AMORIM "ADVANCES IN CORK" SEMINAR, WINE AUSTRALIA 2000

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TRANSCRIPT OF WINEMAKERS SEMINAR

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Mr Antonio Amorim
Prof. Miguel Cabral

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MR HEYES: Welcome to our seminar, Advances in Technology in Cork. We have two people who will address you today. The first person is Mr Antonio Amorim. He is the managing director of Amorim & Irmãos, our parent company, and Tony has a Bachelor in Business Commerce and a winemaking diploma; an indication of the importance of the wine industry to the cork industry.

We also have with us Prof. Miguel Cabral. Prof. Cabral has joined our company just 12 months ago. He is in charge of the research and development team. He was previously with the Vinhos Verdes Institute, in Porto. He continues to lecture and teach at the University of Porto, as well as devote a considerable amount of his time to our company and to the issues that all of us in the industry are concerned about.

If I could pass over to Mr Antonio Amorim, thank you very much for your attention.

MR AMORIM: Good morning, everybody. I would like to thank you for being here with us this morning. Undoubtedly, cork has been out in the public debate in the very recent past, over the last two or three or four years, but I think that this time we are starting to make more sense because we're starting to have these discussions, not so much in the public arena, but in the technical areas with people who are really professionally involved with both the cork and the wine industry. I think the last thing that we all want to do is to put the growth of the consumer market in danger because of a closure, be it cork or something else. So, I think that we need to get our homework done and make sure that doesn't affect the way the wine industry is growing and in particular the way the wine industry is growing from Australia to the world. I've been out here for more than a week now, and I've been really very enthusiastic about the way things are going for you.

I think that this, somehow, can be reflected in the cork world at the same time, because we can say that we are also living our most challenging days. On the one hand, we have a market growing at an enormous pace. Just to give you some figures: Australia, 10 years ago, was a market that used to buy 110, 120 million cork stoppers; today there is a market for more than 550 million cork stoppers, in spite of all the closure debate, in spite of all the alternative materials that, in the

Likewise, in countries like Chile and the United States of America, with very big growth, doubling from 550 million corks about 10 years ago, to over one billion these days. So this is really just showing you one side of the picture, that the cork industry really has had a lot of growth in the last few years, in spite of the public debate on the closures that the wine industry is using. On the other hand, we are going through a very challenging period because we know that we still have some unresolved matters that we need to deal with very quickly. Time is pressing, the clock is ticking, we have no time to lose. For the first time, I think, we're going to hear somebody in the cork industry talking not about the things that they will be doing, but they will be talking to you today about the things that they have done already.

We know that in order to get to where we would like to be, we still have a long way to go. But the most important thing is that the approach of the cork people to the issue is not to waive the problem and say let's blame it on somebody else, but to make sure that we take our own responsibility and that we really stop talking about it and we start doing something about it.

So, what are the four most important steps that I believe the cork industry is going through and has gone through over the last 18 months, as far as resolving the so-called undesired cork taints, TCA? I think that there are four steps concentrating on four different points.

First; vertical integration. That means what? That means avoiding middle people involved in the cork industry. Traditionally and historically we have had a lot of people involved in the different stages of production. Today I think that there is absolutely no doubt that in order for us to control the whole operation process and to avoid speculation in the market place and to give the reliability to the technical performance of our product, as we should be giving, we cannot be buying cork from this guy, buying cork from that guy. We need to be buying cork directly from the source, which is the farm growers, as far as the forest is concerned, and selling it to the winery directly. That's why the Amorim Group has pursued, over the last two or three years, a very big investment plan, not only to control its distribution in different countries where we are present, but also to make sure that we will source our own raw materials. That's why we have a very big investment plan just setting up more cork factories located where the cork is, namely in the middle of the forest.

So, I think that's the first important point, with a very pompous name, but I normally call it vertical integration.

The second important step, crucial in the cork industry, has been the complete analysis of every single stage of the production process and making sure that, whatever internal issues there were, they

efficiently as we could. So we are looking, and we have looked, at the critical points of the production process, identified with the help of our technical people. We are looking at what are the critical points, how critical are they, and making sure that we apply other procedures or technology, in order to be able to sort them out. So we have done that, starting at the beginning of the process with harvesting techniques and the storage of cork in the forest, avoiding contact of cork with the ground over a long period of time. That's why these two facilities that we've just built, down the south of Portugal, have allowed us to store much more cork than we were able to do in the past. Just to give you an idea; each of these facilities has an available storage area of 60,000 square metres, which means that within three or four or five months after the cork harvest, we can get 70, 80 per cent or 90 per cent of our cork in-house, to avoid contact with the ground over a long period and avoiding, therefore, potential contamination problems.

