Technical Note 36

DioSense NM - Non Membraned Chlorine Dioxide Sensor

Introduction

When measuring chlorine dioxide concentrations in water, a high temperature and high pressure environment can present difficulties. These can include increased chemical reactivity or electrochemical changes, which will result in an incorrect measurement when not accounted for. More delicate sensor materials such as membranes can be susceptible to damage, and reagents like electrolytes can be irreversibly altered and rendered ineffective. When taking these considerations into account, the DioSense Non Membraned sensor can be an effective, cost efficient solution.

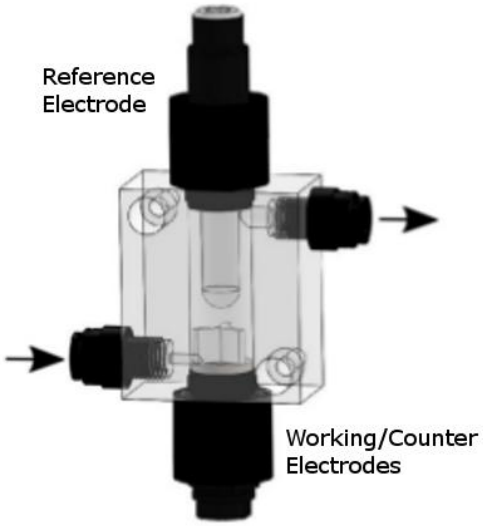

Fig.1 - Non membraned sensor, three electrode potentiostatic system in an acrylic flow cell.

The sensor and how it works

The DioSense NM sensor is a three electrode potentiostatic system comprising a gold working electrode, a stainless steel counter electrode, and a silver/silver chloride reference electrode.

The sensor uses amperometry to electrochemically monitor the concentration of chlorine dioxide. A constant potential is applied between the working and reference electrodes and the current that flows due to this is measured between the counter and working electrodes.

As the sample of chlorine dioxide dissolved in solution passes over the gold surface, the chlorine dioxide is reduced to chlorite;

$ClO_2 + 1e^{--} \rightarrow ClO_2^-$

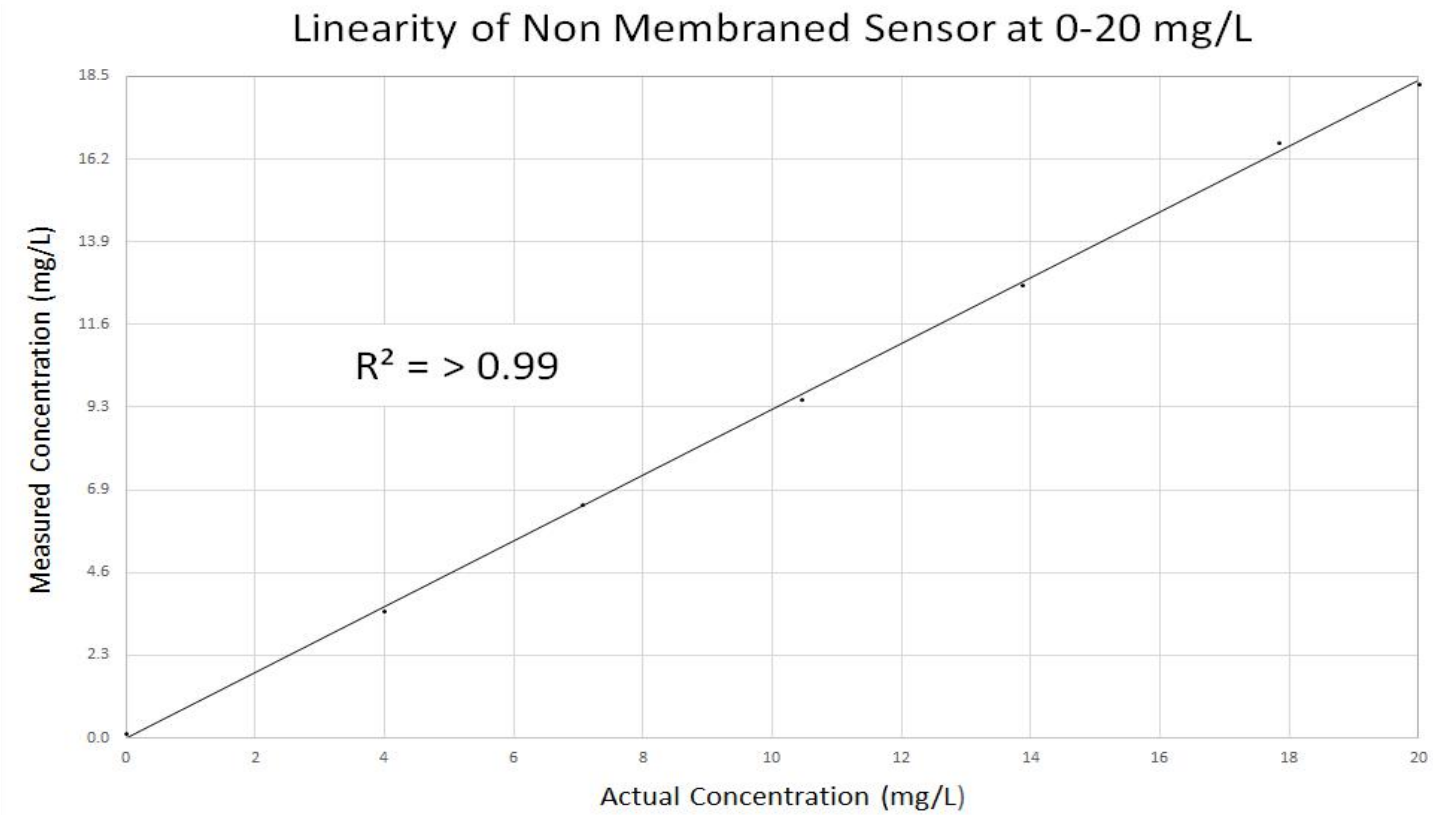

Fig.2 - A graph showing the linear relationship between the concentration measured by the non membraned sensor and the actual concentration.

generating a current that is proportional to the concentration of chlorine dioxide and therefore can be used to create an ongoing measurement.

