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Basics of Non Ideal Flow Formulas

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List of 10 Basics of Non Ideal Flow Formulas

Basics of Non Ideal Flow

1) Area under C-Pulse Curve

Open Calculator

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

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

2) Exit Age Distribution based on Mean Residence Time

Open Calculator

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

ex $$12.05882/\text{s} = \frac{1000\text{m}^3}{34\text{kg}} \cdot 0.41\text{kg}/\text{m}^3$$

3) Exit Age Distribution Curve from C Pulse Curve

Open Calculator

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

ex $$0.120588/\text{s} = \frac{0.41\text{kg}/\text{m}^3}{\frac{34\text{kg}}{10\text{m}^3/\text{s}}}$$

4) F Curve

Open Calculator

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

$$0.482874 = \frac{42.01 mol/m^3}{87 mol/m^3}$$

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

Open Calculator

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

$$95.72733 mol/m^3 = 24 mol/m^3 \cdot \exp(0.069 s \cdot 20.05 mol/m^3*s)$$

6) Mean of C Pulse Curve

Open Calculator

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

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

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

Open Calculator

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

$$17.44888 mol/m^3*s = \left(\frac{1}{0.069 s}\right) \cdot \ln\left(\frac{80 mol/m^3}{24 mol/m^3}\right)$$

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

Open Calculator

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

ex $$0.060049s = \left(\frac{1}{20.05mol/m^3*s}\right) \cdot \ln\left(\frac{80mol/m^3}{24mol/m^3}\right)$$

9) Volume of Reactor based on Exit Age Distribution

Open Calculator

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

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

10) Volumetric Flow Rate based on Mean Pulse Curve

Open Calculator

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

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

Variables Used

- **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

- Function: **exp**, exp(Number)
  Exponential function
- Function: **ln**, ln(Number)
  Natural logarithm function (base e)
- 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

Check other formula lists

- **Basics of Non Ideal Flow Formulas**
- **Convection Model for Laminar Flow Formulas**
- **Dispersion Model Formulas**
- **Earliness of Mixing,Segregation,RTD Formulas**

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