The second important step that we have taken in these new plans is the boiling system. Miguel Cabral will be talking to you about it later on, so I won't go into much detail with that. But I think that's also a crucial step that traditionally was blamed for much of the taint-related issues but I think that now we have definitely dealt with.

If we go on to the production process for champagne and the Twin Top corks, we have also introduced the INOS system and improved it and, at a later stage, ozone treatment, that Miguel Cabral will be talking about in a moment.

The third important step towards a better technical performance of cork in general was the introduction of Twin Tops. Twin Top is a cork stopper that has been enjoying tremendous success. Just to give you an idea of some figures on this cork; about 1.8 billion, 'one-plus-one' Twin Top corks are being sold worldwide. Two big countries are taking them at the moment, Italy, with about 600 million corks, and the United States, where 40 to 45 per cent of our sales are now Twin Tops. All the big names have been dealing with it for some time. There are some companies in the United States that have been using it for six, seven, eight years, so there is a track record for the product. Also scientific technical validation. We ran some trials at Geisenheim Institute, comparing Twin Tops with some cork closures and some alternative closures and the results were very good, very encouraging for the Twin Top.

We were not satisfied with that, so we ran some more trials and comparative analysis over six, 12 and 18 months in Bordeaux as well. Again, the results for Twin Top on every single parameter that was analysed, including sensory, of course, were very good. And the AWRI has been running tests on Twin Tops, as well, for a period of 18 months, I believe. The results are coming out now and I believe that there are very good, clear indications for Twin Tops, that I think came

and formalised soon by the AWRI. We know that some roadshows have been conducted for the members of the Institute, so I'm sure that we will be hearing and seeing more about that.

We have decided to set up a Twin Top plant at Amorim Cork Australia near Melbourne, in Dandenong, where the new production processes that I have mentioned, including the INOS process and ozone treatment, have been put into place. So if one day you want to visit the company and make sure that what we're telling you is being applied there, please feel very much welcome to do so.

With these three steps we are sure of improving the quality and the technical performance of our cork products in a big way, but we are also sure of one thing: while we have made inroads towards a solution of the problem, I don't think with these three steps we have solved the problem yet, to be quite honest with you. So, in order for that to happen, we have set up an R&D department 12 months ago, with professionally-qualified people that do not have a history or background in the cork industry. They are people who, I think, like most of the people present here, have very international, scientific-based thinking about cork and about wine in general. We have brought them on board for three main reasons. First of all, to make sure that whatever process, new or traditional, we are using has not only an empirical, 'from father to son' validation over a period of time, but that there is a proven scientific reason for why things are being done that way.

The second point: make sure that some fundamental research on TCA is actually achieved. That will be done either internally or externally with institutions like the AWRI or UC Davis or Geisenheim or Bordeaux.

So, some of that work is what we would like to present to you here today. The issue of cork is not over yet, unfortunately, we know that, we acknowledge that, but the work on cork is far from being terminated. And this is the most important point that I would like to communicate to you, that there is no looking back now, we know that we have a challenging future, but you also can be sure that we're not talking any more about it, that something is being done about it.

So, I'll pass over to Miguel Cabral who will present to you some of these innovations in more technical, fundamental terms. Thank you very much.

PROF. CABRAL: Good morning, ladies and gentlemen. We would like to share with you the recent and very important improvements that we have made in our industrial process.

All those improvements have just one reason for being put in place: that is the fight against undesirable taints. That is our objective, to fight against the problems that we have with undesirable taints.

But to understand a little better why each of the improvements has been made at a particular point of the industrial process, I will show you first the molecules that are responsible for those undesirable taints, and how they appear.

Looking at this diagram, we can see that there are several compounds that can give rise to undesirable taints, about ten; but undoubtedly 2,4,6-trichloroanisole, TCA, is the most important.

Why is that? For two reasons. From one side, 2,4,6-trichloroanisole is the one that has the lowest sensory threshold, four to six nanograms per litre, four to six parts per trillion, which means minute amounts can be detected. The second reason is that when one of these compounds appears, TCA is normally also present. So, really, when we talk about the fight against undesirable taints, we are really talking about the fight against TCA.

