



FIGHTING CORK TAIN BY EXTRACTING UNDESIRABLE MOLECULES

> THE DIAMOND PROCESS, AN AMBITIOUS GOAL

With its remarkable mechanical, physical and sealing properties, cork is the ideal material for closing bottles of wine. Unfortunately its use entails the risk of a musty taste in the wine caused by the presence of TCA.

The Sabaté R&D department had the following aims:

- to extract TCA molecules from the cork raw material by using a non-aggressive solvent
- to produce closures made from cork capable of preserving wine under good conditions.



Supercritical CO₂ treatment can be used for all forms of cork

> THE DIAMOND PROCESS, THE RESULT OF A CLOSE COOPERATION

Sabaté, the world's second largest cork producer, is the wine closure division of Oeneo, one of the leading supplier groups in the world of wine.

For many years, Sabaté has made use of an integrated system to produce corks, relying on its subsidiaries to select and control the raw materials from the forest right up to delivery to its customers. Thanks to this vertical integration, Sabaté is able to ensure the best possible quality control for each and every stage in production leading up to the finished product.

One of the major priorities for Sabaté's Research and Development department is to drastically reduce the risk of off-flavours due to flawed corks by using supercritical CO₂.

Sabaté's intent was to develop a "clean" process for treating and cleaning cork in order to selectively eliminate undesirable organic compounds such as chlorophenols and chloroanisoles (TCA), without any adverse effect on other organic compounds that give cork closures their indispensable characteristics.

Research carried out by Sabaté soon showed the need to use a selective extraction process. In order to perfect this, a research programme began 1997 with the Laboratory of Supercritical Fluids and Membranes of France's Atomic Energy Commission. This joint programme first produced a feasibility study concerning the use of supercritical CO₂ to extract specific molecules from cork, followed by a study on how to optimise such a process based on laboratory tests and on industrial trials.



**Sabaté's integrated chromatography laboratory
in Céret (Pyrénées-Orientales department)**

> THE DIAMOND PROCESS, EXTRACTION BY SUPERCRITICAL CO₂

What is a supercritical state ?

A chemical substance can exist in a solid, liquid, or gaseous phase according to temperature and pressure. However, there is a fourth phase between liquid and gas: the supercritical state. CO₂ is in a supercritical state when at a temperature of 31°C and at a pressure of 73 bars.

What are the benefits of supercritical CO₂ ?

- It has the penetration power of a gas and the extraction power of a liquid.
- It acts as a solvent to extract organic compounds with a low molecular weight, such as TCA.
- It leaves no residual trace on treated material
- It respects the environment (there is no effluent other than extracted compounds)

Other applications of supercritical CO₂ :

- Decaffeinating coffee and tea
- Extracting certain aromas for perfumes
- Extracting bitterness from hops to make beer

> THE DIAMOND PROCESS TECHNOLOGY SERVING THE WINE INDUSTRY

This process offers numerous advantages:

- **Virtually TCA-free** cork closures, considerably reducing the risk of a musty taste
- Corks with a very low microbiological content thanks to the **antifungal and bacteriostatic properties** of CO₂, which prevent the spread of bacteria and mould.
- It **respects the environment**
- It leaves **no residue** on treated corks

> THE DIAMOND PROCESS, NEARLY 100% EFFICIENT

The results of the semi-industrial trial show :

- 1 – that the corks' mechanical performance was not diminished
- 2 – the efficiency of TCA extraction

Validation by an independent laboratory: C.C.F.R.A

Analyses of TCA levels in 1,428 bottles:

97.8% of the samples had **less than 0.2 ng/l**
(0.2 ng/l = limit of detection)

99.3% of the samples had **less than 0.5 ng/l**
(0.5 ng/l = limit of quantification)



Semi-industrial pilot-programme at the Atomic Energy Commission's Laboratory of Supercritical Fluids

> THE DIAMOND PROCESS PRODUCTION ON AN INDUSTRIAL SCALE

A new factory

A production facility is being built in Spain, in the heart of the cork-producing area

Major investment

15 million euros (*budgeted in 2003*)

Production capacity

500 million corks / year

This new production site will enable Sabaté to have Diamond products available for sale in the first part of 2005.