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Important Formulas of Sludge Age

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List of 14 Important Formulas of Sludge Age

Important Formulas of Sludge Age

1) Concentration of Solids in Returned Sludge given MLSS

Open Calculator

$$X_{Em} = \frac{X' \cdot V}{Q_w \cdot \theta_c}$$

$$0.002632\text{mg/L} = \frac{1200\text{mg/L} \cdot 9\text{m}^3}{9.5\text{m}^3/\text{s} \cdot 5\text{d}}$$

2) Endogenous Respiration Rate Constant given Mass of Wasted Activated Sludge

Open Calculator

$$K^e = \frac{(Y \cdot Q_s \cdot (Q_i - Q_o)) - M_{ws}}{X' \cdot V}$$

$$2.992\text{d}^{-1} = \frac{(0.50 \cdot 10\text{m}^3/\text{s} \cdot (11.2\text{mg/L} - 0.4\text{mg/L})) - 53626\text{mg}}{1200\text{mg/L} \cdot 9\text{m}^3}$$

3) Endogenous Respiration Rate Constant given Maximum Yield Coefficient

Open Calculator

$$K_e = (Y \cdot U) - \left(\frac{1}{\theta_c}\right)$$

$$21599.8\text{d}^{-1} = (0.50 \cdot 0.5\text{s}^{-1}) - \left(\frac{1}{5\text{d}}\right)$$

4) Mass of Solids in Reactor

Open Calculator

$$M_s = V_r \cdot X'$$

$$5000.4\text{mg} = 4.167\text{L} \cdot 1200\text{mg/L}$$

5) Mass of Suspended Solids in System

Open Calculator

fx $$M_{ss} = M^{'} \cdot \theta_c$$

ex $$20000\text{mg} = 0.004\text{kg/d} \cdot 5\text{d}$$

6) Mass of Wasted Activated Sludge

Open Calculator

fx $$M_{ws} = (Y \cdot Q_s \cdot (Q_i - Q_o)) - \left(K^e \cdot V \cdot X^{'}\right)$$

ex $$53626.25\text{mg} = (0.50 \cdot 10\text{m}^3\text{/s} \cdot (11.2\text{mg/L} - 0.4\text{mg/L})) - (2.99\text{d}^{-1} \cdot 9\text{m}^3 \cdot 1200\text{mg/L})$$

7) Maximum Yield Coefficient given Sludge Age

Open Calculator

fx $$Y = \frac{\left(\frac{1}{\theta_c}\right) + K^e}{U}$$

ex $$0.400069 = \frac{\left(\frac{1}{5\text{d}}\right) + 2.99\text{d}^{-1}}{0.5\text{s}^{-1}}$$

8) Mixed Liquor Suspended Solids given Sludge Age

Open Calculator

fx $$X^{'} = \frac{Q_w \cdot X_{Em} \cdot \theta_c}{V}$$

ex $$1185.6\text{mg/L} = \frac{9.5\text{m}^3\text{/s} \cdot 0.0026\text{mg/L} \cdot 5\text{d}}{9\text{m}^3}$$

9) MLSS given Sludge Age

Open Calculator

fx $$X_{sa} = \frac{\theta_c \cdot M_{sc}}{V}$$

ex $$91200\text{mg/L} = \frac{5\text{d} \cdot 1.9\text{mg/L}}{9\text{m}^3}$$

10) Sludge Age

Open Calculator

$$\theta_c = \frac{M_{ss}}{M'}$$

$$5\text{d} = \frac{20000\text{mg}}{0.004\text{kg/d}}$$

11) Sludge Age given Concentration of Solids

Open Calculator

$$\theta_{c'} = \frac{V \cdot X_{sa}}{\left(Q_w \cdot X^R\right) + \left(Q_{max} - Q_w\right) \cdot X^E}$$

$$0.437849\text{d} = \frac{9\text{m}^3 \cdot 91200\text{mg/L}}{\left(9.5\text{m}^3\text{/s} \cdot 0.526\text{mg/L}\right) + \left(11.17\text{m}^3\text{/s} - 9.5\text{m}^3\text{/s}\right) \cdot 10.0\text{mg/L}}$$

