



Design of an Aerobic Digester Formulas

Calculators!

Examples!

Conversions!

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List of 15 Design of an Aerobic Digester Formulas

Design of an Aerobic Digester 🗗

1) Density of Air given Volume of Air Required

$$ho = rac{
m W_{O2}}{
m V_{air} \cdot 0.232}$$

Open Calculator 🗗

ex
$$7183.908 \mathrm{kg/m^3} = rac{5 \mathrm{kg}}{0.003 \mathrm{m^3 \cdot 0.232}}$$

2) Density of Water given Volume of Digested Sludge

$$ho_{
m water} = rac{W_{
m s}}{V_{
m s} \cdot G_{
m s} \cdot \% {
m s}}$$

Open Calculator 🚰

ex
$$1000 {
m kg/m^3} = rac{20 {
m kg}}{10.0 {
m m^3} \cdot 0.01 \cdot 0.20}$$

3) Digester Total Suspended Solids given Volume of Aerobic Digester 🗗

$$\mathbf{X} = rac{\mathrm{Q_i} \cdot \mathrm{X_i}}{\mathrm{V_{ad}} \cdot (\mathrm{K_d} \cdot \mathrm{P_v} + \mathbf{ heta})}$$

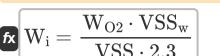
Open Calculator 🗗

$$ext{ex} 0.014468 ext{mg/L} = rac{5.0 ext{m}^3/ ext{s} \cdot 5000.2 ext{mg/L}}{10 ext{m}^3 \cdot (0.05 ext{d}^{-1} \cdot 0.5 + 2.0 ext{d})}$$





4) Initial Weight of Oxygen given Weight of Oxygen Required

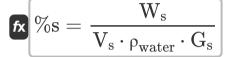


Open Calculator 🚰

$$\mathbf{W}_{\mathrm{i}} = \frac{\mathbf{VSS} \cdot 2.3}{\mathbf{VSS} \cdot 2.3}$$

$$= 3.84058 \mathrm{kg} = \frac{5 \mathrm{kg} \cdot 5.3 \mathrm{kg/d}}{3 \mathrm{kg/d} \cdot 2.3}$$

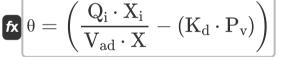
5) Percent Solids given Volume of Digested Sludge



Open Calculator

$$ext{ex} 0.2 = rac{20 ext{kg}}{10.0 ext{m}^3 \cdot 1000 ext{kg/m}^3 \cdot 0.01}$$

6) Solids Retention Time given Volume of Aerobic Digester



Open Calculator 🗗

$$oxed{ex} 2.066882 ext{d} = \left(rac{5.0 ext{m}^3/ ext{s} \cdot 5000.2 ext{mg/L}}{10 ext{m}^3 \cdot 0.014 ext{mg/L}} - (0.05 ext{d}^{-_1} \cdot 0.5)
ight)$$



7) Specific Gravity of Digested Sludge given Volume of Digested Sludge

fx $G_{
m s} = rac{W_{
m s}}{
ho_{
m water} \cdot V_{
m s} \cdot \%
m s}$

Open Calculator 🗗

$$\boxed{ \text{ex} } 0.01 = \frac{20 \text{kg}}{1000 \text{kg/m}^3 \cdot 10.0 \text{m}^3 \cdot 0.20}$$

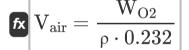
8) Volume of Aerobic Digester

 $V_{
m ad} = rac{Q_{
m i} \cdot X_{
m i}}{X \cdot ((K_{
m d} \cdot P_{
m v}) + heta)}$

Open Calculator

$$ext{ex} 10.33441 ext{m}^3 = rac{5.0 ext{m}^3/ ext{s} \cdot 5000.2 ext{mg/L}}{0.014 ext{mg/L} \cdot ((0.05 ext{d}^{-1} \cdot 0.5) + 2.0 ext{d})}$$

9) Volume of Air Required at Standard Conditions



$$oxed{ex} 0.003 \mathrm{m}^{_3} = rac{5 \mathrm{kg}}{7183.90 \mathrm{kg/m}^{_3} \cdot 0.232}$$



