

## Session: Control and Regulation of Wine Fermentation

Four questions for Professor Doris Rauhut, Professor Manfred Großmann and Dr. Claus-Dieter Patz, Hochschule Geisenheim University

The topic of digitisation is set to dominate the conference, with topics throughout the process chain. It has also opened up new perspectives and options for monitoring and regulating fermentation. The focus isn't just on controlling the fermentation process, but also on the whole spectrum of micro-organisms which are relevant to wine. Research, teaching, consultancy and industry are working closely together here with companies in the wine industry. The "Control and Regulation of Wine Fermentation" session is conceived as an opportunity to take stock, to exchange knowledge and experiences, and to encourage new developments. Professor Doris Rauhut and Dr. Claus-Dieter Patz will moderate the session, and Professor Manfred Großmann will make sure to kick off the exchange of knowledge in his position as "scientific provocateur" and to get the discussion started.

### What advantages does digitisation bring to oenologists from the perspective of microbiology and biochemistry?

**Großmann:** When we think of the lifespan of a grape until it's ripe, we think of a period lasting a few months. Though when it comes to processes such as alcoholic fermentation and malolactic fermentation, or the biological reduction of acidity, this period of time is reduced to just a few days or weeks. The fermentation processes alone make it possible to transfer the potential wine quality of the grapes into real-life wine quality, and so turn it into the sales success that the producers are looking for. This makes it all the more im-



portant for the oenologists to find out as much as possible about the quality of the fermentation process during this short timeframe. Digitisation here is opening up various new ways to record and process data which go far beyond those currently used by wine-growers at the moment, for example measuring the temperature or density of the must and digital control. Considering the increasing demands that wine connoisseurs have in terms of quality, the complex ways in which micro-organisms influence the quality of the wine later on makes it essential for oenologists to have consistent information available to them, for example on which yeasts are active and when, in order to increase the positive effects or to prevent any potential negative effects. As a result of climate change and the changes in the composition of the grapes which comes with it, it is much more necessary to know more about the nutrient content of grapes to avoid any problems with fermentation. Developing quick analysis methods to match, and implementing the results into a consistent fermentation management system would not be possible without digitisation.

Miniaturising the sensor systems on a spectroscopic or a molecular-biological basis, which for example are used in companies working in the pharmaceutical or biotechnology industries, can in some cases help ensure that no gaps occur in monitoring, and help to close the control gaps later on. Here too, it's important to use the events held as part of the DWV-Congress to ascertain what is required, and to engage in a close exchange with the relevant companies, specialist wine laboratories and research institutes.

**Are you not just interested in yeast here, but also in identifying and developing the rest of the micro-organisms used during the production process?**

**Rauhut:** During the last few years, the process of malolactic fermentation, which previously was only carried out to reduce the acid content, has become more and more significant, because the lactic acid bacteria which are responsible for the process also have a significant impact on the flavour of the wine. While for a long time this was considered to have an adverse affect, especially for white wines, these properties have increasingly been used by oenologists in the past few years to create new types of wine. This makes recording and managing bacterial activity using sensors and digital processing methods all the more important. The issues are very similar to those of alcoholic fermentation: are the right micro-organisms working, and what influence does it have on the structure of the flavour and other substances which have an impact on quality.



Firstly, it can be assumed that pH values will be higher in certain years as a result of climate change, which will make it more likely for unwanted malolactic fermentation to occur spontaneously. Being able to quickly digitally record the measurement data required would give oenologists the opportunity to take appropriate corrective measures at the right time.

**Would it not be possible to quickly and reliably monitor the fermentation process by determining the secondary metabolites?**

**Patz:** Right, to do that requires online measurements to monitor each individual fermentation. It has to be possible to meas-

ure relevant substances such as usable nitrogen, vinegar acid, any unwanted flavour particles and others as well as the physical parameters such as temperature, density, pH, O<sub>2</sub>, CO<sub>2</sub> etc which it is already possible to measure. This can already be implemented through systems such as “lab on the chip”. Continuously assessing this data makes it possible for fermentation to be monitored automatically and to be able to react to disturbances at an early stage (Process Analytical Technology; PAT). Here, “intelligent software solutions” can recognise deviations more quickly and reliably by jointly evaluating all process parameters recorded. At the moment, most physical parameters can already be measured cheaply and quickly, while new innovations are expected for chemical substances. Previously however, most systems worked offline.

**What new ideas can the “Control and Regulation of Wine Fermentation” session at the DWV-Congress provide? Who would you definitely recommend to take part in the session?**

**Rauhut:** Digitally recording data to monitor the breakdown of sugar and the temperature at which fermentation takes place is already commonplace at many companies, and is used to control the intensity of the fermentation in a way which is targeted and automated. However, this should only be seen as a first step in digitising the fermentation process, because recording the value-adding components and digitally processing them would significantly improve the monitoring and above all the control of fermentation, which would result in a noticeable improvement in the quality of the wine. So ultimately, it also pays off through increased profits in wine sales.

We see the session as an opportunity to demonstrate the requirements of wine producers in terms of controlling and monitor-

ing fermentation across the entire spectrum, so that we can arouse interest among the relevant areas of the supply industry in getting to grips with the situation and with what the wine industry wants.

This means that it will clearly demonstrate what is needed in terms of sensor technology from the wine producers' perspective, while on behalf of the suppliers it sets out what already exists from a technological point of view and where there is a chance of modifying existing technology depending on requirements, or to completely redevelop them if need be. We also see an im-

portant contribution with regard to the integration of research institutes and specialist wine laboratories, in order to pool together the various skills and experience needed to optimise and develop corresponding digital monitoring and management systems. The sessions, available in both German and English, offer a platform to everybody involved in monitoring and controlling fermentation as well as monitoring the quality of wine to exchange views with both German and international attendees.

Interview by Dr. Rudolf Nickenig