



Redox and Wastewater

WaterWatch² Products

APPLICATION INFORMATION

PARTECH PRODUCTS

MONITOR
7300w² Monitor

SENSORS
WaterTechw² Redox8000
WaterTechw² PHEVT – Combined pH,
Redox and Temperature

INSTALLATION OPTIONS
Flowcell and Dip

What is Redox?

The terms oxidation and reduction refers to the gain or loss of oxygen or hydrogen or electrons. There is always a transfer of electrons in reactions involving oxidation and reduction, that is, the oxidation state of one or more of the elements is always changed.

The term Redox or Oxidation-Reduction Potential (ORP) describes a chemical reaction involving oxidation and reduction, the two processes always occur together because an oxidising agent is always reduced during oxidation and a reducing agent is always oxidised during reduction.

Redox Potential is a measure of the power of a substance to gain electrons in solution. A strong reducing agent which readily loses electrons (which it can give to another substance), will have a high negative redox potential. A strong oxidising agent will have a high positive redox potential. (Redox potential is the same as electrode potential)

Wastewater Applications

As Redox is a measurement of levels of reduction and oxidation processes within a solution or liquor it's use to determine the efficiency of the biological removal of ammonia and nitrate in the Activated Sludge Plants (ASP) would appear obvious. Monitoring Redox allows an operator to determine whether biological reactions are occurring and whether any processes changes are required to improve the efficiency of those reactions.

Nitrification and De-nitrification

Discharge limits mean that nitrification and de-nitrification processes are required to remove ammonia, nitrate and to break down pollutants in the wastewater. The nitrification process is performed by nitrifying bacteria when the Redox value is in the region of +100 to +350mV. In this condition the process is turning ammonia (NH₃) into nitrate (NO³⁻).

The de-nitrification process reduces the nitrate (NO³⁻) to nitrogen (N₂), the de-nitrifying bacteria require the wastewater to have a redox potential in the range -50 to +50 mV.

Biological Phosphorus Removal

Nutrient removal is a key process area in wastewater treatment, with ever lowering discharge consents. Whilst many chemical processes have been implemented to aid the removal of Phosphorus the biological process still has a part to play. The biological process requires a phase where volatile fatty acids in an anaerobic tank (Redox: -100 to -225mV) cause the phosphorus to be released into solution. This is followed by a phase where this soluble phosphorus is converted into a solid condition which can be removed by sedimentation, this requires aerobic conditions (Redox: +25 to +250 mV).

What does the mV Scale Mean?

Redox electrodes and hence the monitors and controllers associated with them provide an output that varies from -2000 to +2000 mV, in practice the measurement span is more like +/- 500 mV. An increasing -ve reading indicates the presence of a reducing agent such as BOD or COD, whereas an increasing +ve value indicates the presence of an oxidising agent such as Oxygen.

Summary

The use of Redox or ORP as a control parameter in wastewater treatment has the potential to reduce costs and to enhance the quality of the treated water and the sludge produced. This measurement has yet to be fully exploited, please contact our engineers for further guidance on how to install and operate our products.

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