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Important Formulas of Oxygen Requirement of the Aeration Tank

Calculators!

Examples!

Conversions!

List of 19 Important Formulas of Oxygen Requirement of the Aeration Tank

Important Formulas of Oxygen Requirement of the Aeration Tank

1) BOD5 given Oxygen Required in Aeration Tank

Open Calculator

fx $$BOD_{5a} = BOD^{u} \cdot \frac{Q_s \cdot (Q_i - Q)}{O_2 + \left(1.42 \cdot Q_w \cdot X^R\right)}$$

ex $$13.55501\text{mg/L} = 2\text{mg/L} \cdot \frac{10\text{m}^3\text{/s} \cdot (13.2\text{mg/L} - 0.4\text{mg/L})}{2.5\text{mg/d} + (1.42 \cdot 9.5\text{m}^3\text{/s} \cdot 1.4\text{mg/L})}$$

2) BOD5 given Ratio of BOD to Ultimate BOD

Open Calculator

fx $$BOD_{5r} = f \cdot BOD^{u}$$

ex $$6\text{mg/L} = 3.0 \cdot 2\text{mg/L}$$

3) BOD5 when Ratio of BOD to Ultimate BOD is 0.68

Open Calculator

fx $$BOD5 = BOD^{u} \cdot 0.68$$

ex $$1.36\text{mg/L} = 2\text{mg/L} \cdot 0.68$$

4) Correction Factor

Open Calculator

fx $$C_f = \frac{N}{\frac{N^s \cdot D \cdot (1.024)^{T-20}}{9.17}}$$

ex $$0.439494 = \frac{3\text{kg/h/kW}}{\frac{2.03\text{kg/h/kW} \cdot 6600\text{mg/L} \cdot (1.024)^{85\text{K}-20}}{9.17}}$$

5) Correction Factor given Oxygen Transfer Capacity

Open Calculator

fx $$C_f = \frac{N}{\frac{N^s \cdot (D^S - D^L) \cdot (1.024)^{T-20}}{9.17}}$$

ex $$0.500029 = \frac{3\text{kg/h/kW}}{\frac{2.03\text{kg/h/kW} \cdot (5803\text{mg/L} - 2.01\text{mg/L}) \cdot (1.024)^{85\text{K}-20}}{9.17}}$$

6) Dissolved Oxygen Saturation for Sewage

Open Calculator

fx $$D^S = \left(\frac{N \cdot 9.17}{N^s \cdot C_f \cdot (1.024)^{T-20}} \right) + D^L$$

ex $$5803.337\text{mg/L} = \left(\frac{3\text{kg/h/kW} \cdot 9.17}{2.03\text{kg/h/kW} \cdot 0.5 \cdot (1.024)^{85\text{K}-20}} \right) + 2.01\text{mg/L}$$

7) Effluent BOD given Ultimate BOD

Open Calculator

fx $$Q_{ub} = Q_i - \left(\frac{\left(\frac{BOD5}{BOD^u} \right) \cdot (O_2 + (1.42 \cdot Q_w \cdot X^R))}{SF} \right)$$

ex $$12.34383\text{mg/L} = 13.2\text{mg/L} - \left(\frac{\left(\frac{1.36\text{mg/L}}{2\text{mg/L}} \right) \cdot (2.5\text{mg/d} + (1.42 \cdot 9.5\text{m}^3\text{/s} \cdot 1.4\text{mg/L}))}{15\text{m}^3\text{/s}} \right)$$

8) Influent BOD given Ultimate BOD

Open Calculator

fx $$Q_i = Q_{ub} + \left(\frac{\left(\frac{BOD5}{BOD^u}\right) \cdot \left(O_2 + \left(1.42 \cdot Q_w \cdot X^R\right)\right)}{Q_s} \right)$$

ex $$13.19425\text{mg/L} = 11.91\text{mg/L} + \left(\frac{\left(\frac{1.36\text{mg/L}}{2\text{mg/L}}\right) \cdot \left(2.5\text{mg/d} + \left(1.42 \cdot 9.5\text{m}^3\text{/s} \cdot 1.4\text{mg/L}\right)\right)}{10\text{m}^3\text{/s}} \right)$$

