Application Note

easySense Line

Dechlorination in Pure Water Treatment

Chlorine (or another oxidizing agent) is used for the required disinfection of filters and piping, as well as the water itself, in the pretreatment stages of pure water systems. However, chlorine is very harmful to expensive reverse osmosis membranes and deionization resins in subsequent treatment stages. A reducing chemical such as bisulfite is added which reduces the chlorine to harmless chloride ion. Measurements must be made to assure that all chlorine has been removed. An on-line measurement can give continuous monitoring of these conditions and provide rapid alarm of an upset before membranes or resins are damaged.

ORP Significance

The correlation between the concentration of chlorine or other oxidizing or reducing material and ORP varies but is usually consistent for a given installation. ORP is logarithmically related to concentration, however, the variables of pH, temperature, minerals and other oxidizing or reducing materials in the water can cause ORP response to shift significantly. For this reason there is no reliable conversion from ORP in millivolts to concentration in parts per million or billion.

In moving from an oxidizing to a reducing condition with extremely small (parts per billion) concentration changes, the ORP typically drops several hundred millivolts. It is very sensitive in detecting the change and is therefore quite useful as a go/no-go alarm parameter. In alarm applications, the exact setpoint value is usually not critical. However, where ORP is used to control reagent feed, more precision is needed

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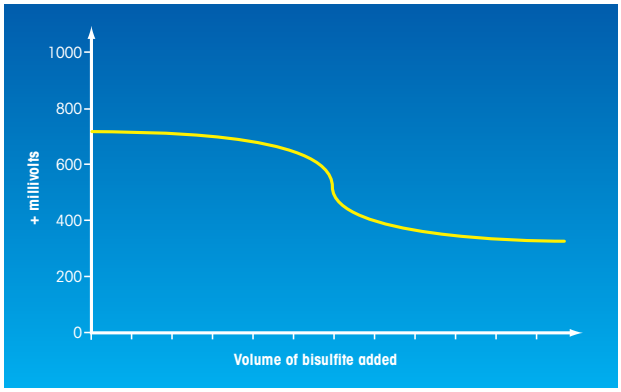
in establishing the control point. A titration curve illustrates ORP response and the considerations in establishing a setpoint.

Dechlorination curve

An ORP titration curve of dechlorination shows the type of response that would be expected for treatment of an off-line grab sample. Chlorinated water in this example gives an ORP of over 700 mV on the left. As small amounts of reducing bisulfite solution are added, the ORP drops in a nonlinear fashion. As the chlorine is all reacted and an excess of bisulfite accumulates, the response reaches a plateau near 350 mV to the right. It is important to establish the setpoint somewhat above the plateau to prevent wasting bisulfite or causing false alarms. The sensitivity of this measurement is apparent from the steep portion of the curve which is the transition from oxidizing to reducing conditions. Continuous processes are controlled to operate near a single point on such a curve.



NOTE: This is only an example titration curve. The curve for a specific installation may be shifted significantly from these millivolt values but the basic shape will be similar for the dechlorination reaction. On-line experience is necessary at startup to establish the particular millivolt operating range and setpoint for an application

The best practice to determine a setpoint for control is to use a colorimetric or other sensitive test for chlorine or bisulfite concentration as a reference. The ORP existing at the time the desired concentration is reached is an appropriate setpoint value. Test kits for these materials are readily available.

ORP Instrumentation

ORP sensors and instrumentation are very similar to pH but the measuring electrode is platinum instead of a glass membrane. The inert metal electrode picks up the ORP millivolt signal – the solution's tendency to add or remove electrons from its surface. The reference electrode completes the circuit and adds in its own (nearly constant) potential. The measuring and reference electrode functions are built into a single convenient probe that mounts into the process piping with an insertion or flow housing.

Instrument solution

The METTLER TOLEDO easy Line™ of instrumentation is designed for especially simple implementation in pretreatment processes such as dechlorination. The easySense ORP 41 electrode contains its own measuring circuit that delivers a reliable digital signal through its detachable cable to the M200 easy measuring instrument. The M200 easy automatically configures itself for ORP measurement on that channel based on the digital signal from the sensor.

The M200 easy is a multiparameter transmitter with one- and two-channel models that accept input from pH, conductivity and dissolved oxygen sensors as well as ORP. easySense self-recognition greatly simplifies installation and startup and allows all transmitters in a system to be identical. The sensors determine the difference. The factory calibration stored in memory is immediately used when the sensor is plugged in.

The easySense ORP 41 electrode fits into a variety of flow and insertion housings including the easyFit 21 or easyFlow 21 to meet specific installation requirements.

Because the easy Line offers multiparameter measurements, it integrates fully into treatment systems needing to monitor changing incoming water quality, adjust pH, monitor reverse osmosis and deionization performance and assure final water purity.

For more information:

www.mt.com/pro-easyline

Brochure 52 121 503 and data sheet 52 121 499

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