But how does TCA appear in Nature and then in our corks? Two main origins: first microbial growth, because TCA, to be formed, always needs two different steps of microbial metabolism, and second, environmental contamination.

In 1996 the Quercus Project, which was conducted by different European countries and was financed by the European Union, produced this diagram where we can see the different origins of TCA. Let's start with glucose, the basic molecule of carbohydrates. Microorganisms metabolise glucose into phenols and so fungi or bacteria produce phenols from this basic carbohydrate molecule.

In the presence of chlorine, which unfortunately is everywhere, we can get a chemical reaction to produce chlorophenols, and chlorophenols are precursors of TCA. Then there is another microbial step, to transform chlorophenols to chloroanisoles, in this case to trichloroanisole. So, we need two different steps of microbial metabolism in order to form 2,4,6-trichloroanisole.

But where does this happen? Water and soil are, of course, the main sources, because there are lots of microorganisms in these places which metabolise the molecules to produce trichloroanisole.

So the reason why, when we harvest cork, we cut off the lower part of the cork bark and don't use that to produce cork stoppers is because that part has a high possibility of being contaminated with TCA. We already have results from that.

Why is that? Because we have a lot of micro-organisms in the soil and in the groundwater, so all the sources to produce TCA, and that of course is mainly in the lower part of the tree rather than in

Another source of TCA is yellow stain on cork. Yellow stain is a yellow shadow that appears in some cork bark that has a disease caused by a mushroom, *Armillaria mellea*. This mushroom is able to synthesise TCA and so when this disease (yellow stain) is present we need to separate the affected cork bark, in order to avoid the presence of TCA. This is exactly what we are doing in our new factory in the south of Portugal, where we have facilities to completely cut out the lower part of the cork bark to avoid TCA contamination, and we separate the yellow stain cork and the lower part of the cork, and this is used for granulated cork, for ceilings, for floors, for rubber cork and other things.

So these are the main origins of TCA, but we can also have TCA from different sources such as wood preservatives. In fact, wood is treated with pentachlorophenol and pentachlorophenol is a precursor of TCA. It can be metabolised by a microbial pathway to pentachloroanisole and then pentachloroanisole loses chlorine molecules and so becomes trichloroanisole.

So, these wood preservatives are really a problem. In France there were several cellars that needed to be rebuilt because the cellars, very beautiful cellars, had timber ceilings and the wine was strongly affected by TCA. So they had to change everything because of the pentachlorophenol (PCP). Of course, herbicides and insecticides have these kinds of chlorine compounds, so they can also be sources of TCA.

So knowing now the sources of TCA, we are going to show you the three most important improvements that we have made in our production process, in order to reduce TCA contamination. Our production process is summarised in this figure. From each tree in the forest, we harvest cork every nine years, then we store it, and then we boil the cork. We boil the cork in order to expand it.

Then we have the mechanical process, where cork, after being boiled, is separated by quality and thickness, and is then sliced, punched and polished.

Then we have the washing process, where cork stoppers are washed and bleached, mainly with hydrogen peroxide. But at this point here, we also have the INOS II washing. The INOS II washing is a big improvement that has already been introduced. It's an additional washing step for the discs that we use in Twin Top corks and in champagne corks. This INOS II system is going to be used in bartops, the small corks. So we will talk a little bit about that.

After washing, we have the ozone treatment of the finished corks, then the surface treatment and, finally, we package the corks in plastic bags, with SO_2, in order to avoid microbial growth. So

system, INOS II and the ozone chamber, and they are located in these three points in the production process.

Let's start with the new boiling system. The new boiling system that we have in our new facility in the south of the country is a very big improvement and completely different from the old system. We have here a picture of the old system and also one of the new system. But let's go to a diagram in order to understand the differences.

On your left-hand side you have the old system, on your right-hand side you have the new system. Let's talk a little bit about the differences. In the old system we boiled four tonnes of cork at once; in the new system we boil just two tonnes of cork at once. With the old system we boiled that four tonnes under compression. So the cork was boiled, but in a static way because the cork piles were compressed and so the water can't move around.

Conversely the new system is completely different. The two tonnes of cork are not compressed. They're put into the tank and then two lids close the tank to stop the cork floating on top of the water. Because the cork is not compressed, the water can move around the individual cork planks. And so we can get a higher extraction of the extractable material and cleaner cork than we had in the previous system.

