Denitrification: Methanol Dose and Sludge (McCarty)

Methanol needed to denitrify nitrate and nitrite and to remove dissolved oxygen, with the biomass produced and alkalinity recovered, by McCarty's equations.

Method: McCarty; Beck and St. Amant (1969); ...

Input parameters

Unit system: SI

Parameter	Value	Unit
Flow	10,000	m³/d
Nitrate nitrogen removed	20.000	mg/L
Nitrite nitrogen removed	1.0000	mg/L
Dissolved oxygen entering	2.0000	mg/L

Calculated results

Parameter	Value	Unit
Methanol concentration needed	52.670	mg/L
Methanol dose	526.70	kg/d
Methanol volume (0.791 kg/L)	27.744	L/h
Biomass produced	11.300	mg/L
Alkalinity recovered (as $CaCO_3$)	74.970	mg/L

Notes for this case

- McCarty's coefficients include cell synthesis; dose 10–20 % above the stoichiometric value in practice and control it on outlet nitrate.

Formula and method

$$C_m = 2.47\,NO_3-N + 1.53\,NO_2-N + 0.87\,DO, \quad C_b = 0.53\,NO_3-N + 0.32\,NO_2-N + 0.19\,DO$$

$$\dot{m} = C_m Q, \quad \dot{V} = \frac{\dot{m}}{791\ \mathrm{kg/m^3}}, \quad Alk = 3.57\,(NO_3-N + NO_2-N)$$

Variables

Q	Flow	m³/s
NO_3-N	Nitrate nitrogen removed	kg/m³
NO_2-N	Nitrite nitrogen removed	kg/m³
DO	Dissolved oxygen entering	kg/m³
C_m	Methanol concentration needed	kg/m³
$\dot{m}_{CH_3OH}$	Methanol dose	kg/s
$\dot{V}$	Methanol volume (0.791 kg/L)	m³/s
C_b	Biomass produced	kg/m³
Alk	Alkalinity recovered (as $CaCO_3$)	kg/m³

Method and standards

McCarty's equations.

Assumptions and limits

- Methanol as the carbon source; methanol density 0.791 kg/L.
- Alkalinity recovered at 3.57 g as $CaCO_3$ per g of nitrate or nitrite nitrogen reduced (the denitrification stoichiometry given in Metcalf & Eddy).

References

- McCarty
- Beck and St. Amant (1969)
- Proc. 24th Industrial Waste Conf.
- Purdue; Metcalf & Eddy
- Wastewater Engineering: Treatment and Resource Recovery
- 5th ed. (McGraw-Hill, 2014)
- ch. 7

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/denitrification-methanol-dose

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.