9) MLSS Returned given Oxygen Required in Aeration Tank

Open Calculator

fx $$X^R = \frac{\left(\frac{Q_s \cdot (Q_i - Q_o)}{f}\right) - O_2}{1.42 \cdot Q_w}$$

ex $$0.929083\text{mg/L} = \frac{\left(\frac{10\text{m}^3\text{/s} \cdot (13.2\text{mg/L} - 9.44\text{mg/L})}{3.0}\right) - 2.5\text{mg/d}}{1.42 \cdot 9.5\text{m}^3\text{/s}}$$

10) Operation Dissolved Oxygen Level

Open Calculator

fx $$D^L = D^S - \left(\frac{N \cdot 9.17}{N^s \cdot C_f \cdot (1.024)^{T-20}} \right)$$

ex $$1.672723\text{mg/L} = 5803\text{mg/L} - \left(\frac{3\text{kg/h/kW} \cdot 9.17}{2.03\text{kg/h/kW} \cdot 0.5 \cdot (1.024)^{85\text{K}-20}} \right)$$

11) Oxygen Required in Aeration Tank

Open Calculator

fx $$O_a = \left(\frac{Q_s \cdot (Q_i - Q)}{f} \right) - \left(1.42 \cdot Q_w \cdot X^R\right)$$

ex $$0.023781\text{mg/d} = \left(\frac{10\text{m}^3\text{/s} \cdot (13.2\text{mg/L} - 0.4\text{mg/L})}{3.0} \right) - \left(1.42 \cdot 9.5\text{m}^3\text{/s} \cdot 1.4\text{mg/L}\right)$$

12) Oxygen Required in Aeration Tank given Oxygen Demand and Ultimate BOD

Open Calculator

fx $$O_r = \left(\frac{Q_s \cdot (Q_i - Q)}{\frac{BOD5}{BOD^u}} \right) - (D^{O2} \cdot Q_w \cdot X^R)$$

ex $$0.161369\text{mg/d} = \left(\frac{10\text{m}^3\text{/s} \cdot (13.2\text{mg/L} - 0.4\text{mg/L})}{\frac{1.36\text{mg/L}}{2\text{mg/L}}} \right) - (2.02 \cdot 9.5\text{m}^3\text{/s} \cdot 1.4\text{mg/L})$$

13) Oxygen Transfer Capacity under Standard Conditions

Open Calculator

fx $$N^s = \frac{N}{\frac{(D^S - D^L) \cdot C_f \cdot (1.024)^{T-20}}{9.17}}$$

ex $$2.030118\text{kg/h/kW} = \frac{3\text{kg/h/kW}}{\frac{(5803\text{mg/L} - 2.01\text{mg/L}) \cdot 0.5 \cdot (1.024)^{85\text{K}-20}}{9.17}}$$

14) Oxygen Transferred under Field Conditions

Open Calculator

fx $$N = \frac{N^s \cdot (D^S - D^L) \cdot C_f \cdot (1.024)^{T-20}}{9.17}$$

ex $$2.999826\text{kg/h/kW} = \frac{2.03\text{kg/h/kW} \cdot (5803\text{mg/L} - 2.01\text{mg/L}) \cdot 0.5 \cdot (1.024)^{85\text{K}-20}}{9.17}$$

15) Ratio of BOD to Ultimate BOD

Open Calculator

fx $$f = \frac{BOD_5}{BOD^u}$$

ex $$3 = \frac{6\text{mg/L}}{2\text{mg/L}}$$

16) Sewage Discharge given Oxygen Required in Aeration Tank

Open Calculator

fx $$Q_{oxy} = \left(\frac{f \cdot (O_2 + (1.42 \cdot Q_w \cdot X^R))}{Q_i - Q} \right)$$

ex $$4.426406\text{m}^3/\text{s} = \left(\frac{3.0 \cdot (2.5\text{mg/d} + (1.42 \cdot 9.5\text{m}^3/\text{s} \cdot 1.4\text{mg/L}))}{13.2\text{mg/L} - 0.4\text{mg/L}} \right)$$