But this new system is a dynamic system, it is not a static system. The water that is used to boil the cork in this new system is circulating all the time around a circuit and the water is continuously filtered through this solids filter in order to clean the water. Then it is continuously passed through this VCT (a Volatile Continuous Trap) System, now called CONVEX system (Continuous Volatile Extraction). It is this system, which I will explain to you later on, that allows the water to be cleaned continuously of volatile compounds.

At the end of each boiling cycle the water is sucked into this big tank and through another solids filter, as appears here, so the water is filtered again.

More differences: in the old system the tank was normally made of iron, which produced some iron contamination in cork, what we call iron tannates. In the new system, of course, all the system is in stainless steel, so there is no contamination at all.

Now, probably one of the main differences, which I left to the end on purpose, is that the new system uses this water to boil around 40 tonnes of cork over 24 hours of different boiling cycles. Conversely, the old system used the same water to boil four tonnes each cycle, but used the same water for five days, which meant that probably after 24 hours the water had no more extraction capacity.

new system is optimal up to 40 tonnes of cork? Well, we have some indicators; the chemical oxygen demand of the water, the colour, that is measured by the absorbance at 420 nanometres, and, finally, the pH.

Let us see the results we've got. The chemical oxygen demand of the water continues to grow after boiling 40 tonnes, which means that the capacity for extraction continues. But the colour of water reaches a plateau, as you can see here, near 40 tonnes, (the colour is measured by the absorbence at 420 nanometres). Finally, the pH, near 40 tonnes, also reaches a plateau. So we think that 40 tonnes of cork is the maximum amount of cork that we can boil with this system, using the same water.

Now, let's talk a little bit about the CONVEX system. The CONVEX system, shown in this picture, is connected with the boiling tank. You see here the tank of boiling water and the CONVEX system. But, again, let's go to the diagram, so we can understand better.

The philosophy of this CONVEX system is as simple as this; the water comes into the system, and it flushes down here in a curtain, in order to increase the surface area. So, the water comes down here in a curtain and a fan blows air into the water, in order to evaporate the volatile compounds. Don't forget that this water is at 96 degrees, a high temperature, enough to release the volatile compounds.

In order to check if this system is really efficient, we prepared a solution of 200 parts per billion of TCA that we introduced into the system. Of course, because of the water flow the concentration of TCA entering the system is reduced from 200 PPB to 40 PPT. What we got coming out of the system was something like O.5 PPT, which means a reduction in TCA in the water passing through the system of 97 per cent. This shows us clearly that the CONVEX system is efficient in removing volatile compounds.

Having had this new boiling system explained in detail, let's see the improvements that we've got with INOS, and why we use INOS. As I already told you, INOS is used to wash discs and is going to be used to wash bartops. In the INOS system we put cork discs in a tumbler and fill it with hot water, and then we apply pressure and negative pressure, a little bit of a vacuum and a little bit of positive pressure. As a result, the lenticels of the discs function like a pump; with vacuum they are compressed, with positive pressure they expand and so the extractable material is extracted into the water. So this system cleans the discs because it allows the extractable material to be extracted easily.

But because we use pressure and negative pressure, we had some doubts about the performance of the discs. We wanted to see if the cell structure was maintained. As you can see from these electron microscope pictures, the cell structure of the discs is maintained without problem, it's not damaged. And so we know, clearly, that the

Let us see two examples of the efficiency of this INOS system. One indication is the presence of tannic acid. With tannic acid we made a soak of discs in water or 10 per cent ethanol and in that soak we got a certain amount of tannic acid, shown in this chromatogram figure. After INOS, discs from the same batch were put in a soak and we got a much lower amount, a reduction of about 50 per cent of the tannic acid in the soak medium. This shows the efficiency of INOS in cleaning up the discs.

This slide shows an observation from TCA-contaminated discs. The discs were contaminated with different chlorine compounds, mainly TCA, but also all the others, and as we can see, we have a significant reduction after INOS. 'After INOS' is shown by the blue bars and the orange bars show before INOS'. So we have a reduction in these compounds, but not a clean disc yet.

Finally, the ozone. We introduce ozone into our production process towards the end of the process. Why ozone? Well, ozone is now becoming fashionable, in fact lots of industries are now using ozone. In the wine industry, it is used to clean barrels, to clean bottles; in the textile industry, to clean the residual water that contains lots of stain, lots of colour. The food industry likes to keep non-contaminated seafood in big tanks of water. So ozone is now used in several industries, it's used in a lot in water treatment industries. So why not try to see what the effect of ozone is in the cork industry?

