Important Disposing of the Sewage Effluents Formulas PDF

Formulas
Examples
with Units

List of 33
Important Disposing of the Sewage Effluents Formulas

1) Actual Dissolved Oxygen Formula

Evaluate Formula

Formula

$$A_{DO} = S_{DO} - D$$

Example with Units

$$4.8\,\text{mg/L} = 9\,\text{mg/L} - 4.2\,\text{mg/L}$$

2) Mixing Concentration Formula

Evaluate Formula

Formula

$$C = \frac{C_s \cdot Q_s + C_R \cdot Q_{stream}}{Q_s + Q_{stream}}$$

Example with Units

$$1.2 = \frac{0.2 \cdot 10\,\text{m}^3/\text{s} + 1.3 \cdot 100\,\text{m}^3/\text{s}}{10\,\text{m}^3/\text{s} + 100\,\text{m}^3/\text{s}}$$

3) River Stream Concentration Formula

Evaluate Formula

Formula

$$C_R = \frac{C \cdot \left(Q_s + Q_{stream}\right) - \left(C_s \cdot Q_s\right)}{Q_{stream}}$$

Example with Units

$$1.3 = \frac{1.2 \cdot \left(10\,\text{m}^3/\text{s} + 100\,\text{m}^3/\text{s}\right) - \left(0.2 \cdot 10\,\text{m}^3/\text{s}\right)}{100\,\text{m}^3/\text{s}}$$

4) River Stream Flow Rate Formula

Evaluate Formula

Formula

$$Q_{stream} = \frac{\left(C_s \cdot Q_s\right) - \left(C \cdot Q_s\right)}{C - C_R}$$

Example with Units

$$100\,\text{m}^3/\text{s} = \frac{\left(0.2 \cdot 10\,\text{m}^3/\text{s}\right) - \left(1.2 \cdot 10\,\text{m}^3/\text{s}\right)}{1.2 - 1.3}$$

5) Saturated Dissolved Oxygen Formula

Evaluate Formula

Formula

$$S_{DO} = D + A_{DO}$$

Example with Units

$$9\,\text{mg/L} = 4.2\,\text{mg/L} + 4.8\,\text{mg/L}$$

6) Sewage Concentration Formula

Evaluate Formula

Formula

$$C_s = \frac{C \cdot \left(Q_s + Q_{stream}\right) - \left(C_R \cdot Q_{stream}\right)}{Q_s}$$

Example with Units

$$0.2 = \frac{1.2 \cdot \left(10\,\text{m}^3/\text{s} + 100\,\text{m}^3/\text{s}\right) - \left(1.3 \cdot 100\,\text{m}^3/\text{s}\right)}{10\,\text{m}^3/\text{s}}$$

7) Sewage Flow Rate Formula

Evaluate Formula

Formula

$$Q_s = \frac{\left(C_R - C\right) \cdot Q_{stream}}{C - C_s}$$

Example with Units

$$10\,\text{m}^3/\text{s} = \frac{\left(1.3 - 1.2\right) \cdot 100\,\text{m}^3/\text{s}}{1.2 - 0.2}$$

8) Critical Oxygen Deficit Formulas

8.1) Critical Oxygen Deficit Formula

Evaluate Formula

Formula

$$D_c = K_D \cdot L_t \cdot \frac{10^{-K_D \cdot t_c}}{K_R}$$

Example with Units

$$0.0002 = 0.23\,\text{d}^{-1} \cdot 0.21\,\text{mg/L} \cdot \frac{10^{-0.23\,\text{d}^{-1} \cdot 0.5\,\text{d}}}{0.22\,\text{d}^{-1}}$$

8.2) Critical Oxygen Deficit given Self Purification Constant Formula

Evaluate Formula

Formula

$$D_c = L_t \cdot \frac{10^{-K_D \cdot t_c}}{f}$$

Example with Units

$$0.0002 = 0.21\,\text{mg/L} \cdot \frac{10^{-0.23\,\text{d}^{-1} \cdot 0.5\,\text{d}}}{0.9}$$

8.3) Critical Oxygen Deficit in First Stage Equation Formula

Evaluate Formula

Formula

$$D_c = \frac{\left(\frac{L_t}{f}\right)^f}{1 - (f - 1) \cdot D_o}$$

Example with Units

$$0.0005 = \frac{\left(\frac{0.21\,\text{mg/L}}{0.9}\right)^{0.9}}{1 - (0.9 - 1) \cdot 7.2\,\text{mg/L}}$$

