In-Situ Inc.

Innovations in Water Monitoring

Technical Note

Two-Point Dissolved Oxygen Calibration Using Yeast

Using Yeast as a Safe, Low-Cost, and Eco-Conscious Alternative to Sodium Sulfite

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Abstract

Two-point dissolved oxygen (DO) calibrations for the RDO® PRO Probe and the RDO® Sensor (available on the Aqua TROLL® 400 and TROLL® 9500 Instruments) require 100% oxygen saturation calibration solution and a 0% (zero-point) calibration solution. Traditionally, sodium sulfite is used as a zero-point solution. Making a zero-point solution with yeast is a natural, safe, and ecologically mindful alternative that provides accurate results at a lower cost.

Introduction

Yeast are living microorganisms that have been used for centuries in the production of leavened breads and alcohol. The same natural metabolic processes also cause yeast to consume DO from water, which makes the sample a suitable zero-point calibration standard (Alba-Lois et al 2010). Yeast is a chemically inert, naturally occurring organism that is 100 percent biodegradable. This makes handling and disposal safe and easy (EPA 1997). Dry yeast is readily available and should be stored according to manufacturer instructions.

For the most accurate results, the RDO PRO Probe and RDO Sensor should be calibrated under stable and controlled conditions, like those found in a laboratory setting. However, field calibration can also be performed with a high level of accuracy. Calibration solutions should be similar temperature to the sample matrix. One or two calibration points can be performed. If only one point is taken, the software uses the results of a previous calibration for the other point.

A two-point calibration is recommended for In-Situ optical RDO probes and sensors when DO

values are expected to be less than 1 mg/L, when required by Standard Operating Procedures, and after replacing the sensor cap.

Calibration Procedure

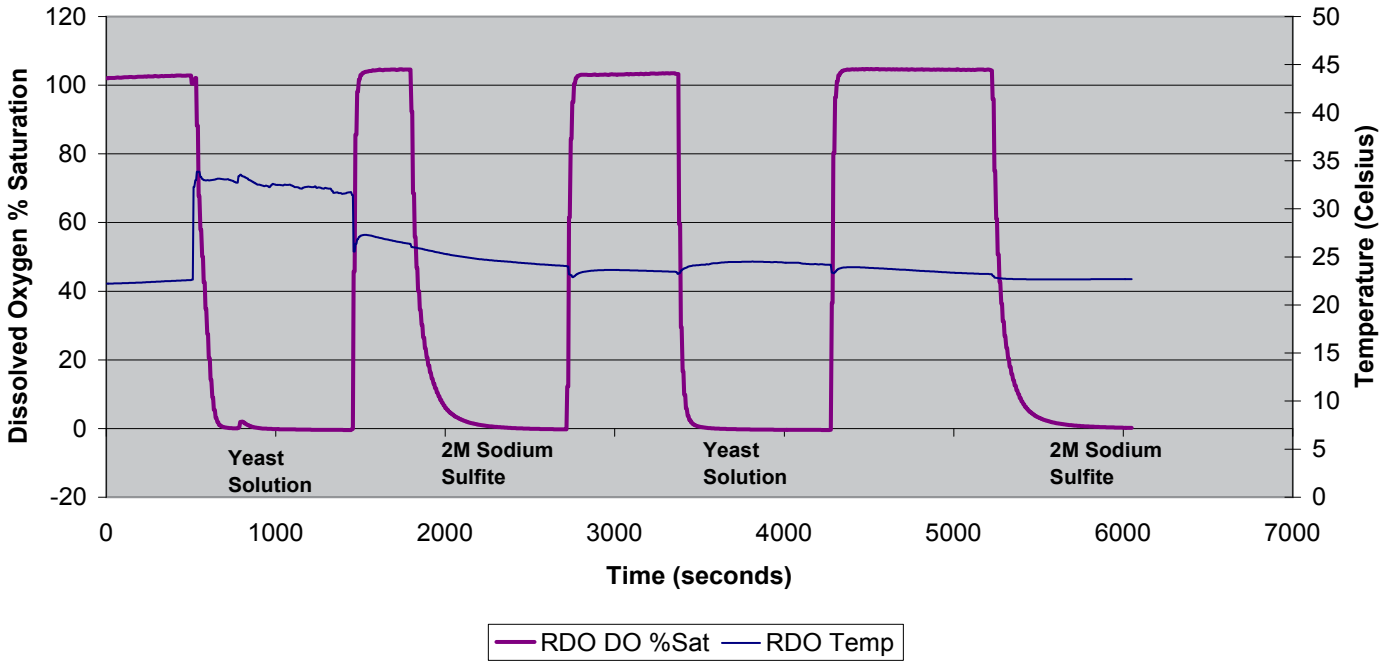
100% DO calibration is performed in water saturated with air or air saturated with water. For best results, use the In-Situ RDO Bubbler Cal Kit (Cat. No. 0048580) or RDO PRO Calibration Cup (Cat. No. 0088890) as specified for your instrument.

0% DO calibration is performed in an oxygen-depleted solution. Fast ("rapid") rise or active dry baker's yeast can be used to make a 0% solution. Other options for a 0% DO calibration include sodium sulfite (Na_2SO_3) or bubbled nitrogen; call In-Situ Inc. for details.

Procedure for Using Yeast to Make a 0% DO Environment

1. Dissolve 1 envelope or 1 tablespoon (TBS) of either fast rise or active dry yeast in 1 cup of warm water. If using active dry yeast, dissolve 1 TBS of sugar into water prior to adding the yeast.
2. Stir the mixture and allow it to stabilize for at least 15 minutes. For best results, allow the solution to reach ambient temperature.
3. After stabilization, the 0% solution is ready for use. Follow the instructions for the 100% oxygen saturation point, then follow the instructions for the zero-point oxygen point. Use the prepared yeast solution in place of Na_2SO_3 solution.

Yeast vs. Sodium Sulfite as a Zero-Point Calibration Standard—% Saturation
Comparison of RDO PRO Probe DO Readings in Sodium Sulfite, Yeast Solution, and 100% Air-Saturated Water



The above graph shows DO saturation readings, alternating between 100% and 0% saturation. The 0% saturation readings were recorded by alternating between a prepared yeast solution and a 2 M Na_2SO_3 solution. The data indicates that there is no significant variance between 0% DO readings when using a yeast solution versus using a Na_2SO_3 solution. Additionally, there is no affect on 100% saturation readings when utilizing either solution. Note: minor temperature variations are due to solution cooling in ambient conditions, which does not significantly effect results.

Average DO Readings		
	mg/L	**% Saturation**
Yeast Solution	0.0063	0.105%
Water Saturated Air (after yeast solution)	6.951	104.57%
Sodium Sulfite	0.004	0.056%
Water Saturated Air (after sodium sulfite)	7.273	103.49%

References

1. Alba-Lois, L. & Segal-Kischinevzky, C. 2010. Beer and wine makers. *Nature Education* 3(9):17 (http://www.nature.com/scitable/topicpage/yeast-fermentation-and-the-making-of-beer-14372813). Resourced from web March 21, 2012.
2. EPA Report. February 1997. *Saccharomyces cerevisiae* Final Risk Assessment. (http://www.epa.gov/biotech_rule/pubs/fra/fra002.htm). Resourced from web March 21, 2012.

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