$$t = \left[ -\frac{1}{\alpha} \ln(\beta - \alpha x) \right]_0^x$$

$$t = +\frac{1}{\alpha} \ln\left( \frac{\beta}{\beta - \alpha x} \right)$$

on simpifying

$$x = \frac{\beta}{\alpha} \left( 1 - \exp(-\alpha t) \right)$$

$$x = \frac{1}{\left(1 + \frac{\tau_{rxn}}{\tau_n}\right)} \left( 1 - \exp\left[ -t\left( \frac{1}{\tau_{xn}} + \frac{1}{\tau_n} \right) \right] \right)$$

$$x = \frac{1 - \exp\left\{ -t\left( \frac{1}{\tau_{rxn}} + \frac{1}{\tau_n} \right) \right\}}{(\tau_{rxn})\left( \frac{1}{\tau_{xn}} + \frac{1}{\tau_n} \right)} \rightarrow \text{like a } 1^{st} \text{ order differential eq}^{n}\text{'s solution}$$

$$\tau = \left( \frac{1}{\frac{1}{\tau_{xn}} + \frac{1}{\tau_n}} \right)$$

→ timescale or time constant

$\tau_n \uparrow \Rightarrow$ more time of residence {or time to recat}

$\tau_{rxn} \uparrow \Rightarrow$ conversion is lesser

$\tau_{xn}$ is generally not controlled cause it is decided by the rxn

{($\tau_n$) can be controlled by controlling flow rate}