

## Evolution of oxygen transfer in the various cork stopper manufacturing conditions. Effect of this parameter on still and sparkling wine

### Summary

One of the most significant variables that affect the evolution of wine in the bottle is the supply of oxygen through its stopper: the oxygen transfer rate).

Cork stoppers are known to have an advantage over their synthetic alternatives in this respect due to their vegetal matrix. Corks enable the progressive ingress of oxygen into the bottle over time, preventing the oxidation and reduction processes that are characteristic of certain alternative stoppers. The project consisted in determining the variables in the cork stopper production process that affect oxygen transfer and obtaining information to modify the production procedure to adjust the oxygen transfer rate of the corks in accordance with the consensus values for each type of wine.

### Objectives

1. Assessment of oxygen transfer throughout the production process.
2. Application of control measures based on the values obtained in point 1.
3. Assessment of the effect of the oxygen transfer rate on the wine.
4. Preparation of a catalogue of cork stoppers with different transfer rates and their effects on the evolution of the wine.
5. Foster relations between the cork sector and the winemaking industry.

### Description of the actions carried out in the project

ACTION 1. Drafting of a protocol to measure cork stopper oxygen transfer.

ACTION 2. Control of oxygen transfer throughout the production process.

ACTION 3. Assessment of the oxygen transfer rates.

ACTION 4. Drafting of a protocol of cork stopper manufacturing guidelines to obtain different oxygen transfer rates.

ACTION 5. Dissemination.

### Final results and practical recommendations

The results of the project were as follows:

- An innovative method for measuring the permeability of cork stoppers throughout the manufacturing process was obtained. This protocol, which is expected to be officially standardised in the medium term, makes it possible to establish oxygen permeability values for the different types of stopper in conditions very similar to real world. Similarly, the companies could supply more homogeneous products in relation to this property in order to better compete with alternative stoppers.
- The relevant factors in the manufacturing process of corks that affect oxygen permeability were determined.

- Characterisation of the different variables that affect the final oxygen transfer ratio (OTR) of the corks should be further explored, bearing in mind this is an opportunity to strengthen the relationship between wineries and cork makers while ensuring the highest quality end product. Furthermore, the development of the wines in this study should be studied over a longer period.
- With regard to cork companies, while guaranteeing the homogeneity of their corks using the OTR variable, different production processes also need to be considered. More critical points or factors in the manufacturing process that may influence the permeability of the stopper need to be identified. The most influential production processes should be defined and controlled.
- The type of wine or sparkling wine the stopper is to be used for should be known so a suitable product may be offered. The oxidative capacities of each wine vary depending on numerous parameters, but winemakers and wineries know how long they want their wines to last. Synergies should be created between the winery and the cork maker to find the most appropriate cork-wine combination in each case.
- With regard to wineries, the type of cork to be used in their wines should be carefully selected, taking into account the variable oxygen transfer rate and the type of wine.

### Conclusions

- The oxygen permeability of the stopper in still and sparkling wines affects their chemical and sensory development.
- Different types of cork stoppers (natural one-piece, granular and cork discs) have different oxygen permeability characteristics.
- For each type of cork, there are factors in the production process that have key impact on the oxygen transfer ratio of different batches of corks.
- Use of stoppers with higher or lower oxygen permeability depends on the oxidative capacity of each wine, which in turn depends mainly on the grape variety.
- Determining the type of cork to be used is a key factor for wineries that want to control how their wines age and the oxygen transfer values of the corks should be known so as to favour the desired ageing.

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**Subject area(s) of application**

<input type="checkbox"/>	Agricultural production system
<input type="checkbox"/>	Agricultural practice
<input type="checkbox"/>	Agricultural equipment and machinery
<input type="checkbox"/>	Livestock farming and animal welfare
<input type="checkbox"/>	Vegetable production and horticulture
<input type="checkbox"/>	Landscape / Territorial management
<input type="checkbox"/>	Pest and disease control
<input type="checkbox"/>	Fertilisation and nutrient management
<input type="checkbox"/>	Soil management
<input type="checkbox"/>	Genetic resources
<input type="checkbox"/>	Forestry
<input type="checkbox"/>	Water management
<input type="checkbox"/>	Climate and Climate Change
<input type="checkbox"/>	Energy management
<input type="checkbox"/>	Waste and by-product management
<input type="checkbox"/>	Biodiversity and environmental management
<input checked="" type="checkbox"/>	Food quality/processing and nutrition
<input checked="" type="checkbox"/>	Supply chain, marketing and consumption
<input checked="" type="checkbox"/>	Competitiveness and agricultural and forestry diversification
<input checked="" type="checkbox"/>	General

**Geographical area(s) of application**

PROVINCE(S)	REGION(S)
Girona	Gironès and Baix Empordà

**Dissemination of the project (publications, seminars, multimedia, etc.)**

The project has been disseminated mainly through the coordinating body (Catalan Cork Institute Foundation) and the following actions have been carried out, among others:

1. Web portal of the participating companies and the research centre:  
<https://www.icsuro.com/projectes/determinacio-de-levolucio-de-la-permeabilitat-a-loxigen/>
2. Dissemination on the @ICSuro social media
3. ICSuro article and newsletter: <https://www.icsuro.com/la-quimioluminescencia-com-a-control-de-permeabilitat-a-loxigen-dels-taps-de-suro/>
4. Writing of a scientific article titled '*Kinetics of oxygen ingress of cork agglomerate and micro agglomerate stoppers for sparkling wine into pressurised empty bottles*' which is pending publication.

**More information on the project**

PROJECT DATES	TOTAL BUDGET
Start date (month-year): June 2018	Total budget: €119,016.09
Completion date (month-year): September 2020	DARP funding: €48,357.86
Current status: Executed	EU funding: €36,480.49

Own funding: €34,177.74
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*Order ARP/133/2017 of 21 June, approving the regulatory bases for grants for cooperation for innovation by promoting the creation of European Association for Innovation operational groups in the areas of agricultural productivity and sustainability and the execution of innovative pilot projects by those groups, and Resolution ARP/1868/2017, of 20 June, announcing the call for the grant.*

