17-6 ideálně míchaný průtočný reaktor

$$2A \underset{k^-}{\overset{k^+}{\rightleftharpoons}} B + C$$

$\dot{V} = 100\ m^3/h$

$c_{A0} = 1.5\ kmol/m^3$

$c_{B0} = c_{C0} = 0$

$k^+ = 5\ m^3/kmol \cdot h$

$K = \frac{k^+}{k^-} = 16$

$\zeta = 0.8 \cdot \zeta_{MAX}$

$V = ?$

$$c_A = c_{A0}(1-\zeta)$$

$$c_B = c_C = c_{A0}\left(0 + \frac{1}{2}\zeta\right) = c_{A0}\frac{1}{2}\zeta$$

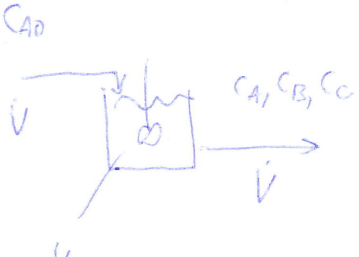
$$\left.\begin{aligned}[A] &= c_{A0}(1-\zeta_{MAX}) \\ [B] = [C] &= c_{A0}\frac{1}{2}\zeta_{MAX}\end{aligned}\right\} \text{rovnovážné koncentrace}$$

$$K = \frac{[B][C]}{[A]^2} = \frac{c_{A0}\frac{1}{2}\zeta_{MAX}\, c_{A0}\frac{1}{2}\zeta_{MAX}}{c_{A0}^2(1-\zeta_{MAX})^2} = \frac{\left(\frac{1}{2}\zeta_{MAX}\right)^2}{(1-\zeta_{MAX})^2}$$

$$\sqrt{K} = \frac{\frac{1}{2}\zeta_{MAX}}{1-\zeta_{MAX}} \rightarrow 1-\zeta_{MAX} = \frac{\zeta_{MAX}}{2\sqrt{K}} \rightarrow \zeta_{MAX} = \frac{1}{1+\frac{1}{2\sqrt{K}}}$$

$$\zeta_{MAX} = \frac{1}{1+\frac{1}{2\cdot 4}} = \frac{8}{9} = 0.8889$$

$$\zeta = 0.8\,\zeta_{MAX} = 0.8 \cdot \frac{8}{9} = \underline{0.71}$$



$$r = k^+ c_A^2 - k^- c_B c_C$$

$$r = k^+\left(c_A^2 - \frac{c_B c_C}{k}\right)$$

AKUM = VSTUP − VÝSTUP + ZDROJ

$$0 = c_{A0}\dot{V} - c_A\dot{V} - 2 \cdot r \cdot V$$

$$V = \frac{-(c_{A0}-c_A)\cdot\dot{V}}{-2r}$$

$$V = \frac{(1.5-0.435)\cdot 100}{2\cdot 0.8575}$$

$$\underline{V = 62.1\ m^3}$$

$c_A = 1.5 \cdot (1-0.71) = 0.435\ kmol/m^3$

$c_B = c_C = 1.5 \cdot \frac{1}{2} \cdot 0.71 = 0.5325\ kmol/m^3$

$$r = 5 \cdot \left[0.435^2 - \frac{0.5325^2}{16}\right] = 0.8575\ \frac{kmol}{m^3 \cdot h}$$