

# Dissolved oxygen in fruit juices

Fast and accurate determination using an optical sensor

---

## Summary

Dissolved oxygen (DO), incorporated into juices during processing, affects quality parameters of the beverage during storage such as Vitamin C concentration, color, and aroma. Vitamin C (ascorbic acid) is irreversibly oxidized to dehydroascorbic acid in the presence of oxygen. The speed of degradation depends on temperature, exposure to light, and pH value. Aside from the destruction of vitamins and other antioxidants by oxygen, a browning of the juice is a further possibility.

Various oxygen removal methods are used during juice production, such as vacuum-deaeration (vacuum on product to release dissolved oxygen) or gas sparging (replacing O<sub>2</sub> with another gas, such as N<sub>2</sub>) to increase product quality and extend shelf life. However, these methods have the drawback that the aroma might be affected since the volatile compounds are also removed. In some cases, oxygen scavengers are incorporated into the packaging material.

By assessing the content of dissolved oxygen in fruit juices, manufacturers can improve the overall product quality. This application note describes a fast and accurate determination of dissolved oxygen in juices by using an optical sensor.

# Configuration



## 2.914.0230 - 914 pH/DO/Conductometer, laboratory version

Portable two-channel pH/DO/conductivity measuring instrument with intelligent measuring input for measuring dissolved oxygen/pH /mV and analog measuring input for conductivity/TDS/salinity and temperature. You will be optimally equipped for measurements in the field and in the laboratory with this battery-operated measuring instrument with a stand plate. Digital measuring input for the O<sub>2</sub> Lumitrode or the intelligent pH electrodes; Analog conductivity measuring input for the 4-conductor conductivity measuring cells; Laboratory pH/DO and conductivity measuring instrument with built-in battery pack; Parallel measurement of pH value and conductivity; Parallel measurement of oxygen and conductivity; Robust, water-tight, and dust-tight housing (IP67) for tough outdoor and laboratory use; LCD color display with background illumination making results easy to read; USB interface for simple data export to PC or printer; Large internal memory (10,000 data sets); Pin-protected User mode and Expert mode, prevents unwanted parameter changes; GLP-compliant printout and data export with User ID and timestamp;



## 6.1116.000 - O<sub>2</sub> Lumitrode

The optical sensor for measuring dissolved oxygen (DO) can be used with a 913 pH/DO meter or with a 914 pH/DO conductometer. The measuring principle of the sensor is based on luminescence quenching. The space-saving and maintenance-free sensor is suitable for DO measurement, for example in: Water quality control; Wastewater industry; Beverage production; Fish farming; This sensor is supplied with a calibration vessel, and 3 x 30 mL oxygen standard, 0%. Where necessary, it is easy to replace the measurement cap (O<sub>2</sub> cap) which contains the oxygen-intensive luminophore.

---

## Sample and Sample Preparation

The method is demonstrated on apple juice and multivitamin juice. Shake the sealed sample well before analysis. No further sample preparation is required.

# Experimental



Figure 1. 914 pH/DO/Conductometer equipped with an O<sub>2</sub>-Lumitrode for the determination of dissolved oxygen in juices.

This analysis is carried out on a 914 pH/DO/Conductometer equipped with an O<sub>2</sub>-Lumitrode which is calibrated with 100% and 0% air saturation.

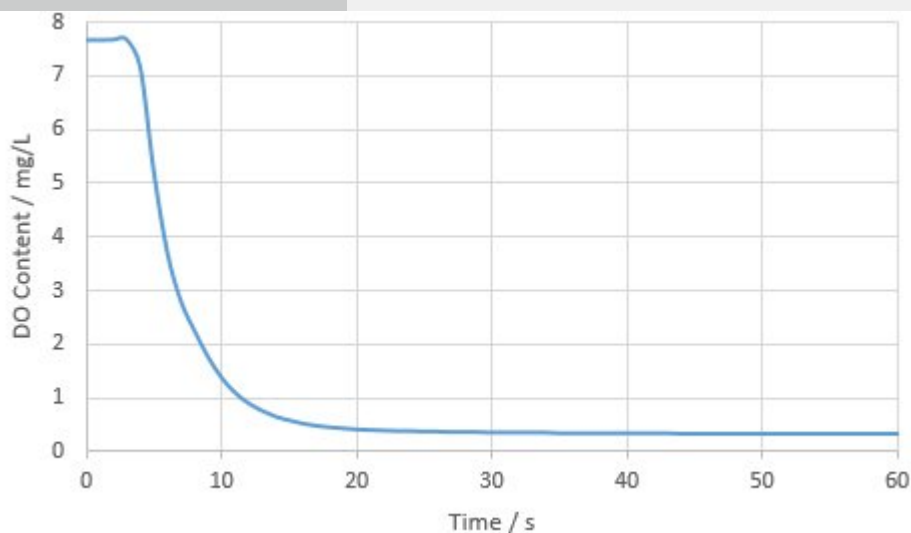
The prepared sample is carefully opened and the O<sub>2</sub>-Lumitrode is placed directly into the sample. The measurement is started, and the DO content is measured until a stable value is reached. Afterwards, the sensor is removed and rinsed well with deionized water. If necessary, blot dry. For each analysis, a new sample bottle is opened. The sensor is stored dry with mounted calibration vessel for protection.

## Results

For each analysis, stable results are obtained within approximately 20 seconds. The calculated absolute standard deviation is smaller than 0.1 mg/L.

**Table 1.** Content of dissolved oxygen (mg/L) in apple juice and multi vitamin juice (n = 3).

	Mean DO content in mg/L	SD(abs) mg/L	SD(rel) %
Apple Juice	1.04	0.09	8.3
Multivitamin juice	0.28	0.03	9.4



**Figure 2.** Example measurement curve of the DO content in multivitamin juice.

---

## Conclusion

The dissolved oxygen content in juices can be assessed reliably and quickly using a 914 pH /DO Conductometer equipped with the optical sensor O<sub>2</sub>-Lumitrode. An accurate measurement takes less than 30 seconds and the sensor is completely maintenance-free. No need to worry about the quality of your sensor: if the O<sub>2</sub> cap needs to be replaced, the instrument will inform you.

### **Metrohm USA**

*9250 Camden Field Pkwy  
33578 Riverview, FL*

info@metrohmusa.com  
tel:866-METROHM