Activated Sludge Plant Control

Application & Product Data
Typical Treatment Plant

- Dissolved Oxygen (DO)
- pH
- Redox (ORP)
- Suspended Solids (MLSS)
- Returned Activated Sludge
- Surplus Activated Sludge
Activated sludge is a biochemical process for treating sewage and industrial wastewater that uses air (or oxygen) and microorganisms to biologically oxidize organic pollutants, producing a waste sludge (or floc) containing the oxidized material.

Atmospheric air or pure oxygen is bubbled through primary treated sewage (or industrial wastewater) and combined with organisms to develop a biological floc which reduces the organic content of the sewage.

The combination of raw sewage and biological mass is commonly known as Mixed Liquor.
• Anoxic & Aeration configuration is appropriate for Carbon and Nitrogen treatment. Aeration for Carbon only treatment.
• In all activated sludge plants, once the sewage (or industrial wastewater) has received sufficient treatment, excess mixed liquor is discharged into settling tanks and the treated supernatant is run off to undergo further treatment before discharge.
• Part of the settled material, the sludge (RAS), is returned to the head of the aeration system to re-seed the new sewage entering the tank.
• Mixed Liquor is a mixture of raw or settled wastewater and activated sludge within an aeration tank in the activated sludge process.
• Mixed Liquor Suspended Solids (MLSS) is the concentration of suspended solids in the mixed liquor, usually expressed in milligrams per litre (mg/l), often referred to as SS or TSS.
Aeration Process

Fine Bubble Aeration

Surface Aeration

Circular Surface Aerator
Packaged treatment plants have the same requirements for sensors.
Air is forced into the aeration basins, it increases the activity of the microorganisms and helps keep the organic waste thoroughly mixed.

Dissolved Oxygen is added to the aeration basin to enhance the oxidation process by providing oxygen to aerobic microorganisms so they can turn organic waste into inorganic byproducts.

Microorganisms must have at least 0.1 to 0.3 mg/l DO. Plants maintain the DO to 2 mg/l. If the DO is less than 2 mg/l the bugs in the centre of the floc may die as the bugs on the outside of the floc use up the DO first. If this happens the floc breaks up.

When the DO comes too high it waste energy. The aeration process takes between 30-60% of the total electrical power in a WwTW. Automated aeration process using DO according to the USEPA may reduce energy costs by 50%.

Also adds benefit of mixing, bring the bugs, oxygen and nutrient together. This keeps the floc suspended and prevents it from settling.

Why Measure Dissolved Oxygen?
Ensure Success – Pick your Location

Find
• Representative sample point of the process
• Well mixed sample
• Safe to reach sensors

Avoid
• Dead Zone
• Extreme Turbulence
• Area next to Aerator
• Hazardous access to sensor
• Reaching over handrails

Platform over aeration process
Inaccessible probes
Surface aeration
Where should the DO sensor go?
Oxidation Ditch

Aerator  Inlet  RAS  Aerator

Outlet

Not representative

Not fully mixed

Good Balance  False High

Here
# Why Measure Suspended Solids

<table>
<thead>
<tr>
<th>Mixed Liquor Suspended Solids</th>
<th>If MLSS is too high</th>
<th>If MLSS is too low</th>
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| Mixed Liquor is a mixture of raw or settled wastewater and activated sludge contained in an aeration basin. Standard control band 1,000 to 4,000 mg/l. membrane batch reactor CMBR control 6-8k | - The process is prone to bulking and treatment system becomes overloaded.  
- Causes DO content to drop off with the effect that organic matters are not fully degraded and biological ‘die off’.  
- Excessive aeration wastes electricity. | - The process will not operate efficiently and waste energy.  
- The biological active ‘bugs’ are being lost and the system may need expensive re-seeding. |
A proportion of the floc is called Return Activated Sludge (R.A.S.) and is used to re-seed the process.

Measuring the solids concentration of RAS allows the return volume to be adjusted to keep the solids level in the aeration basin within the control parameters.

Excess sludge which eventually accumulates beyond that returned is defined as Surplus or Waste Activated Sludge (SAS/WAS).

This is removed from the treatment process to keep the ratio of biomass to food supplied (sewage or wastewater) in balance.

