High-tech Products

New Cartridge-type D.O. Sensor Saves Time, Money

By Jim Klauer

Most continuous dissolved oxygen measurement systems in today's marketplace use either electrolytic or galvanic type measurement techniques to gather required data.

In a basic galvanic cell, the oxygen content of the electrolyte is brought into equilibrium with the sample oxygen content. The electrodes are polarized by an induced voltage, causing an electrochemical reaction when the oxygen comes into contact with the electrodes. This reaction creates a current flow through the electrolyte, the magnitude of which is proportional to the oxygen concentration in the electrolyte. The galvanic cell has some inherent disadvantages. This technique depends on the reduction of oxygen molecules to generate a measurement voltage, making it susceptible to contamination of the electrodes and electrolyte. If a contaminating material permeates the membrane, it will cause the cell potential to shift. This shift will be falsely interpreted as a change in dissolved oxygen concentration. Another problem occurs at low oxygen concentration levels. Since the output of a galvanic cell is linearly proportional to the amount of oxygen present, the potential for errors at low oxygen levels increases due to a low signal-to-noise ratio. Finally, the anode electrode will be consumed due to the electrochemical reaction necessary for the dissolved oxygen measurement.

The electrolytic measurement technique, which typically uses a polarographic cell, addresses some of the problems associated with a galvanic cell. A polarographic cell requires a polarization voltage to be applied to the electrodes. As long as this voltage is maintained at a constant level, the cell will not be as susceptible to contamination of the electrodes and electrolyte as a galvanic cell. If a contaminating material does permeate the membrane, the cell potential will not shift. A polarographic cell measures the current flow that results from reduction of the oxygen molecules in the cell. Since this current flow is linearly proportional to the amount of oxygen present, potential for errors at low oxygen levels is reduced. Finally, the anode electrode will not be consumed by the electrochemical reaction.

To address the inherent measurement problems of electrode contamination, electrolyte depletion, and membrane coating, GLI International, Inc. has introduced the first (and only) Ross Cell Technology dissolved oxygen sensor that features a replaceable membrane cartridge. This sensor, Model 5600-series, uses three-electrode polarographic Ross Cell technology that consists of a platinum working electrode (cathode), a platinum counter electrode (anode), and a silver reference electrode. The oxygen that is dissolved in the process diffuses through an oxygen permeable membrane, and is reduced at the working electrode. The reverse of this reaction occurs at the counter electrode. Because the Ross cell generates as much oxygen as it consumes, it operates at equilibrium with no net difference in consumed oxygen. Measurement at equilibrium minimizes sensor maintenance and extends membrane cartridge life. The accuracy of the measurement will not be affected by partial membrane fouling, so the Ross Cell technology sensor will provide accurate readings as long as the membrane is not completely fouled. Measurement at equilibrium also eliminates electrolyte depletion and oxide formation that would normally consume the electrodes. GLI is so confident that this sensor will provide accurate and dependable dissolved oxygen measurements that it is covered by an industry-exclusive, 30-month pro-rated warranty. The replaceable membrane cartridge of the sensor consists of a pre-installed, semi-permeable membrane, electrolyte, and electrodes and is guaranteed for a period of one year from date of shipment. If the cartridge fails for any reason during this time, except physical damage, it will be replaced at no charge.

An operator calibrates a GLI self-cleaning D.O. system consisting of a Model D63 analyzer and a 5600-Series Ross Technology membrane cartridge sensor.

Monitoring dissolved oxygen is an important part of the activated sludge process. It assists in ensuring that there is sufficient dissolved oxygen in the process for the biological activity to take place, and helps to optimize energy usage through controlled air addition. In some cases, aeration accounts for between 2% and 3% of their annual energy costs. So, maintaining a proper level of dissolved oxygen can greatly reduce energy costs, thereby saving the plant money.

The Model 5600-series sensor saves time and money. By virtue of its unique Ross technology design, easily replaceable membrane cartridge, and unmatched warranty it reduces maintenance time and cost. It also accurately and continuously measures the dissolved oxygen concentration at various stages throughout the treatment plant, which helps reduce energy costs by maintaining the optimum level of dissolved oxygen in the process.

References

Measurement of Dissolved Oxygen, Michael L. Hitchman, August 1978.
Oxygen in Liquids (Dissolved Oxygen), R.K. Kaminski, B.G. Liptak & G.J. Rorech.

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