At Amorim we have several facilities, several ozone generators, in our different plants. In this slide, this is a generator in Portugal, an ozone generator that introduces ozone into the water for the washing system to ensure that water is completely clean of microorganisms. This system here is a humidity chamber that we use in one of our plants in America. This is the ozone chamber in Amorim Cork Australia and this is a new ozone chamber, in our facilities in Portugal.

What are our objectives with ozone? Two things; first, we aim to have a significant reduction in the microbiological load. Why is that? Because by doing so we reduce the possibility of TCA because the microorganisms are important in the development of TCA. That is one part.

Second, ozone acts as an oxidising agent, a really strong one, and we know that oxidation changes the properties of compounds. So, we really want to see what is the direct effect of ozone on TCA. I know that ozone is not selective, is not directed at TCA, but it can work with TCA.

First of all, when we started with these ozone chambers

microbiological load, as it does in other industries, principally in the water industry. So, with a small generator in the lab, we examined corks before ozone and corks after ozone. We wanted to see the microbiological burden measured by what we call the colony-forming units that correspond to the amount of yeast or bacteria or mould that appears.

It was a group of 22 corks, and after ozone the microbiological load of corks was much lower. Not a complete sterilisation, as you can see, but a significant reduction in the microbiological load.

Those observations related to the surface of the corks. We also wanted to see if ozone was able to get into the core of the corks because, you know, there is a big network of lenticels inside. And we found ozone was able to enter the cork cores. Before ozone we had a significant amount, mainly bacteria, and after ozone we got a significant reduction on the cork core, but, again, not a complete sterilisation.

So having these results, we were encouraged to test ozone under industrial conditions, hence the big chambers. The first experiments we made related to the position of corks in the baskets. We put corks in baskets within the chamber and we wanted to see if ozone is efficient in different parts of the baskets. Of course, the baskets have holes everywhere, but we know that the corks are close together. So, we wanted to see if ozone was efficient from the top to the bottom of the basket. And it was. In these two different experiments before ozone we had a significant amount of colony-forming units, and after ozone we had very strong reductions, 42 to 92 per cent, in microbiological load… but non-sterilisation yet.

So knowing that the ozone is efficient within the basket, we wanted to see if there was an equal distribution within the chamber. We wanted to see if the reductions were equal in the baskets in one corner, one in another corner and in the middle of the chamber, and they were. An equal reduction of 74 per cent.

Because ozone is not selective, as I already explained to you, we wanted to see the effect of ozone in the sensorial analysis of corks. We are not talking about corks contaminated yet with TCA, because we are only now doing that work, but we are talking about normal corks, but very low-grade corks because we wanted to go to the worst case scenario. We made a large sensory test with our sensory panel. Our sensory panel is constituted of 10 tasters who have been trained very, very intensely, over six months, to identify cork taints, so they were really used to these cork taints.

Forty-one corks from one load were passed through ozone and 41 corks from the same load were not passed through ozone

20 corks came out clean, which means that nobody found one off flavour, but before ozone, just four were in that situation.

The opposite was the case with rejected corks. Rejected corks were corks that more than 50 per cent of the panel said were not good, so they rejected.

This result has to be confirmed because we want to do more experiments on it. However, it clearly shows that the ozone, as we suspected, refreshes the corks.

Finally, because ozone is a strong oxidant, we wanted to see the effect of ozone on the cell structure of corks because if the cell structure is damaged because of ozone, compared to the non-ozonated corks, then we will probably have problems with the mechanical properties of corks. It was not the case. We examined corks before ozone and after ozone, to one millimetre and two millimetres depth under the electron microscope. At one millimetre depth we had some destruction of the structure both before ozone and after ozone, the same amount, which is understandable, because after washing with peroxide, we also have some cell damage. But at two millimetres depth we had no problem at all, either before or after ozone. So, after this, we clearly see that ozone does not affect the sealing properties of cork, but it does reduce significantly the microbiological burden.

So, to finalise, I want to say to you we are now clearly on track. We are on the way to solving the problem. It is not solved yet, but the amount of taint or off flavours that we find is reducing more and more with all these improvements. Thank you very much for your attention.

MR HEYES: We trust that you found both of our speakers interesting and what we'd like to do now is to invite any of you to ask questions of either of our speakers on any of the subject matters. If you could, please, identify yourself and your company and feel free to pose some interesting questions for our two speakers.