Typical Range

- 4,000 to 6,000 mg/l
Measurement Options

**Laboratory Tests**
- Sample sent away
- Results not known until at least 24hrs after the event
- Sample degrades in transit

**Site Settling Jars/Handheld Meter**
- Very operator dependent
- Takes 30 minutes

**Portable Monitor**
- Calibration can be made to same standard as fixed installation systems
- Available when operator is on site, manual adjustment possible

**Fixed Installation Monitor**
- 24/7 Monitoring
- Automated control possible
Benefits of Online Monitoring

Pro’s

• Continuous In-Line Monitoring reduces the need for time-consuming laboratory analysis
• Removes operator dependency from the measurement
• Real-time monitoring provides more accurate process control
• Improves plant efficiency by providing stability and continuity to the treatment process

Conn’s

• Capital costs
• Whole life costs
Products
Partech’s Portable Products

Portable Suspended Solids
740 Monitor with Soli-Tech 10 Sensor

Portable Dissolved Oxygen
Handy Polaris
The Soli-Tech 10 Sensor uses
- Infrared Light Attenuation
- Wavelength = 880 nm

The sensor has two ranges that are automatically selected by the 740 Monitor
- Wide application range
  - from 20-100 to 0-20,000 mg/l
- User selectable units
  - Can measure in FTU, mg/l g/l, ppm, %SS or your own defined units
- Multiple site setups
  - Uses pre-set profiles to suit application
  - Up to 10 different setups on one system

Supplementary Features
- Rechargeable battery
- Carry Bag included
- Protective Case includes hand strap for security
- Language Options
  - Currently Italian
  - French planned
• Galvanic Sensor
  – Self Polarising and Temperature Compensated
• No warm up time, short response time
  – 90% of end value in less than 20 seconds
• Automatic Calibration and self check
• 1400 hours from one 9V alkaline battery
  – Approximately 2 years with 1 hour use per day
• Large easy to read graphical LCD display
7300w² Monitor/Controller

Multiple Sensors
- 1 or 2 into the base unit
- Upto 8 using expansion boxes
- Any w² sensor is compatible with the monitor

Graphic Display with trending
- Easy to configure
- Multiple language ability

Flexible control and monitoring options
- Profibus output – anticipated late 2011
- Triple Validation option
- Dosing control and datalogging available on request
Sensors – Dissolved Oxygen

OxyTech² RDO-X
- Dissolved Oxygen & Temperature Sensor
- Optical Luminescent Technology
- Applications
  - Activated Sludge Control
  - Fast Response, Long Cap Life, Abrasion Resistant

OxyTech² GAL
- Dissolved Oxygen
- Galvanic principle.
- Applications.
  - Activated Sludge Control
  - Exceptional resistance to damage. Long term stability of 3 years without need for sensor replacement or membrane replacement

Fast response – Minimal Maintenance
Sensors – Suspended Solids

TurbiTech² LA

- Light Attenuation Principle.
- 860nm Wavelength
- Designed for use in the Aeration system of an activated sludge plant.
- Sensor can also measure Returned Activated Sludge (R.A.S), Surplus Activated Sludge (S.A.S)

TurbiTech² LA

- Large optical surface & sample volume ensures tolerant of fouling.
- Deposits of fats and grease on the sensor area do not prevent the sensors from measuring unlike smaller optical surfaces.
- Self Cleaning mechanism. Initiated by monitor at user determined frequency.
- Cleaning process only takes 90 seconds
Fit for Purpose!

LA Light Attenuation optics

The cleaning action is thorough & effective

Designed for the application

DO Cleaning – no compressor, no wipers
Correct application of instrumentation to control ASP will:

- Lower blower usage – reduce energy
- Reduce wear on plant - Less maintenance.
- Improve response to process changes
- Remove operator error from process adjustment
What Good ASP Measurement can Achieve!

Done well
- Reduce energy usage
- Increase plant life
  - Blowers and Aerators working less
- Better Effluent Quality
- Improved Sludge Control
- Warning of process problems

Done Poorly
- Poor Effluent Quality
- Drain on ICA resources
  - Repairs
  - Calibration
- Wasted Energy
  - Over Aeration
- Bulking of Sludge
- False alarms
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