12) Sludge Age given MLSS

Open Calculator

$$\theta_{c''} = \frac{V \cdot X'}{Q_w \cdot X^R}$$

$$0.025015\text{d} = \frac{9\text{m}^3 \cdot 1200\text{mg/L}}{9.5\text{m}^3\text{/s} \cdot 0.526\text{mg/L}}$$

13) Sludge Age given Total Solids Removed

Open Calculator

$$\theta_{ct} = \frac{V \cdot X^E}{M'}$$

$$22.5\text{d} = \frac{9\text{m}^3 \cdot 10.0\text{mg/L}}{0.004\text{kg/d}}$$

14) Volume of Wasted Sludge Per Day

Open Calculator

fx $$Q_w = \frac{M_s}{X^R}$$

ex $$9.505703\text{m}^3/\text{s} = \frac{5000\text{mg}}{0.526\text{mg/L}}$$

Variables Used

- K_e Endogenous Respiration Constant *(1 Per Day)*
- K^e Endogenous Respiration Rate Constant *(1 Per Day)*
- M_s Mass of Solids *(Milligram)*
- M_{sc} Mass Concentration of Suspended Solids *(Milligram per Liter)*
- M_{ss} Mass of Suspended Solids *(Milligram)*
- M_{ws} Mass of Wasted Activated Sludge *(Milligram)*
- M' Mass of Solids Leaving the System *(Kilogram per Day)*
- Q_i Influent BOD *(Milligram per Liter)*
- Q_{max} Peak Sewage Flow *(Cubic Meter per Second)*
- Q_o Effluent BOD *(Milligram per Liter)*
- Q_s Sewage Discharge *(Cubic Meter per Second)*
- Q_w Volume of Wasted Sludge per day *(Cubic Meter per Second)*
- U Specific Substrate Utilization Rate *(1 Per Second)*
- V Volume of Tank *(Cubic Meter)*
- V_r Volume of Reactor Tank *(Liter)*
- X_{Em} Concentration of Solids given MLSS *(Milligram per Liter)*
- X_{sa} MLSS given Sludge Age *(Milligram per Liter)*
- X' Mixed Liquor Suspended Solids *(Milligram per Liter)*
- X^E Concentration of Solids in Effluent *(Milligram per Liter)*
- X^R Concentration of Solids in Returned Sludge *(Milligram per Liter)*
- Y Maximum Yield Coefficient
- θ_c Sludge Age *(Day)*
- $\theta_{c'}$ Sludge Age given Concentration of Solids *(Day)*
- $\theta_{c''}$ Sludge Age given MLSS *(Day)*

- θ_{ct} Sludge Age given Total Solids Removed *(Day)*

Constants, Functions, Measurements used

- Measurement: **Weight** in Milligram (mg)
  Weight Unit Conversion
- Measurement: **Time** in Day (d)
  Time Unit Conversion
- Measurement: **Volume** in Cubic Meter (m^3), Liter (L)
  Volume Unit Conversion
- Measurement: **Volumetric Flow Rate** in Cubic Meter per Second (m^3/s)
  Volumetric Flow Rate Unit Conversion
- Measurement: **Mass Flow Rate** in Kilogram per Day (kg/d)
  Mass Flow Rate Unit Conversion
- Measurement: **Mass Concentration** in Milligram per Liter (mg/L)
  Mass Concentration Unit Conversion
- Measurement: **Density** in Milligram per Liter (mg/L)
  Density Unit Conversion
- Measurement: **First Order Reaction Rate Constant** in 1 Per Day (d^{-1}), 1 Per Second (s^{-1})
  First Order Reaction Rate Constant Unit Conversion

Check other formula lists

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

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