

Monitoring Dissolved Carbon Dioxide and Oxygen in Wine

Relevant for: Wineries, fillers and bottlers of wine

Dissolved oxygen (DO) in wine is considered detrimental due to its oxidative properties. Thus, premium quality wine producers aim to minimize oxygen pick-up and deaerate wine before bottling. In addition, the CO₂ content is adjusted to ensure cost effectiveness, constant quality and make sparkling wine sparkle. To assure your product contains the target gas content, Anton Paar's inline sensors for monitoring CO₂ and DO content can easily be installed directly into your production line. You benefit from an accurate and reliable monitoring for a wide range of concentrations.

1 Wine production

The wine production is a series of process steps which transform grapes to wine. DO naturally occurs during grape crushing, pressing and during the pumping of grape juice into the fermentation tank. Oxygen is used up during the initial stages of alcoholic fermentation. In the later stages of wine production it is unwanted. It reduces the quality, the shelf life and affects the aroma negatively. Therefore wine is often deaerated prior to filling. Before filling, the CO₂ content produced by fermentation (1 – 2 g/L) is adjusted to the target value. The target value (0.3 – 10 g/L) varies for the different types of wine.

2 CO₂ monitoring

To ensure constant carbonation levels the CO₂ concentration in wine must be measured. The CO₂ sensors Carbo 5100 and Carbo 6300 easily detect any deviations from the target CO₂ values. This allows online process control of carbonation.

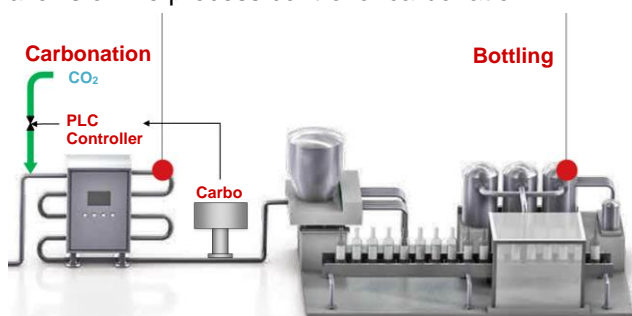


Figure 1: Online process control of carbonation.

The CO₂ sensor is installed after the carbonation or/and degassing unit of choice:

- **Carbonation system with a venturi injector**
The sensor must be installed after the dissolving path to prevent contact with bubbles.
- **Gas liquid membrane contactor**
The sensor is typically installed directly after

the membrane unit as the added CO₂ dissolves completely in the contactor.

- **Inline nitrogen stripping system**

The CO₂ content can only be monitored by the Carbo 6300 installed after the degassing tank and before the filler. The Carbo 6300 is not influenced by other dissolved gases.

3 DO monitoring

Inline measurement of DO ensures product quality throughout the entire production process and allows unwanted DO sources to be identified. DO is monitored at process units where oxygen pick-up is critical (e.g. after and prior to filtration) and after deaeration.

4 Lab and process working together

Results of the process measurements (Oxy 5100, Carbo 5100 and Carbo 6300) match with the lab reference (CboxQC™).

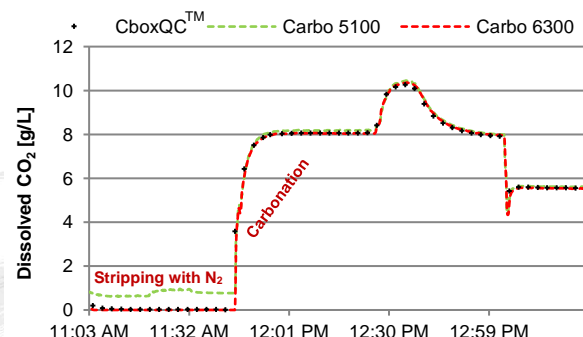


Figure 2: Dissolved CO₂ content measured in wine

Figure 2 illustrates the correlation of process and lab data obtained for sparkling wine for a wide range of CO₂ concentrations. Deviations between the Carbo 5100 and the lab reference (CboxQC™) during stripping with N₂ (for times < 11:45) result from a relatively high content of dissolved N₂. Both, the

measurement method of the lab reference and the Carbo 6300 are not influenced by dissolved foreign gases such as O₂ and N₂. Figure 3 illustrates the correlation of process and lab data for DO in red and white wine.

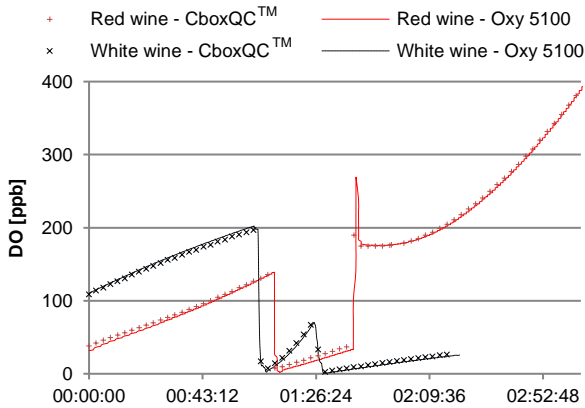


Figure 3: DO content measured in different wines

5 Measurement Setup

Carbo 6300 (Figure 4) is an inline CO₂ sensor based on the spectroscopic approach of Attenuated Total Reflection (ATR). The patented technologies of this sensor grant uninfluenced measurement of CO₂. The sensor is completely maintenance-free and EHEDG Type EL Class I certified and designed for harsh environments (CIP/SIP at max. 130 °C for max. 30 min). Alternative choice is Carbo 5100 using the classical p/T method of CO₂ analysis.



Figure 4: Carbo 5100 (left) and Carbo 6300 (right)

The Oxy 5100 (Figure 5) optical DO sensor enables highly accurate drift-free measurements throughout the entire production process. The sensor is EHEDG Type EL Class I certified and designed for harsh environments (CIP/SIP at max. 130 °C for max. 30 min.). It recognizes the sensor cap including factory calibration values for quick and easy cap exchange. Oxy 5100 estimates the remaining life time of the sensor cap and warns you when a new cap is

required. Connectivity to Anton Paar's lab systems is available via Davis 5 (data recording, visualization and analysis).



Figure 5: Oxy 5100 dissolved oxygen sensor

Sensor		Measurement range	Accuracy
Carbo 5100		0...20 g/L (0...10 vol)	0.05 g/L (0.025 vol)
Carbo 6300		0...12 g/L (0...6 vol)	
Oxy 5100	Trace Range	0...2000 ppb	≤ ±1 ppb or 3 % *
	Wide Range	0...24 ppm	≤ ±0.042 ppm or 3 % *

* at 20°C two point adjusted, the larger value is valid

6 Application essentials

Pressure must be kept above the saturation pressure. Should bubbles come in contact with the sensor the measured values may be incorrect.

7 Benefits

- Cost effectiveness by correct CO₂ dosage
- Fulfill legal requirements
- Constant product quality
- Optimal DO management to reduce the amount of additional sulfide

8 Other Online / Inline instruments

Wine Monitor: Wine Monitor 5500/5600;
Color/Turbidity options

Refractive index (°Brix): L-Rix 5100 or 5200

Sound velocity (interface detection): L-Sonic 5100

Color: L-Col 6100

Software: Davis 5 Data Acquisition and Visualization Software (incl. mPDS 5 Evaluation Unit)

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