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Preservation of wine without sulphite addition

In order to avoid wine spoilage, most wineries add sulphur dioxide to the wine. However, sulphites dissolved in the wine can potentially cause allergies. An alternative preservation method without or with significantly reduced sulphite addition has been developed by an international consortium within the EU-funded project "PreserveWine-DEMO", in which the Fraunhofer IGB is involved.

A good glass of wine is a byword for quality of life – not just for connoisseurs. In order to avoid wine spoilage, wineries mostly add sulphur dioxide during the winemaking process. However, the sulphites that dissolve in wine can cause allergic reactions – including asthma. Within the EU they must therefore be declared as an ingredient on the label and the limits for sulphites in wine have been reduced. Sulphites unfold their preservative action in two ways. On the one hand they inactivate microorganisms, such as unwanted yeasts, acetic acid bacteria and lactic acid bacteria, thus protecting wine from spoilage. Secondly, they act as antioxidants and protect delicate flavours against oxidation. Both effects ensure that wine is preserved and can be stored for ageing. Conventional alternative physical preservation methods such as filtration are suited for wine only to a limited extent, because they also remove colour and valuable flavours. Other methods operating at high temperatures, such as pasteurization, are unsuited as they destroy heat-sensitive ingredients.

A new method for preservation of liquid foods, working at moderate temperatures and therefore referred to as "cold pasteurization", is the so-called pressure change technology, which has been developed and patented by the Dresden company Edecto for fruit juice within the framework of a nationally funded project¹. "The physical process has effects similar to those of sulphurization of the wine: growth of microorganisms is prevented because the cells are mechanically disrupted. In addition, the protective atmosphere of an inert gas decreases oxidation reactions, so drinks are stabilized," explains Edith Klingner, a physicist at Edecto, who coordinates the EU-funded project "PreserveWine-DEMO".

¹ IKON Regionale Wachstumskerne funded by the German Federal Ministry of Education and Research, 2006.

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In the initial PreserveWine project, international partners including Edecto investigated whether the new method can also be applied to wine. At the Fraunhofer IGB a batch plant was modified and on the basis of initial results a continuous plant was developed and built. The TÜV-approved pilot plant can treat up to 120 litres of wine per hour at a pressure of 250 to 500 bar and at temperatures below 40°C. The results are promising for the treatment of white wine as well as red wine. "Unwanted oxidizing enzymes are inactivated, while neither temperature-sensitive ingredients nor colour and taste are altered by the treatment," confirms Dr. Ana Lucía Vásquez-Caicedo, food technologist and group manager at the Fraunhofer IGB.

In the pressure change technology a chemically inert gas, such as nitrogen or argon, is dissolved at high pressure in the liquid to be preserved. When the liquid is exposed to a high pressure of up to 500 bar, the solubility of the gas increases in the liquid. As a result, the dissolved gas also diffuses into the microbial cells. When the pressure is finally abruptly decreased, the gas expands – even within the cells – and causes these to burst. The previously dissolved gas then goes back into the gas phase and is recovered for reuse.

"In studies at the Fraunhofer IGB and our partner institute ADERA we have shown that the colour of the wine is maintained over time during storage in barrels or bottles. In wine tastings, we found that the taste is not affected," says Vásquez-Caicedo. The new preservation method can be used in different stages of wine production: after vinification (wine pressing) of white wine, after the alcoholic fermentation, after the malolactic fermentation employed mainly in red wine for acid degradation as well as when racking and filling.

In the follow-up project "PreserveWine-DEMO" the process will be transferred as a winery process to industrial scale. To this end, the researchers want to build a mobile plant that can be tested on site in various wineries. In parallel, the consortium aims to ensure product quality and process feasibility and wants to examine consumer acceptance of the new technology.

The previous results have been achieved in the project "PreserveWine" (Grant Agreement No. 262507), which was funded from December 2010 to November 2012 in the European Union's 7th Research Framework Programme. The follow-up project "PreserveWine-DEMO – Demonstration of a non-thermal process to replace use of sulphites and other chemical preservatives in European wines to meet new European Directive" (Grant Agreement No. 606569) has been funded in the EU's 7th Research Framework Programme since January 2014. Project partners are the Fraunhofer IGB (Germany) and the Association pour le Développement de l'Enseignement et des Recherches auprès des Universités des Centres de Recherche et des Entreprises d'Aquitaine (France) as research partners, the companies Edecto (Germany), Statiflo (UK), Uvasol (UK) and Malthe Winje (Norway) as technology suppliers, the Société Civile Agricole du Château Guiraud (France) as a user as well as the winery association Comité de la Communauté économique Européenne Industries Commerce Vins (Belgium).

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In the EU-funded PreserveWine-DEMO project a process for the preservation of wine using pressure change technology is developed by the Fraunhofer IGB together with the company Edecto and other partners.

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