17) Ultimate Biochemical Oxygen Demand

Open Calculator

fx $$BOD^u = \frac{BOD5}{0.68}$$

ex $$2\text{mg/L} = \frac{1.36\text{mg/L}}{0.68}$$

18) Ultimate BOD given Ratio of BOD to Ultimate BOD

Open Calculator

fx $$BOD_u = \frac{BOD5}{f}$$

ex $$0.453333\text{mg/L} = \frac{1.36\text{mg/L}}{3.0}$$

19) Volume of Wasted Sludge Per Day given Oxygen Required in Aeration Tank

Open Calculator

fx $$Q_{w'} = \frac{\left(\frac{Q_s \cdot (Q_i - Q)}{f} \right) - O_2}{1.42 \cdot X}$$

ex $$0.025039\text{m}^3/\text{s} = \frac{\left(\frac{10\text{m}^3/\text{s} \cdot (13.2\text{mg/L} - 0.4\text{mg/L})}{3.0} \right) - 2.5\text{mg/d}}{1.42 \cdot 1200\text{mg/L}}$$

Variables Used

- **BOD_5** BOD of 5 days at 20° C *(Milligram per Liter)*
- **BOD_{5a}** BOD5 given Oxygen Required in Aeration Tank *(Milligram per Liter)*
- **BOD_{5r}** BOD5 given Ratio of BOD to Ultimate BOD *(Milligram per Liter)*
- **BOD_u** Ultimate BOD given Ratio of BOD to Ultimate BOD *(Milligram per Liter)*
- **BOD^u** Ultimate BOD *(Milligram per Liter)*
- **BOD5** 5 Days BOD *(Milligram per Liter)*
- **C_f** Correction Factor
- **D** Difference between Saturation DO and Operation DO *(Milligram per Liter)*
- **D^L** Operation Dissolved Oxygen *(Milligram per Liter)*
- **D^{O2}** Oxygen Demand of Biomass
- **D^S** Dissolved Oxygen Saturation *(Milligram per Liter)*
- **f** Ratio of BOD to Ultimate BOD
- **N** Oxygen Transferred *(Kilogram per Hour per Kilowatt)*
- **N^s** Oxygen Transfer Capacity *(Kilogram per Hour per Kilowatt)*
- **O_2** Theoretical Oxygen Requirement *(Milligram per Day)*
- **O_a** Oxygen Required in Aeration Tank *(Milligram per Day)*
- **O_r** Oxygen Required *(Milligram per Day)*
- **Q** Effluent BOD *(Milligram per Liter)*
- **Q_i** Influent BOD *(Milligram per Liter)*
- **Q_o** Effluent BOD given Oxygen Required *(Milligram per Liter)*
- **Q_{oxy}** Sewage Discharge given Oxygen Required *(Cubic Meter per Second)*
- **Q_s** Sewage Discharge *(Cubic Meter per Second)*
- **Q_{ub}** Effluent BOD given Ultimate BOD *(Milligram per Liter)*
- **Q_w** Volume of Wasted Sludge per day *(Cubic Meter per Second)*
- **$Q_{w'}$** Volume of Wasted Sludge *(Cubic Meter per Second)*
- **SF** Sewage Flowrate *(Cubic Meter per Second)*
- **T** Temperature *(Kelvin)*

- **X** MLSS *(Milligram per Liter)*
- **X^R** MLSS in Returned or Wasted Sludge *(Milligram per Liter)*

Constants, Functions, Measurements used

- Measurement: **Temperature** in Kelvin (K)
  Temperature Unit Conversion
- Measurement: **Volumetric Flow Rate** in Cubic Meter per Second (m^3/s)
  Volumetric Flow Rate Unit Conversion
- Measurement: **Mass Flow Rate** in Milligram per Day (mg/d)
  Mass Flow Rate Unit Conversion
- Measurement: **Density** in Milligram per Liter (mg/L)
  Density Unit Conversion
- Measurement: **Specific Fuel Consumption** in Kilogram per Hour per Kilowatt (kg/h/kW)
  Specific Fuel Consumption Unit Conversion

Check other formula lists

- **Design of Continuous Flow Type of Sedimentation Tank Formulas**
- **Food to Microorganism Ratio or F to M Ratio Formulas**
- **Efficiency of High Rate Filters Formulas**

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