

Material and Energy Balance Summary

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I. Batch Reactor

I.A. Material Balance

$$\frac{dC_A}{dt} = v_A r$$

I.B. Energy Balance

$$\frac{dT}{dt} = \frac{-\Delta H_R r}{C_T C_{p,mix}}$$

II. CSTR

II.A. Material Balance

$$\frac{dC_A}{dt} = \frac{F_{in}}{V} C_{A,in} - \frac{F_{out}}{V} C_A + v_A r$$

II.B. Energy Balance

$$\frac{dT}{dt} = \frac{\frac{F_{in}}{V} C_{T,in} C_{p,mix,in} (T_{in} - T) - \Delta H_R r}{C_T C_{p,mix}}$$

III. PFR

III.A. Material Balance

$$\frac{dC_A}{dz} = v_A \frac{r}{v_z}$$

III.B. Energy Balance

$$\frac{\partial T}{\partial z} = \frac{-\Delta H_R \frac{r}{v_z}}{C_T C_{p,mix}}$$