated cork body of a specific granulation;
- Champagne cork stopper – these belong to the group of technical stoppers, with an agglomerated cork body and one, two or three discs at one end, with a diameter greater than normal stoppers.
- Capsulated cork stoppers – natural cork stopper with a capsule made of wood, PVC, metal, glass etc. glued to one end.

For more information see the APCOR Cork Stopper Technical Kit, available at http://www.apcor.pt/en/portfolio-posts/updated-information-on-cork-stoppers/.

THE UNIQUE CHARACTERISTICS OF CORK STOPPERS

The natural properties of cork stoppers offer to wine industry a closure with unbeatable characteristics. The main properties of cork are:

Lightness
It weighs just 0,16 grams per cubic centimeter. Around 85% to 90% of the stopper volume is made up of a gas mixture similar to air.

Flexibility, elasticity and compressibility
These properties are conferred upon cork by the roughly 800.000.000 cells (40.000.000 cells/cm3) which make up a cork stopper. The cells are watertight and contain a gaseous mixture similar to air, which allows a cork stopper to be easily compressed (in order to insert it completely into the bottle neck) and recover its initial shape once decompressed, guaranteeing a perfect fit to the bottle neck. This fit is also dynamic over time, as it accompanies the expansion and contraction undergone by the glass as a result of variations in ambient temperature, ensuring that the bottle remains perfectly sealed.

Impermeability
Impermeability to liquids and practically impermeable to gases, thanks to the suberin and cerin contained in the composition of its cells.

Imputrescibility
As a result of its specific chemical and structural composition, cork is highly resistant to the effect of moisture and consequently to the oxidation that it causes.

Recyclable, reusable and renewable
Cork stoppers can be recycled and ground up into granules which are used in the manufacture of other products such as flooring, insulating and covering panels, shoe soles, fishing floats, etc. Recycled cork is never used to make more stoppers. The industrial use of cork guarantees the sustainability of the montados, contributing to a balanced relationship with nature and the maintenance of associated ecosystems.

CORK STOPPERS vs OTHER CLOSURES

	Cork	Plastic	Aluminium
Origin	Forestry product, non polluting, harvested every 9 years without damaging the tree.	Oil; non-renewable source.	Mineral; non-renewable source.
Energy consumption	Low	High	High
Climate change	Cork acts as a carbon sink. A large part of the energy requirements of the production process are met by using biomass.	Petrochemical processes have a high impact in terms of the emission of greenhouse gases.	Primary production of one tonne of aluminium causes the emission of 12 tonnes of CO2, on average. Industrial transformation of aluminium into the finished product (cap) causes additional CO2 emissions.
CO2 emissions (g)/1000 closures	1 437 g	14 716 g	37 161g
Recyclability	100% recyclable with low energy consumption.	Lower rate of recycling.	100% recyclable with high energy consumption.
Biodiversity	The cork industry promotes and sustains the *montado* ecosystem, on which a large number of animal species depend.	Extraction and transport of oil and refining of oil-based products have a potentially very negative impact on ecosystems.	Bauxite mines have a potentially huge negative impact on ecosystems.
Interaction with wine	Allow micro-oxygenation and bottle ageing; Adapt to different necks, even when irregularities are present; Able to withstand temperature variations and different degrees of pressure; Ancestral relationship with wine, preferred by consumers.	Difficult to extract with the corkscrew and then reinsert in the bottleneck; Stimulate premature oxidation; Have a tendency to absorb aromas and may transmit strange aromas or flavours; Succeeded in gaining initial acceptance, but are losing market share.	Stimulate the development of sulphide odours; Require stringent control on the bottling line, with a tolerance of up to 0.1 mm; Vulnerable to physical impact during transport and storage, causing “random oxidation”; Can delay the evolution of the wine; Not tested for prolonged storage of wine; Capsules easily tampered with; Associated with cheap wine.

Source: Amorim 2006 Sustainability Report and APCOR