9) Critical Time Formulas

9.1) Critical Time Formula

Evaluate Formula

Formula

$$t_c = \left(\frac{1}{K_R - K_D}\right) \cdot \log10\left(\left(\frac{K_D \cdot L_t - K_R \cdot D_o + K_D \cdot D_o}{K_D} \cdot L_t\right) \cdot \left(\frac{K_R}{K_D}\right)\right)$$

Example with Units

$$697.8548\,\text{d} = \left(\frac{1}{0.22\,\text{d}^{-1} - 0.23\,\text{d}^{-1}}\right) \cdot \log10\left(\left(\frac{0.23\,\text{d}^{-1} \cdot 0.21\,\text{mg/L} - 0.22\,\text{d}^{-1} \cdot 7.2\,\text{mg/L} + 0.23\,\text{d}^{-1} \cdot 7.2\,\text{mg/L}}{0.23\,\text{d}^{-1}} \cdot 0.21\,\text{mg/L}\right) \cdot \left(\frac{0.22\,\text{d}^{-1}}{0.23\,\text{d}^{-1}}\right)\right)$$

9.2) Critical Time given Self Purification Constant with Critical Oxygen Deficit Formula

Evaluate Formula

Formula

$$t_c = \log10 \frac{D_c \cdot \frac{f}{L_t}}{K_D}$$

Example with Units

$$0.4745\,\text{d} = \log10 \frac{0.0003 \cdot \frac{0.9}{0.21\,\text{mg/L}}}{0.23\,\text{d}^{-1}}$$

9.3) Critical Time given Self Purification Factor Formula

Evaluate Formula

Formula

$$t_c = -\left(\log10 \frac{1 - (f - 1) \cdot \left(\frac{D_c}{L_t}\right) \cdot f}{K_D \cdot (f - 1)}\right)$$

Example with Units

$$2.2839\,\text{d} = -\left(\log10 \frac{1 - (0.9 - 1) \cdot \left(\frac{0.0003}{0.21\,\text{mg/L}}\right) \cdot 0.9}{0.23\,\text{d}^{-1} \cdot (0.9 - 1)}\right)$$

9.4) Critical Time when we have Critical Oxygen Deficit Formula

Evaluate Formula

Formula

$$t_c = \log10 \frac{\frac{D_c \cdot K_R}{K_D \cdot L_t}}{K_D}$$

Example with Units

$$0.5896\,\text{d} = \log10 \frac{\frac{0.0003 \cdot 0.22\,\text{d}^{-1}}{0.23\,\text{d}^{-1} \cdot 0.21\,\text{mg/L}}}{0.23\,\text{d}^{-1}}$$

10) Deoxygenation Coefficient Formulas

10.1) Deoxygenation Coefficient given Self Purification Constant Formula

Evaluate Formula

Formula

$$K_D = \frac{K_R}{f}$$

Example with Units

$$0.2444\,\mathrm{d^{-1}} = \frac{0.22\,\mathrm{d^{-1}}}{0.9}$$

10.2) Deoxygenation Constant given Self Purification Constant with Critical Oxygen Deficit Formula

Evaluate Formula

Formula

$$K_D = \log 10 \frac{D_c \cdot \frac{f}{L_t}}{t_c}$$

Example with Units

$$0.2183\,\mathrm{d^{-1}} = \log 10 \frac{0.0003 \cdot \frac{0.9}{0.21\,\mathrm{mg/L}}}{0.5\,\mathrm{d}}$$

11) Oxygen Deficit Formulas

11.1) DO Deficit using Streeter-Phelps Equation Formula

Evaluate Formula

Formula

$$D = \left(K_D \cdot \frac{L}{K_R - K_D} \right) \cdot \left(10^{-K_D \cdot t} - 10^{-K_R \cdot t} + D_o \cdot 10^{-K_R \cdot t} \right)$$

Example with Units

$$5.3649\,\mathrm{mg/L} = \left(0.23\,\mathrm{d^{-1}} \cdot \frac{40\,\mathrm{mg/L}}{0.22\,\mathrm{d^{-1}} - 0.23\,\mathrm{d^{-1}}} \right) \cdot \left(10^{-0.23\,\mathrm{d^{-1}} \cdot 6\,\mathrm{d}} - 10^{-0.22\,\mathrm{d^{-1}} \cdot 6\,\mathrm{d}} + 7.2\,\mathrm{mg/L} \cdot 10^{-0.22\,\mathrm{d^{-1}} \cdot 6\,\mathrm{d}} \right)$$

