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Sludge Recycle and Rate of Returned Sludge Formulas

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List of 12 Sludge Recycle and Rate of Returned Sludge Formulas

Sludge Recycle and Rate of Returned Sludge

Mixed Liquor Suspended Solid MLSS

1) MLSS given Sludge Recirculation Ratio

Open Calculator

fx $$X = \frac{\alpha \cdot X^{R}}{1 + \alpha}$$

ex $$1200\text{mg/L} = \frac{1.5 \cdot 2000\text{mg/L}}{1 + 1.5}$$

2) MLSS given Sludge Volume Index and Recirculation Ratio

Open Calculator

fx $$X' = \frac{1}{SVI \cdot (1 + \alpha)}$$

ex $$2.666667\text{mg/L} = \frac{1}{150\text{mL/g} \cdot (1 + 1.5)}$$

3) MLSS given SVI and Sewage Discharge

Open Calculator

fx $$X' = \frac{\left(\frac{Q_{r''}}{Q_{s'}}\right)\cdot\left(10^6\right)}{SVI} \Big/ 1+\left(\frac{Q_{r''}}{Q_{s'}}\right)$$

ex $$857.3387\text{mg/L} = \frac{\left(\frac{100\text{m}^3\text{/d}}{9000\text{m}^3\text{/s}}\right)\cdot\left(10^6\right)}{150\text{mL/g}} \Big/ 1+\left(\frac{100\text{m}^3\text{/d}}{9000\text{m}^3\text{/s}}\right)$$

Sewage Discharge

4) Sewage Discharge given MLSS and SVI

Open Calculator

fx $$Q_s = \frac{Q_{r'}}{X} \Big/ \left(\frac{10^6}{SVI_s}\right)-X$$

ex $$9.992278\text{m}^3\text{/s} = \frac{0.518\text{m}^3\text{/d}}{1200\text{mg/L}} \Big/ \left(\frac{10^6}{0.5\text{L/g}}\right)-1200\text{mg/L}$$

5) Sewage Discharge given Sludge Recirculation Ratio

Open Calculator

fx $$Q_s = \frac{Q_r}{\alpha}$$

ex $$10\text{m}^3\text{/s} = \frac{15\text{m}^3\text{/s}}{1.5}$$

Sludge Recirculation Ratio

6) Sludge Recirculation Rate given MLSS and SVI

Open Calculator

fx $$Q_{r'} = Q_s \cdot \left(\frac{X}{\left(\frac{10^6}{SVI_s} \right) - X} \right)$$

ex $$0.5184 m^3/d = 10 m^3/s \cdot \left(\frac{1200 mg/L}{\left(\frac{10^6}{0.5 L/g} \right) - 1200 mg/L} \right)$$

7) Sludge Recirculation Rate given Sludge Recirculation Ratio

Open Calculator

fx $$Qr' = \alpha \cdot C_s$$

ex $$15.552 m^3/d = 1.5 \cdot 0.12 mg/L$$

8) Sludge Recirculation Ratio

Open Calculator

fx $$\alpha = \frac{Q_r}{Q_s}$$

ex $$1.5 = \frac{15 m^3/s}{10 m^3/s}$$

9) Sludge Recirculation Ratio given Sludge Volume Index

Open Calculator

fx $$\alpha = \left(\frac{SSV}{X'}\right) \cdot 1000$$

ex $$1.505251 = \left(\frac{1.29 mg/L}{857 mg/L}\right) \cdot 1000$$

Sludge Volume Index

10) MLSS given Sludge Volume Index

Open Calculator

fx $$X = \frac{V_{ob} \cdot 1000}{SVI}$$

ex $$1204.667 mg/L = \frac{180.7 \cdot 1000}{150 mL/g}$$

11) Sludge Volume Index

Open Calculator

fx $$SVI = \left(V_{ob} \cdot \frac{1000}{X}\right)$$

ex $$150.5833 mL/g = \left(180.7 \cdot \frac{1000}{1200 mg/L}\right)$$

12) Sludge Volume Index given Sewage Discharge and MLSS

Open Calculator

fx $$\mathrm{SVI_s} = \frac{\left(\frac{\mathrm{Q_r}}{\mathrm{Q_s}}\right)}{\left(\frac{\mathrm{Q_r}}{\mathrm{Q_s}}\right) \cdot \mathrm{X} + \mathrm{X}}$$

ex $$0.5\mathrm{L/g} = \frac{\left(\frac{15\mathrm{m^3/s}}{10\mathrm{m^3/s}}\right)}{\left(\frac{15\mathrm{m^3/s}}{10\mathrm{m^3/s}}\right) \cdot 1200\mathrm{mg/L} + 1200\mathrm{mg/L}}$$

Variables Used

- C_s Sewage Concentration *(Milligram per Liter)*
- Q_r Recirculation Flow *(Cubic Meter per Second)*
- $Q_{r'}$ Sludge Recirculation Rate given MLSS *(Cubic Meter per Day)*
- $Q_{r''}$ Recirculation Flow given MLSS *(Cubic Meter per Day)*
- Q_s Sewage Discharge *(Cubic Meter per Second)*
- **Qr'** Recirculation Flow given Recirculation Ratio *(Cubic Meter per Day)*
- **Qs'** Sewage Discharge given MLSS *(Cubic Meter per Second)*
- **SSV** Settled Sludge Volume *(Milligram per Liter)*
- **SVI** Sludge Volume Index *(Milliliter per Gram)*
- SVI_s Sludge Volume Index given Sewage Discharge *(Liter per Gram)*
- V_{ob} Sludge Volume
- **X** MLSS *(Milligram per Liter)*
- **X'** MLSS given Recirculation Ratio *(Milligram per Liter)*
- $X^{'}$ Mixed Liquor Suspended Solids *(Milligram per Liter)*
- X^R MLSS in Returned or Wasted Sludge *(Milligram per Liter)*
- **α** Recirculation Ratio

Constants, Functions, Measurements used

- Measurement: **Volumetric Flow Rate** in Cubic Meter per Day (m³/d), Cubic Meter per Second (m³/s)
  Volumetric Flow Rate Unit Conversion
- Measurement: **Density** in Milligram per Liter (mg/L)
  Density Unit Conversion
- Measurement: **Specific Volume** in Milliliter per Gram (mL/g), Liter per Gram (L/g)
  Specific Volume 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**
- **Sludge Recycle and Rate of Returned Sludge Formulas**

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