Maybe I can lead off with one to, sort of, warm you up a little bit? In this country, it's quite common for people to bin wines. By that, they have wooden bins that hold around, what, 500, 600 bottles. How would it be possible for our wine companies to be sure that the timber in those bins was not going to adversely affect the wine? Is there something that can be done, can we test the timber, how can we be sure? I've posed a difficult one.

PROF. CABRAL: I think that nowadays, after the big problems that happened in France with the wood treatment, I think that nowadays all the winemakers are aware of that kind of problem, so I think that we don't have any more treated wood in the cellars and so it’s probably not a big problem.

It's important, also, to know that if we have a contaminated wine with TCA and that contamination came from the

pentachloroanisole or pentachlorophenol. Not just TCA, but pentachloroanisole, principally, that is volatile as trichloroanisole is. So it's not very difficult to distinguish where the contamination has come from; from wood.

QUESTION: (indistinct).

MR HEYES: Miguel, the question was, with the Twin Top cork, with the INOS process, the boiling process, what is the level of contamination that could be expected in those discs?

PROF. CABRAL: There are several things to say about that. First of all, we didn't present here a validation, a final validation of the INOS, and the reason we didn't do it is because, to validate a process like INOS or the boiling system, we need to have a significant number of samples. Each INOS cycle or each boiling cycle uses different discs, different cork, so one batch of cork can vary from another. And so we need use a big sample size to reduce this variable as much as we can. So we are not able to say to you that the INOS discs have zero or 0.5 or 1 PPT of TCA. We are not able to say that because we are working on that now, and we are going to take some time to do it.

But, conversely, on the other hand, what we can say is that we have now significant experience with INOS II washing of discs in Twin Top corks all over the world, as Mr Antonio says, mainly in the States, and we have had no problems with that kind of disc. It is important to note that we have had no problems with that kind of disc because we add an additional washing step in the process for those cork discs

Third point; we have two interesting studies that have been already published and one of the them is going to be published in a journal in America. One was made with Excell Laboratories in France, in Bordeaux, and the other one was the Geisenheim Institute in Germany. These two studies compared the performance of (natural) cork stoppers, Twin Tops and synthetics, and both studies concluded the same thing: that the performance of Twin Top corks was fantastic compared, of course, to synthetics, but even compared to natural corks.

QUESTION: With the Twin Tops corks you've got the agglomerate in the middle?

MR HEYES: That's correct, yes, it's an agglomerate body with two discs, yes.

QUESTION: What process of treatment is done to the agglomerate component of the cork? Assuming that the Twin Tops eventually will… a red wine that's been down for some time will slowly, you know, the wine will slowly penetrate (the discs) and hit the agglomerate part of the cork. What treatment does it receive?

MR HEYES: Miguel?

PROF. CABRAL: So, it was a good question because when we talk about discs we need, also, to talk about the body, the granulated cork, that is the other part of the cork. First, the granulated cork that is used in Twin Top corks comes from the new boiling facility in Ponte de Sor, so it is cork that is boiled with this new extraction system.

Secondly, we heat the granules in order to volatilise compounds that can be there. But, at the present moment, we are trying a new system to clean granulated cork because, as you probably

contact is much higher, than to clean whole cork stoppers. So we start with granules and what we have now is a prototype that uses steam in order to clean the volatile compounds, mainly TCA, from the granules.

Why do we use steam? Because TCA is steam-volatile. So, by passing steam through the granules, it is much easier to clean the granules than in (whole) cork stoppers because we have a much smaller surface of contact, you see. So we are now using raw materials boiled in the new boiling system, we are using heat and then we are experimenting with this steam volatilisation.

QUESTION: (indistinct).

PROF. CABRAL: The granules? Not yet.

MR HEYES: We can't put an agglomerated cork in ozone and this stage, it has an effect on the binding materials and can have an effect on the flavour characteristics.

To answer your question on the discs; what we do at Amorim Cork Australia is the discs, after they've gone through the INOS process, need a period of time to rest. It's a fairly aggressive process because it is putting them under pressure, it's pulling them under vacuum, and the cork then needs time to recover. So we actually store the discs in silos, which are covered with ozone, and they're held there for three days before they can go through the next stage of the processing. The ozone is not only keeping them in a very sterile condition, but it is also a deodorising agent, so it has an ability to reduce the flavour threshold of the disc. I'm sorry, a gentleman put his hand up there.