11.2) Log value of Critical Oxygen Deficit Formula

Evaluate Formula

Formula

$$D_c = 10^{\log 10 \left(\frac{L_t}{f} \right) - \left(K_D \cdot t_c \right)}$$

Example with Units

$$0.0002 = 10^{\log 10 \left(\frac{0.21\,\mathrm{mg/L}}{0.9} \right) - \left(0.23\,\mathrm{d^{-1}} \cdot 0.5\,\mathrm{d} \right)}$$

11.3) Oxygen Deficit Formula

Evaluate Formula

Formula

$$D = S_{DO} - A_{DO}$$

Example with Units

$$4.2\,\mathrm{mg/L} = 9\,\mathrm{mg/L} - 4.8\,\mathrm{mg/L}$$

11.4) Oxygen Deficit given Critical Time in Self Purification Factor Formula

Evaluate Formula

Formula

$$D_c = \left(\frac{L_t}{f - 1} \right) \cdot \left(1 - \left(\frac{10^{t_c \cdot K_D \cdot (f - 1)}}{f} \right) \right)$$

Example with Units

$$0.0002 = \left(\frac{0.21\,\mathrm{mg/L}}{0.9 - 1} \right) \cdot \left(1 - \left(\frac{10^{0.5\,\mathrm{d} \cdot 0.23\,\mathrm{d^{-1}} \cdot (0.9 - 1)}}{0.9} \right) \right)$$

12) Oxygen Equivalent Formulas

12.1) Oxygen Equivalent given Critical Oxygen Deficit Formula

Evaluate Formula

Formula

$$L_t = D_c \cdot \frac{K_R}{K_D \cdot 10^{-K_D \cdot t_c}}$$

Example with Units

$$0.374\,\mathrm{mg/L} = 0.0003 \cdot \frac{0.22\,\mathrm{d^{-1}}}{0.23\,\mathrm{d^{-1}} \cdot 10^{-0.23\,\mathrm{d^{-1}} \cdot 0.5\,\mathrm{d}}}$$

12.2) Oxygen Equivalent given Critical Time in Self Purification Factor Formula

Evaluate Formula

Formula

$$L_t = D_c \cdot \frac{f - 1}{1 - \left(\frac{10^{t_c \cdot K_D \cdot (f - 1)}}{f} \right)}$$

Example with Units

$$0.3655\,\text{mg/L} = 0.0003 \cdot \frac{0.9 - 1}{1 - \left(\frac{10^{0.5\,\text{d} \cdot 0.23\,\text{d}^{-1} \cdot (0.9 - 1)}}{0.9} \right)}$$

12.3) Oxygen Equivalent given Log value of Critical Oxygen Deficit Formula

Evaluate Formula

Formula

$$L_t = f \cdot 10^{\log 10(D_c) + (K_D \cdot t_c)}$$

Example with Units

$$0.3519\,\text{mg/L} = 0.9 \cdot 10^{\log 10(0.0003) + (0.23\,\text{d}^{-1} \cdot 0.5\,\text{d})}$$

12.4) Oxygen Equivalent given Self Purification Constant with Critical Oxygen Deficit Formula

Evaluate Formula

Formula

$$L_t = D_c \cdot \frac{f}{10^{-K_D \cdot t_c}}$$

Example with Units

$$0.3519\,\text{mg/L} = 0.0003 \cdot \frac{0.9}{10^{-0.23\,\text{d}^{-1} \cdot 0.5\,\text{d}}}$$

13) Reoxygenation Coefficient Formulas

13.1) Reoxygenation Coefficient at 20 Degree Celsius Formula

Evaluate Formula

Formula

$$K_{R(20)} = \frac{K_R}{(1.016)^{T - 20}}$$

Example with Units

$$0.22\,\text{d}^{-1} = \frac{0.22\,\text{d}^{-1}}{(1.016)^{20\,\text{K} - 20}}$$

13.2) Reoxygenation Coefficient given Critical Oxygen Deficit Formula

Evaluate Formula

Formula

$$K_R = K_D \cdot L_t \cdot \frac{10^{-K_D \cdot t_c}}{D_c}$$

Example with Units

$$0.1235\,\text{d}^{-1} = 0.23\,\text{d}^{-1} \cdot 0.21\,\text{mg/L} \cdot \frac{10^{-0.23\,\text{d}^{-1} \cdot 0.5\,\text{d}}}{0.0003}$$

