

Pi Technical Note 43

Dissolved Oxygen Meter for Aeration Control

Introduction

Online Dissolved Oxygen (DO) monitors are crucial for controlling the oxygen available to the microbes in an aeration lane or oxidation ditch. Typically up to 50% of the cost of running a waste water treatment plant with aeration is the cost of the electricity to run the blowers, often the cost of purchasing many online DO meters is less than 10% of its 10 year total cost of ownership. An online DO meter that is reading 0.1 ppm low could cost more than its purchase and installation costs in increased electricity costs in just a few months.

Galvanic vs Optical DO measurements

Early measurement of online DO in waste water was made by electrochemical cells that needed sacrificial electrodes, electrolyte, membranes and a lot of calibration. Whilst there are some companies still advocating the use of this technology it was largely replaced in the 1990s and 2000s with online optical measurement. The vast majority of online DO systems used today are optically based similar to the sensor shown in Figure 1.



Fig. 1: Dissolved Oxygen Sensor - OxySense

Why is controlling the blowers so important?

Simply put, the microbes need enough oxygen to do the job. More oxygen than this and we are wasting energy and promoting the growth of unwanted biologies in the process. Many plants are estimated to waste significant energy by over aerating their process.

What do you need from an online DO meter?

Reliability, Dependability and Reproducibility are the three most important things that a plant needs if it is to optimise its treatment (i.e. control the DO in the aeration lanes to a precise and accurate level).

Typically an aeration basin will have 'lanes' with more than one DO sensor. If these DO meters are reading very different levels and do not track each other it is very difficult for a plant to know how to implement a control strategy. DO meters fail low, an unfortunate consequence of the technology. A reliable, dependable and reproducible DO meter will be consistent and will check its own responsiveness so an operator doesn't need to worry.

Reliability means Robust - The Pi DO sensor has what is probably the most robust lumiphore (sensing material) of any available DO meter. As shown in Figure 2, the lumiphore is the disc of material that is used to sense the amount of oxygen present and it needs to be tough to withstand the high energy, aggressive environment that they work in.

Figure 3 shows a graph of how long the Pi DO lumiphore works during a sandblasting experiment against two other leading suppliers of online DO monitors. The results are staggering. The Pi sensor lasts more than 20 times longer! You can't scratch our lumiphore off with a thumbnail!

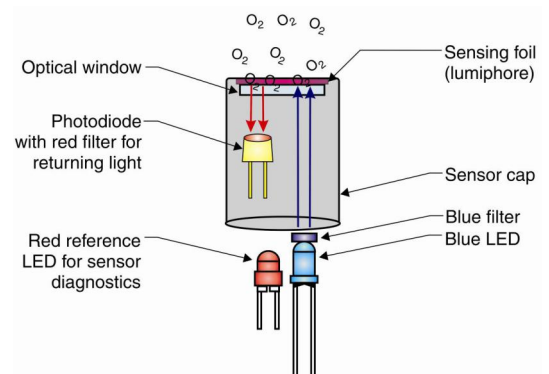


Fig. 2: OxySense Diagram

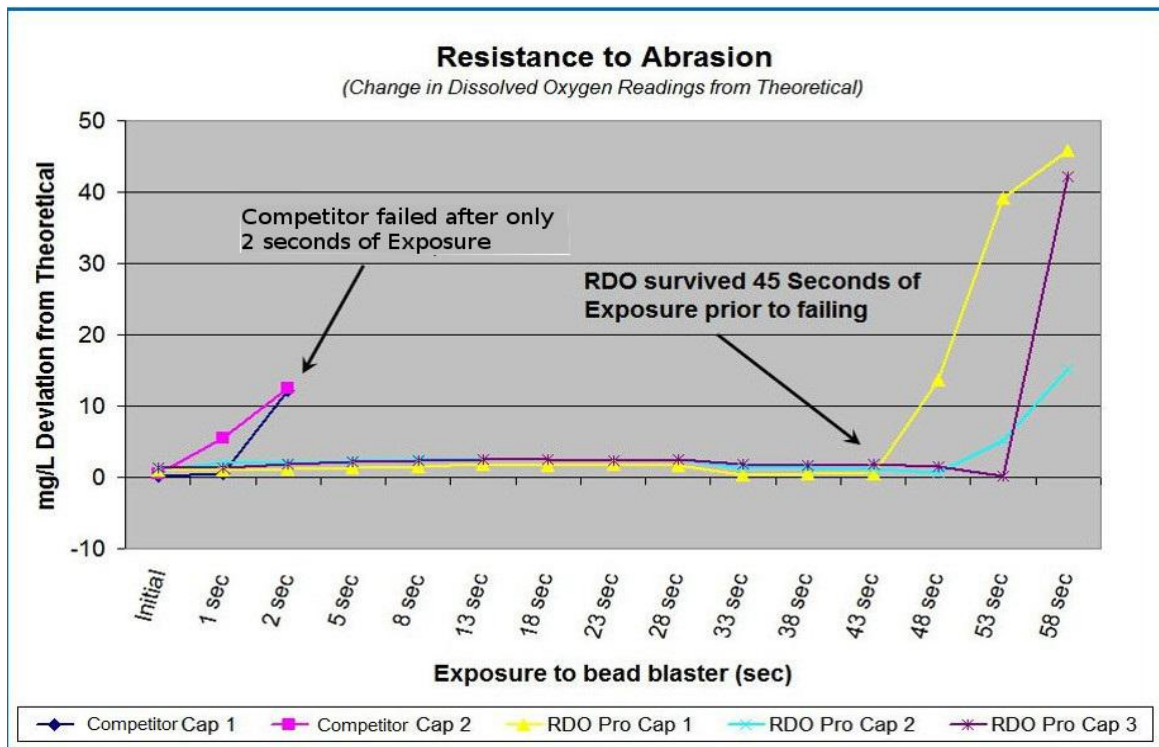


Fig. 3: Graph displaying resistance of Pi lumiphore during sandblasting experiment against a competitor.

Dependability means Clean - If you ask operators how often they maintain a DO meter (clean/calibrate etc.) you often get the answer "every week". On a large plant that can mean an operator spends half their time doing nothing but maintaining the DO sensors!

The Pi online DO analyser has an optional cleaning system that can clean the lumiphore and keep it clean potentially for the entire life of the sensor. Utilising compressed air from site or a small robust compressor available from Pi, the autoclean keeps the sensor clean and that's not all...

Dependability means Self-Checking - If you ask the operator why they clean/calibrate the sensor weekly you will often get the answer "so we know it's working".

In modern plants the DO levels are kept low to reduce the energy required for the blowers. This means that the DO sensors can often read close to 0 mg/l. How do we know that the sensors are reading correctly and aren't faulty? The traditional solution is for an operator to pull the sensor out and watch it respond to air, and when it's out the operator may as well clean it and calibrate it.

What if there was a way to check the response to air without taking it out of the aeration lane?

Well there is! The Pi autoclean system not only automatically cleans the sensor but whilst doing so, also checks the response to air. Any issues are reported to the operator who no longer has to maintain the sensors every week.

How long can they last without any operator interference?

On a recent trial in a UK Utility the Pi OxySense was installed for 13 months alongside their existing DO meter and during that time the sensor was removed once for manual cleaning when the power to the autoclean system was inadvertently off for a week. That was the only time the sensor was removed from its position in the aeration lane and throughout the entire trial the instrument was reliable, dependable, and consistently accurate.