QUESTION: Just continuing on with the agglomerated corks; you haven't had them out for a very long period of time, you haven't had any problem with the delamination of the granules, them pulling apart over time, and what's the compound you glue it together with in the granulated cork?

MR AMORIM: Delamination of the cork?

QUESTION: Yes, you don't have any problem with that coming apart because in some previous corks, over time, they have come apart in the older-style granulated corks. What's the product in the cork that glues it together? What's the glue?

MR AMORIM: We have not come across any problem of delamination or any problem of the discs getting separated from the agglomerate. I think that in the initial stages one would have seen that, but we've been using the new Twin Top for some years now, and the volumes that we are producing and the efficiency of the process at the moment guarantees that (while) that's a problem that probably we had at the initial stages, that's not happening now.

As far as the binding elements that we use in the Twin Top, they are exactly the same that was used traditionally in the champagne corks. You have two alternatives: you can have either casein or you can use polyurethane.

QUESTION: I'd like to ask exactly how you do your sensory analysis, like, whether you do individual corks, and also whether you've correlated that with

PROF. CABRAL: There is some debate about the best way to do sensory with corks. My personal view is that I like very much to do it with water, because the water is clean and has no background. So, how do we do it? We do it, normally, in water with individual corks, one in each flask, normally 24 hours in a soak, with some warmth in the water to help extraction. Then we do the testing, the sensorial analysis, in the normal chamber, a clean room without off odours.

When we want to do TCA analysis we need to use, or we can use, two different ways, but all with GCMS, with gas chromatography, plus mass spectrometry. We can do it by both ways, one with a methodology that was developed in TCA by the Americans from the ETS in California, that is solid phase micro-extraction, where we create a headspace and we volatilise from a soak the components under temperature, and the fibre catches the compound. And then we inject that fibre into the chromatograph machine. Or we grind cork, extract the compounds with some solvents, and then we concentrate (the solution) and inject it directly, what we call direct injection, in order to see in this second case, the total TCA. In the first case, what we measure is what we call releasable TCA.

MR HEYES: I think we're now starting to run out of time, I thank you very much for your questions. I'd just like to finish off, perhaps, to answer a few queries that came out of the questions.

The AWRI's testing was able to show that the discs on the Twin Top cork gave a very effective seal and the loss of free SO_2 was absolutely minimal and significantly better than even a natural cork. This was one of the points that came out and has also shown up in other tests.

The second point was that after 18 months there has been a consideration that, perhaps because the disc, like a champagne cork, has a lenticel running through to the agglomerate, there may be some glue characteristics. They have found nothing like that at all, in fact the sensory analysis on these corks has come out very, very well. However, I guess it's a matter of doing sufficient numbers and we wouldn't say to you that you could expect to buy this product and have a 100 per cent success rate and that they would be totally taint-free. Our own experience, and now we obviously have produced many millions of Twin Tops here in this country, and we test the discs on arrival from Portugal and after the INOS process before they go through the plant and the incidence of TCA or mouldy-type characteristics, and certainly when we get to woody characteristics, is extremely low. I can't give you a figure at this point, but as an example, when we're testing natural wine corks through a sensory analysis we generally find that we have a level of between 0.4 to 0.8 per cent. What that means when it gets into the actual bottle of wine and how that relates, I'm not really too sure, but this is the sort of effects that we're finding. When we look at Twin Tops I can tell you that it is significantly less, I mean, we would be talking 0.1 per cent or even lower than that, I'd have to sit down and do the figures, but results of these are very, very good.

bottled for three to five years, no more than that. I have had a few people who have said to me, yes, they were very pleased with them, they want to move up into a next level. We don't have the experience on that yet and I would suggest that you do your own trialing and test these very carefully before you, perhaps, take it a little bit beyond what it is originally intended for.

Thank you very much for your attention. In the folder there is a little questionnaire, we'd appreciate it if you could fill that out, it's an ideal opportunity for you to communicate with us and for us to be able to communicate with you and we want to have this openness of discussion. Secondly, you will find that there are some tasting notes in there and we have some Burgundy wines. Now, we purposely opened them early so they'd be slightly oxidised and they wouldn't overshadow any of the Australian wines that are on show here today. Please enjoy them, there is some Premier Cru and some lovely wines there for you to try. Please enjoy. Thank you very much for your company.

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