

ROSA SYSTEM WINNING THE WAR AGAINST TCA

Miguel Cabral, Amorim & Irmãos, R&D Department

ROSA is Amorim's new weapon in the fight against TCA (2,4,6-trichloroanisole) in wine corks. Scientific trials show that ROSA dramatically reduces releasable TCA and the incidence of musty taints in bottled wine.

TCA remains the biggest obstacle to improved consistency in wine cork manufacturing.

A common trace contaminant in the packaged food and beverage industries, TCA is estimated to be responsible for 70 to 80 per cent of recorded instances of cork-related taint in wine. It imparts a musty or mouldy aroma to food or drinks and, in wine, it may dull the fruit qualities or render the wine undrinkable.

TCA is detectable on the nose and palate at remarkably low concentrations, a characteristic that presents a formidable challenge to quality control in the cork production process and in post-production handling and storage. The compound—a product of the interaction between chlorine-based compounds and microorganisms in the corkwood, or in factory or warehouse environs—may be readily absorbed by the cork at almost any stage in the manufacturing process.

Defeating a trace contaminant in these circumstances has required both an enormous R&D effort and a large investment in new plant and equipment, which will eventually encompass all of Amorim's facilities worldwide.

Amorim's anti-TCA strategy

In the late 1990s, Amorim began a coordinated effort to attack the sources of TCA in its corkwood and TCA formation in cork processing. The aim was to sharply reduce the incidence of TCA in wine and ultimately eliminate cork as a cause of musty taints.

The strategy adopted by Amorim was to examine and validate its production process and develop a suite of techniques to *prevent* or avoid TCA and remove or *cure* the contaminant in Amorim's cork products.

Preventive techniques developed since the strategy was adopted have included:

- improved cork harvesting methods and controls
- rigorous controls on storage and seasoning of raw corkwood
- new cork purchasing and selection procedures
- a completely new boiling system for washing the cork planks
- an aggressive washing process (INOS II) for cork discs
- ozone to deodorise corks and prevent microbial contamination
- comprehensive chemical analysis to identify suspect cork.

These initiatives have achieved significant progress in the fight against TCA. For example, comprehensive chemical testing of cork bales for TCA has virtually eliminated the sensory

rejection of corks supplied to Amorim's US clients, leading to the absence of TCA claims.

Using the five gas-chromatography (GC) machines now operating in Amorim's R&D department, Amorim is able to test nearly 2500 cork samples a week, detecting TCA at very low concentrations. An analytical capability on this scale has enabled staff to routinely identify and isolate suspect batches of cork at all stages of production, thereby significantly improving Amorim quality control procedures.

The introduction of the ROSA system represents the first industrial-scale process that reliably and significantly extracts TCA and other volatile compounds from cork components and whole stoppers.

How ROSA works

ROSA is the Amorim's latest and perhaps most important development to date in its anti-TCA strategy.

It is a proprietary cleaning process developed by Amorim as a result of an intensive R&D effort over more than three years, involving thousands of experiments and chemical analyses and a major process re-engineering program.

Internal and independent validation trials have confirmed that ROSA reduces releasable TCA levels up to 80 per cent.

As a consequence of these trials, the system is now being progressively introduced into Amorim's plants and wine cork products.

ROSA is based on *controlled steam distillation* whereby steam and water under pressure force out volatile trace compounds within the cork cells.

Steam has long been known to be effective in the laboratory for removing volatile compounds such as TCA from cork. However, getting the process to work reliably on an industrial scale has, before now, eluded manufacturers.

In reproducing the laboratory trials of ROSA on a semi-industrial and then as an integrated component in the industrial manufacturing of corks, Amorim's researchers and engineers have had to overcome many obstacles, including:

- uneven levels of reduction of TCA
- adverse effect of the process on the cork's physical properties and visual appearance
- recontamination of the cork due to steam condensation.

