Biological Sludge Production from Yield and Decay

Biomass produced in an activated sludge process from flow, BOD removed, yield coefficient, decay coefficient and sludge age, as volatile and total solids.

Method: P_x = Y Q (S₀ − S)/(1 + k_d θ_c) (Metcalf & Eddy)

Input parameters

Unit system: SI

Parameter	Value	Unit
Wastewater flow	2,000.0	m³/d
Influent BOD_5	300.00	mg/L
Effluent soluble BOD_5	10.000	mg/L
Yield (kg VSS per kg BOD_5) Your design value; often 0.4–0.8.	0.60000	
Endogenous decay coefficient	0.060000	1/d
Sludge age (SRT)	10.000	d
Volatile share of the solids	80.000	%

Calculated results

Parameter	Value	Unit
Observed yield	0.37500	
Biomass produced (VSS)	217.50	kg/d
Total solids produced	271.87	kg/d

Notes for this case

• Add inert influent solids to the total for the sludge handling load. Y is per kg BOD_5 removed; no cell-debris term is included, so P_x is lower than a full Metcalf & Eddy VSS production that adds f_d k_d X θ_c debris.

Formula and method

$$Y_{obs} = \frac{Y}{1 + k_d \theta_c}, \quad P_x = Y_{obs}\, Q (S_0 - S)$$

Variables

Q	Wastewater flow	m³/s
S_0	Influent BOD_5	kg/m³
S	Effluent soluble BOD_5	kg/m³
Y	Yield (kg VSS per kg BOD_5)	-
k_d	Endogenous decay coefficient	1/s
θ_c	Sludge age (SRT)	s
VSS/TSS	Volatile share of the solids	-
Y_{obs}	Observed yield	-
P_x	Biomass produced (VSS)	kg/s
P_{TSS}	Total solids produced	kg/s

Method and standards

Biomass balance.

Assumptions and limits

- Steady state, complete mix.
- The yield Y is on a BOD_5 basis (kg VSS per kg BOD_5 removed); yields quoted per kg bCOD are lower and must not be mixed in.

- Active biomass only: the cell-debris (endogenous residue) term and inert influent VSS are not included, so P_x is lower than a full Metcalf & Eddy VSS production.
- If the effluent BOD exceeds the influent, the removal is taken as zero and the page warns.

References

- P_x = Y Q (S_o − S)/(1 + k_d θ_c) (Metcalf & Eddy)

Report details

Report reference	FCC-NVQT-V9E0 (the same inputs always give the same reference)
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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/sludge-production-yield

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.