13.3) Reoxygenation Coefficient given Self Purification Constant Formula

Evaluate Formula

Formula

$$K_R = K_D \cdot f$$

Example with Units

$$0.207\,\text{d}^{-1} = 0.23\,\text{d}^{-1} \cdot 0.9$$

13.4) Reoxygenation Coefficients Formula

Evaluate Formula

Formula

$$K_R = K_{R(20)} \cdot (1.016)^{T - 20}$$

Example with Units

$$0.65\,\text{d}^{-1} = 0.65\,\text{d}^{-1} \cdot (1.016)^{20\,\text{K} - 20}$$

13.5) Stream Depth given Reoxygenation Coefficient Formula

Evaluate Formula

Formula

$$d = \left(3.9 \cdot \frac{\sqrt{v}}{k} \right)^{\frac{1}{1.5}}$$

Example with Units

$$42.2505\,\text{m} = \left(3.9 \cdot \frac{\sqrt{60\,\text{m/s}}}{0.11\,\text{s}^{-1}} \right)^{\frac{1}{1.5}}$$

13.6) Temperature given Reoxygenation Coefficient at T degree Celsius Formula

Evaluate Formula

Formula

$$T = \log\left(\left(\frac{K_R}{K_{R(20)}}\right), 1.016\right) + 20$$

Example with Units

$$19.9853\,\text{K} = \log\left(\left(\frac{0.22\,\text{d}^{-1}}{0.65\,\text{d}^{-1}}\right), 1.016\right) + 20$$

14) Self Purification Constant Formulas

14.1) Self Purification Constant Formula

Evaluate Formula

Formula

$$f = \frac{K_R}{K_D}$$

Example with Units

$$0.9565 = \frac{0.22\,\text{d}^{-1}}{0.23\,\text{d}^{-1}}$$

14.2) Self Purification Constant given Critical Oxygen Deficit Formula

Evaluate Formula

Formula

$$f = L_t \cdot \frac{10^{-K_D \cdot t_c}}{D_c}$$

Example with Units

$$0.5372 = 0.21\,\text{mg/L} \cdot \frac{10^{-0.23\,\text{d}^{-1} \cdot 0.5\,\text{d}}}{0.0003}$$

14.3) Self Purification Constant given Log value of Critical Oxygen Deficit Formula

Evaluate Formula

Formula

$$f = \frac{L_t}{10^{\log10\left(D_c\right) + \left(K_D \cdot t_c\right)}}$$

Example with Units

$$0.5372 = \frac{0.21\,\text{mg/L}}{10^{\log10\left(0.0003\right) + \left(0.23\,\text{d}^{-1} \cdot 0.5\,\text{d}\right)}}$$

Variables used in list of Disposing of the Sewage Effluents Formulas above

- **A_{DO}** Actual Dissolved Oxygen *(Milligram per Liter)*
- **C** Mixing Concentration
- **C_R** River Concentration
- **C_s** Sewage Concentration
- **d** Depth of Stream *(Meter)*
- **D** Oxygen Deficit *(Milligram per Liter)*
- **D_c** Critical Oxygen Deficit
- **D_o** Initial Oxygen Deficit *(Milligram per Liter)*
- **f** Self-Purification Constant
- **k** Reoxygenation Coefficient per Sec *(1 Per Second)*
- **K_D** Deoxygenation Constant *(1 Per Day)*
- **K_R** Reoxygenation Coefficient *(1 Per Day)*
- **$K_{R(20)}$** Reoxygenation Coefficient at Temperature 20 *(1 Per Day)*
- **L** Organic Matter at Start *(Milligram per Liter)*
- **L_t** Oxygen Equivalent *(Milligram per Liter)*
- **Q_s** Sewage Discharge *(Cubic Meter per Second)*
- **Q_{stream}** Discharge in Stream *(Cubic Meter per Second)*
- **S_{DO}** Saturated Dissolved Oxygen *(Milligram per Liter)*
- **t** Time in Days *(Day)*
- **T** Temperature *(Kelvin)*
- **t_c** Critical Time *(Day)*
- **v** Velocity *(Meter per Second)*

Constants, Functions, Measurements used in list of Disposing of the Sewage Effluents Formulas above

- Functions: **log**, log(Base, Number)
  Logarithmic function is an inverse function to exponentiation.
- Functions: **log10**, log10(Number)
  The common logarithm, also known as the base-10 logarithm or the decimal logarithm, is a mathematical function that is the inverse of the exponential function.
- Functions: **sqrt**, sqrt(Number)
  A square root function is a function that takes a non-negative number as an input and returns the square root of the given input number.
- Measurement: **Length** in Meter (m)
  Length Unit Conversion
- Measurement: **Time** in Day (d)
  Time Unit Conversion
- Measurement: **Temperature** in Kelvin (K)
  Temperature Unit Conversion
- Measurement: **Speed** in Meter per Second (m/s)
  Speed Unit Conversion
- Measurement: **Volumetric Flow Rate** in Cubic Meter per Second (m^3/s)
  Volumetric Flow Rate 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

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