For example, steam treatment may alter the mechanical properties of the cork, reducing its elasticity or compressibility and hence its effectiveness as a seal. It can also change its visual appearance, which affects its grading and hence the commercial value of the cork. In the case of a cork disc or finished cork stopper, steam treatment may deform the physical dimensions of the cork, requiring costly and time-consuming rectification.

In researching these phenomena, Amorim noted that steam at high temperatures—while more effective at removing TCA—affected proportionally more cork than steam at a lower temperature.

This necessitated trials to establish the optimal balance between TCA removal and level of deformation or mechanical alteration, a research effort that is continuing.

As at 2003, the ROSA process has been perfected for cork granules, used in the manufacture of technical corks, with the result that ROSA-treated technical corks are mechanically and functionally almost identical to untreated corks—except for having a much lower risk for TCA contamination. A major R&D effort is continuing into optimising the process for whole cork stoppers.

Bringing ROSA on stream

The ROSA system is being progressively integrated into Amorim's cork production plants during 2003 and 2004.

At the time of writing, Amorim had introduced ROSA into three plants in Portugal for the production of cork granules. These granules form the shanks of Amorim's technical corks, such as Twin Top[®]. Another plant is expected to have ROSA on stream in early 2004.

Amorim expects all Twin Top[®] corks sold in the US, Australia and South Africa to be ROSA-treated during the first quarter of 2004, with the global transition to 100 per cent ROSA-treated Twin Tops to be completed by late 2004.

Validating the process

Mindful of the need to confirm the efficacy of ROSA to the satisfaction of the wine industry, Amorim has invested significantly in validation trials of the new system.

Amorim's own internal validation of the process has shown that ROSA is highly effective in reducing the concentration of releasable TCA in natural cork and bottled wine.

In a series of validation tests conducted by Amorim, an industrial ROSA prototype achieved TCA reductions in cork granules ranging from 75 to 92 per cent. In experiments on cork discs (which are used in Twin Top[®] corks), ROSA reduced the TCA content in samples by an average of 73 per cent.

In addition to its own research, Amorim commissioned *independent* validations of ROSA by suitably-accredited laboratories: the Australian Wine Research Institute (AWRI), Campden & Chorleywood Food Research Association (CCFRA) in the UK and the Geisenheim Research Institute in Germany. A fourth validation by a French laboratory is currently under way.

These respected laboratories undertook blind analytical tests on cork granules before and after treatment with ROSA to determine the average level of reduction in releasable TCA.

In each case, to help ensure consistency between laboratories, half of each batch of samples were analysed in Portugal using Amorim's laboratory facilities; the other half were analysed in the researchers' own laboratories. The samples were collected from a source known to be naturally contaminated with TCA.

The test results from each laboratory were highly consistent and extremely encouraging. They indicate very large reductions (of the order of 70 to 80 per cent) in the average level of TCA in the cork material and provide strong evidence that ROSA is an effective industrial treatment for TCA-affected wine corks.

These results corroborate those of Amorim's own internal validation trials.

Martin Hall at the Campden & Chorleywood Food Research Association, described the results as "very impressive". In his report, he wrote: "It is also fair to assume that the ROSA treatment is likely to have similar effects on other organic compounds found in natural cork and would therefore reduce the likelihood of other wine defects resulting from migration of these compounds into the wine."

Amorim is continuing to develop the ROSA process for natural cork stoppers and technical corks. Internal validation has shown comparable reductions in TCA levels for the process in these products at a semi-industrial scale.

Bottling trials

In addition to the research outlined above, Amorim's R&D department is undertaking short and medium-term bottling experiments using ROSA-treated corks.

The purpose of this research is to measure the incidence of TCA contamination resulting from ROSA-treated corks in wine stored in typical cellaring conditions.

To date, Amorim can report very significant reductions in average TCA concentrations between wines sealed with ROSA-treated and untreated agglomerate corks, Twin Top[®] corks and natural corks.

These bottling trials are continuing, although it is already clear that ROSA treatment is able to reduce very significantly the risk of musty taints in bottled wine, thereby ensuring that cork remains the best closure for wine.

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