Important Basics of Non Ideal Flow Formulas PDF

Formulas
Examples
with Units

List of 10
Important Basics of Non Ideal Flow Formulas

1) Area under C-Pulse Curve Formula

Evaluate Formula

Formula

$$A = \frac{M}{v_0}$$

Example with Units

$$3.4\,\mathrm{m^2} = \frac{34\,\mathrm{kg}}{10\,\mathrm{m^3/s}}$$

2) Exit Age Distribution based on Mean Residence Time Formula

Evaluate Formula

Formula

$$E_\theta = \frac{V}{M} \cdot C_{pulse}$$

Example with Units

$$12.0588\,\mathrm{1/s} = \frac{1000\,\mathrm{m^3}}{34\,\mathrm{kg}} \cdot 0.41\,\mathrm{kg/m^3}$$

3) Exit Age Distribution Curve from C Pulse Curve Formula

Evaluate Formula

Formula

$$E = \frac{C_{pulse}}{\frac{M}{v_0}}$$

Example with Units

$$0.1206\,\mathrm{1/s} = \frac{0.41\,\mathrm{kg/m^3}}{\frac{34\,\mathrm{kg}}{10\,\mathrm{m^3/s}}}$$

4) F Curve Formula

Evaluate Formula

Formula

$$F = \frac{C_{step}}{C_{A0}}$$

Example with Units

$$0.4829 = \frac{42.01\,\mathrm{mol/m^3}}{87\,\mathrm{mol/m^3}}$$

5) Initial Concentration of Reactant in Plug Flow Reactant with Negligible Density Changes Formula

Evaluate Formula

Formula

$$C_{Ao} = C_A \cdot \exp\left(\tau_p \cdot k_{plug\ flow}\right)$$

Example with Units

$$95.7273\,\mathrm{mol/m^3} = 24\,\mathrm{mol/m^3} \cdot \exp\left(0.069\,\mathrm{s} \cdot 20.05\,\mathrm{mol/m^{3}*s}\right)$$

6) Mean of C Pulse Curve Formula

Evaluate Formula

Formula

$$T = \frac{V}{v_0}$$

Example with Units

$$100\,\mathrm{s} = \frac{1000\,\mathrm{m^3}}{10\,\mathrm{m^3/s}}$$

7) Rate Constant for Plug Flow Reactor using Space Time for Negligible Density Changes Formula

Evaluate Formula

Formula

$$k_{plug\ flow} = \left(\frac{1}{\tau_p}\right) \cdot \ln\left(\frac{C_{Ao}}{C_A}\right)$$

Example with Units

$$17.4489\,\mathrm{mol/m^3{*}s} = \left(\frac{1}{0.069\,\mathrm{s}}\right) \cdot \ln\left(\frac{80\,\mathrm{mol/m^3}}{24\,\mathrm{mol/m^3}}\right)$$

8) Space Time for Plug Flow Reactor with Negligible Density Changes Formula

Evaluate Formula

Formula

$$\tau_p = \left(\frac{1}{k_{plug\ flow}}\right) \cdot \ln\left(\frac{C_{Ao}}{C_A}\right)$$

Example with Units

$$0.06\,\mathrm{s} = \left(\frac{1}{20.05\,\mathrm{mol/m^3{*}s}}\right) \cdot \ln\left(\frac{80\,\mathrm{mol/m^3}}{24\,\mathrm{mol/m^3}}\right)$$

9) Volume of Reactor based on Exit Age Distribution Formula

Evaluate Formula

Formula

$$V = \frac{E_\theta \cdot M}{C_{pulse}}$$

Example with Units

$$995.122\,\mathrm{m^3} = \frac{12\,\mathrm{1/s} \cdot 34\,\mathrm{kg}}{0.41\,\mathrm{kg/m^3}}$$

10) Volumetric Flow Rate based on Mean Pulse Curve Formula

Evaluate Formula

Formula

$$v_0 = \frac{V}{T}$$

Example with Units

$$10\,\mathrm{m^3/s} = \frac{1000\,\mathrm{m^3}}{100\,\mathrm{s}}$$

Variables used in list of Basics of Non Ideal Flow Formulas above

- **A** Area under Curve *(Square Meter)*
- **C_A** Reactant Concentration *(Mole per Cubic Meter)*
- **C_{A0}** Initial Concentration of Reactant *(Mole per Cubic Meter)*
- **C_{Ao}** Initial Reactant Conc. *(Mole per Cubic Meter)*
- **C_{pulse}** C Pulse *(Kilogram per Cubic Meter)*
- **C_{step}** C Step *(Mole per Cubic Meter)*
- **E** Exit Age Distribution *(1 Per Second)*
- **E_θ** E in Mean Residence Time *(1 Per Second)*
- **F** F Curve
- **$k_{plug\ flow}$** Rate Constant for Plug Flow Reactor *(Mole per Cubic Meter Second)*
- **M** Units of Tracer *(Kilogram)*
- **T** Mean Pulse Curve *(Second)*
- **V** Volume of Reactor *(Cubic Meter)*
- **v_0** Volumetric Flow Rate of Feed to Reactor *(Cubic Meter per Second)*
- **τ_p** Space Time for Plug Flow Reactor *(Second)*

Constants, Functions, Measurements used in list of Basics of Non Ideal Flow Formulas above

- Functions: **exp**, exp(Number)
  n an exponential function, the value of the function changes by a constant factor for every unit change in the independent variable.
- Functions: **ln**, ln(Number)
  The natural logarithm, also known as the logarithm to the base e, is the inverse function of the natural exponential function.
- Measurement: **Weight** in Kilogram (kg)
  Weight Unit Conversion
- Measurement: **Time** in Second (s)
  Time Unit Conversion
- Measurement: **Volume** in Cubic Meter (m^3)
  Volume Unit Conversion
- Measurement: **Area** in Square Meter (m^2)
  Area Unit Conversion
- Measurement: **Volumetric Flow Rate** in Cubic Meter per Second (m^3/s)
  Volumetric Flow Rate Unit Conversion
- Measurement: **Molar Concentration** in Mole per Cubic Meter (mol/m^3)
  Molar Concentration Unit Conversion
- Measurement: **Density** in Kilogram per Cubic Meter (kg/m^3)
  Density Unit Conversion
- Measurement: **Reaction Rate** in Mole per Cubic Meter Second (mol/m^3*s)
  Reaction Rate Unit Conversion
- Measurement: **Time Inverse** in 1 Per Second (1/s)
  Time Inverse Unit Conversion

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