Fig.3 - Flow regulator.

Environmental Factors

The current measured during this process can be altered by factors other than the chlorine dioxide concentration. The most significant of these are;

- **Temperature -** Higher temperatures result in higher currents and change the calibration slope. To account for this, the non membraned sensor is fitted with its own thermistor to measure temperature and a compensation calculation accounts for any variations.
- **Flow Rate -** An accurate reading is dependent on the flow rate remaining constant following calibration. To achieve this, a flow regulator is recommended to ensure a consistent flow rate that is unaffected by changes in pressure.

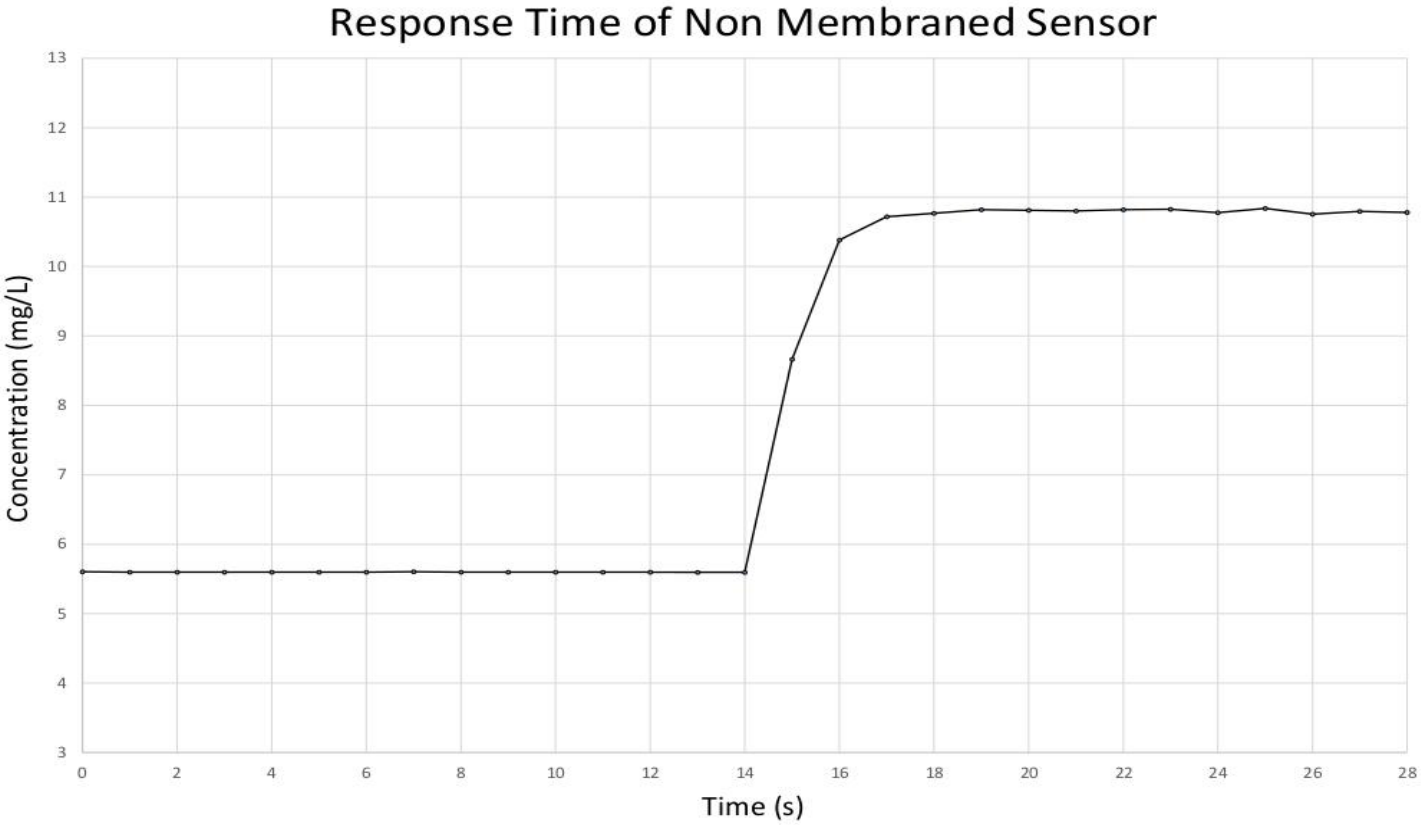

Fig.4 - A graph showing the response time of the non membraned sensor to changes in concentration

Advantages

- **Low Maintenance -** doesn't require electrolyte or other reagents to work.
- **The presence of a third electrode** (the counter electrode) stops current being passed through, and altering the potential of, the reference electrode.
- **Operates at high temperature and pressure (70°C and 6 Bar).**
- **Quick response time (T_{90} < 2 seconds).**

Fig.5 - Gold working electrode.

Disadvantages

- **Sensitive to interferents.**
- **Restricted to cable length (2m).**
- **Sensitive to changes in flow (can be overcome using a flow regulator, see Fig.3).**

Conclusion

For more information or to find out if the DioSense Non Membraned sensor is the right choice for your application, check out our DioSense Selection Guide or contact us to speak to one of our salespeople now.