10) Volume of Digested Sludge

 $V_{
m s} = rac{W_{
m s}}{
ho_{
m water} \cdot G_{
m s} \cdot \%
m s}$

Open Calculator 🚰

ex $10 {
m m}^{_3} = rac{20 {
m kg}}{1000 {
m kg/m}^{_3} \cdot 0.01 \cdot 0.20}$

11) VSS as Mass Flow Rate given Weight of Oxygen Required

 $oldsymbol{ iny VSS} = rac{\mathrm{W_{O2} \cdot VSS_w}}{2.3 \cdot \mathrm{W_i}}$

Open Calculator

ex $3.000453 ext{kg/d} = rac{5 ext{kg} \cdot 5.3 ext{kg/d}}{2.3 \cdot 3.84 ext{kg}}$

12) Weight of Oxygen given Volume of Air 🖒

fx $W_{O2} = (V_{air} \cdot
ho \cdot 0.232)$

Open Calculator 🗗

13) Weight of Oxygen Required to Destroy VSS

 $extbf{KW}_{\mathrm{O2}} = rac{\overline{\mathrm{VSS} \cdot 2.3 \cdot \mathrm{W_i}}}{\mathrm{VSS_w}}$

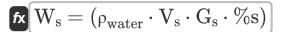
Open Calculator 🗗

 $oxed{ex} 4.999245 ext{kg} = rac{3 ext{kg/d} \cdot 2.3 \cdot 3.84 ext{kg}}{5.3 ext{kg/d}}$





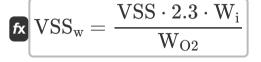
14) Weight of Sludge given Volume of Digested Sludge 🖸



Open Calculator 🗗

ex $20 \text{kg} = (1000 \text{kg/m}^3 \cdot 10.0 \text{m}^3 \cdot 0.01 \cdot 0.20)$

15) Weight of VSS given Weight of Oxygen Required 🗗



Open Calculator

 $= \frac{5.2992 \mathrm{kg/d} \cdot 2.3 \cdot 3.84 \mathrm{kg}}{5 \mathrm{kg}}$



Variables Used

- %s Percent Solids
- G_S Specific Gravity of Sludge
- K_d Reaction Rate Constant (1 Per Day)
- P_v Volatile Fraction
- Qi Influent Average Flow Rate (Cubic Meter per Second)
- Vad Volume of Aerobic Digester (Cubic Meter)
- Vair Volume of Air (Cubic Meter)
- Vs Sludge Volume (Cubic Meter)
- VSS Volume of Suspended Solid (Kilogram per Day)
- VSS_w Volatile Suspended Solid Weight (Kilogram per Day)
- **W**_i Weight of Initial Oxygen (Kilogram)
- W_{O2} Weight of Oxygen (Kilogram)
- **W**_s Weight of Sludge (Kilogram)
- X Digester Total Suspended Solids (Milligram per Liter)
- X_i Influent Suspended Solids (Milligram per Liter)
- θ Solids Retention Time (Day)
- p Density of Air (Kilogram per Cubic Meter)
- Pwater Water Density (Kilogram per Cubic Meter)





Constants, Functions, Measurements used

- Measurement: Weight in Kilogram (kg)
 Weight Unit Conversion
- Measurement: Time in Day (d)
 Time Unit Conversion
- Measurement: Volume in Cubic Meter (m³)

 Volume Unit Conversion
- Measurement: Volumetric Flow Rate in Cubic Meter per Second (m³/s)
 Volumetric Flow Rate Unit Conversion
- Measurement: Mass Flow Rate in Kilogram per Day (kg/d)
 Mass Flow Rate Unit Conversion
- Measurement: Density in Kilogram per Cubic Meter (kg/m³), Milligram per Liter (mg/L)
 - Density Unit Conversion
- Measurement: First Order Reaction Rate Constant in 1 Per Day (d⁻¹)

 First Order Reaction Rate Constant Unit Conversion





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