Oxygen Requirement of an Activated Sludge Process

Oxygen needed in an activated sludge aeration tank from flow, BOD removed, the BOD_5/BOD_u ratio and biomass wasted, plus oxygen for nitrification.

Method: $O_2 = Q(S_0 - S)/f - 1.42\ P_x + 4.57\ Q\ \Delta N$ (Metcalf & Eddy, Wastewater Engineering)

Input parameters

Unit system: SI

Parameter	Value	Unit
Wastewater flow	2,000.0	m^3/d
Influent BOD_5	300.00	mg/L
Effluent soluble BOD_5	10.000	mg/L
BOD_5/BOD_u ratio	68.000	%
Biomass wasted (as VSS)	180.00	kg/d
Ammonia nitrogen nitrified (0 if none)	0	mg/L

Calculated results

Parameter	Value	Unit
Oxygen required	597.34	kg/d
Air at 23.2 % O_2 by mass, 1.2 kg/m^3, if all oxygen transferred	89.401	m^3/h

Notes for this case

- Divide the air by the diffuser's field transfer efficiency for the real blower flow.

Formula and method

$$\dot{m}_{O_2} = \frac{Q(S_0 - S)}{f} - 1.42 P_x + 4.57\, Q\, \Delta N$$

Variables

Q	Wastewater flow	m^3/s
S_0	Influent BOD_5	kg/m^3
S	Effluent soluble BOD_5	kg/m^3
f	BOD_5/BOD_u ratio	-
P_x	Biomass wasted (as VSS)	kg/s
ΔN	Ammonia nitrogen nitrified (0 if none)	kg/m^3
$\dot{m}_{O_2}$	Oxygen required	kg/s
$\dot{V}_a$	Air at 23.2 % O_2 by mass, 1.2 kg/m^3, if all oxygen transferred	m^3/s

Method and standards

Oxygen balance.

Assumptions and limits

- Steady state.
- A negative oxygen balance (biomass wasted too large for the BOD removed) is shown as zero and flagged as inconsistent inputs.

References

- $O_2 = Q(S_0 - S)/f - 1.42\ P_x + 4.57\ Q\ \Delta N$ (Metcalf & Eddy, Wastewater Engineering)

Report details

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Release checks	2 reference cases of this calculator, computed independently, are checked on every release

Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

This calculator online

https://calc.firecad.com/environmental/wastewater/aeration-oxygen-demand

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.