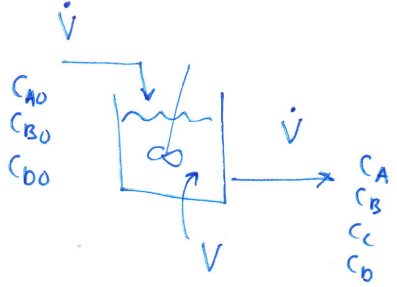
4.17-3 CSTR

$A + B \underset{k^-}{\overset{k^+}{\rightleftharpoons}} C + D$



$C \rightarrow 10\ t/den$

$C_{A0} = 4.2\ kmol/m^3$

$C_{B0} = 10.9\ kmol/m^3$

$C_{D0} = 16.4\ kmol/m^3$

$\rho = 1045\ kg/m^3$

$k^+ = 8 \cdot 10^{-9}\ \frac{m^3}{mol \cdot s}$

$k^- = 2.55 \cdot 10^{-9}\ \frac{m^3}{mol \cdot s}$

$\xi = 0.3$

$V = ?$

$C_A = C_{A0} \cdot (1 - \xi) = 4.2 \cdot (1 - 0.3) = \underline{2.94\ kmol/m^3}$

$C_B = C_{B0} - C_{A0} \cdot \xi = 10.9 - 4.2 \cdot 0.3 = \underline{9.64\ kmol/m^3}$

$C_C = C_{A0} \cdot \xi = 4.2 \cdot 0.3 = \underline{1.26\ kmol/m^3}$

$C_D = C_{D0} + C_{A0} \cdot \xi = 16.4 + 4.2 \cdot 0.3 = \underline{17.66\ kmol/m^3}$

Požadovaný průtok

$\dot{m}_C = 10\ t/den = \frac{10\,000}{24 \cdot 3600} = 0.1157\ kg/s$

$\dot{V} \cdot C_C \cdot M_C = 0.1157\ kg/s \rightarrow \dot{V} = \frac{0.1157}{C_C \cdot M_C} = \frac{0.1157}{1.26 \cdot 88} = \underline{0.0010435\ \frac{m^3}{s}}$

$\frac{m^3}{s}\ \ \frac{kmol}{m_3}\ \ \frac{kg}{kmol}$

$M_C = M(CH_3COOC_2H_5) = M(C_4H_8O_2) = 4 \cdot 12 + 8 \cdot 1 + 2 \cdot 16 = 88\ kg/kmol$

Bilance reaktoru

AKUM = VSTUP − VÝSTUP + ZDROJ

$0 = \dot{V} \cdot C_{A0} - \dot{V} \cdot C_A + 1 \cdot r \cdot V$

$r = k^+ \cdot C_A \cdot C_B - k^- \cdot C_C \cdot C_D$

$V = \frac{\dot{V} \cdot (C_{A0} - C_A)}{r} = 0.0010435 \cdot \frac{(4.2 - 2.94) \cdot 10^3}{169.99 \cdot 10^{-3}}$

$r = 8 \cdot 10^{-9} \cdot 2.94 \cdot 10^3 \cdot 9.64 \cdot 10^3 - \ldots$

$\ldots 2.55 \cdot 10^{-9} \cdot 1.26 \cdot 10^3 \cdot 17.66 \cdot 10^3 =$

$= 8 \cdot 10^{-3} \cdot 2.94 \cdot 9.64 - 2.55 \cdot 10^{-3} \cdot 1.26 \cdot 17.66 =$

$= 169.99 \cdot 10^{-3}\ \frac{mol}{m^3 \cdot s} =$

$V = \underline{7.73\ m^3}$