15-15 500 t/rok 92%mol S + B

$\xi_S = 30\%$ $V = 1{,}8\ m^3$

$T_0 = 308\ K$ $A = 7{,}5\ m^2$

a) $T = ?$

b) $T_C = ?$

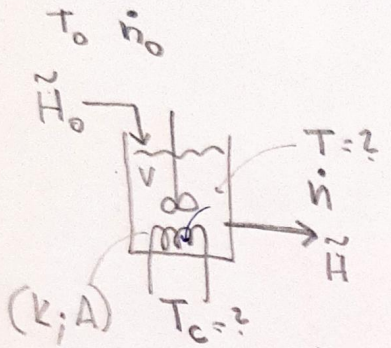
$r = k \cdot c_S^{3/2}$ $k = A \exp(-E_A/RT)$ (E_A: 96,79 kJ/mol)

$\Delta_R h = -69{,}14$ kJ/mol $3{,}3 \cdot 10^{11}\ m^{1{,}5}\ kmol^{0{,}5}\ h^{-1}$

1 rok = 8000 h

$\langle c_p \rangle = 1{,}886\ kJ\ kg^{-1}\ K^{-1}$

$K = 84\ kJ/(m^2 \cdot h \cdot K)$ $\rho = 870\ kg/m^3$



$\tilde{\dot{H}}_0 - \dot{Q}_c = \tilde{\dot{H}} + \Delta_R h \xi$

Předpoklad: [$\Delta_R h$ nezávisí na teplotě]

$T_{ref} = T$

$\tilde{\dot{H}}_0 = \langle c_p \rangle \cdot \dot{n} \cdot (T_0 - T)$

$\tilde{\dot{H}} = \langle c_p \rangle \cdot \dot{n} \cdot (T - T) = 0$

$\dot{Q}_c = K \cdot A \cdot (T - T_C)$

S = C_8H_8 $8 \cdot 12 + 8 = 104$ kg/kmol

B = C_4H_6 $= 4 \cdot 12 + 6 = 54$ kg/kmol

$\xi = ?$

$\dot{n}_S = \dot{n}_{S0}(1 - \xi_S)$ $\dot{n}_{S0} = x_{S0} \cdot \dot{n}_0 = x_{S0} \cdot \frac{\dot{m}_0}{\bar{M}} = 0{,}575$ kmol/hod

$\dot{n}_S = \dot{n}_{S0} - 1 \cdot \dot{\xi}$ $\bar{M} = x_{S0} M_S + (1 - x_{S0}) \cdot M_B = 100$ kg/kmol

$\dot{\xi} = \dot{n}_{S0} \xi_S = 0{,}575 \cdot 0{,}30 = 0{,}1725$ kmol/hod

Kinetika

$\dot{n}_{S0} - r \cdot V = \dot{n}_S$

$\dot{n}_{S0} - r \cdot V = \dot{n}_{S0} - \dot{\xi}$

$r = \dot{\xi}/V$

$r = k(T) \cdot c_S^{3/2}$

$c_S = \frac{\dot{n}_S}{\dot{V}} = \frac{\dot{n}_S}{\dot{m}/\rho} = 5{,}603$ kmol/m³

$T = 370\ K$ odpověď a)

b)

$$\tilde{\dot{H}}_0 = \dot{m} \langle c_p \rangle (T_0 - T) = \frac{500 \cdot 10^3}{8000} \cdot 1{,}886 \cdot (308 - 370) = -7324{,}8 \text{ kJ/kmol}$$

$$\tilde{\dot{H}} = 0$$

$$Q_c = K \cdot A \cdot (T - T_c)$$

$$\Delta_R h \} = -69{,}14 \cdot 10^3 \cdot 0{,}1725 = -11926{,}7 \text{ kJ/h}$$

kJ/kmol kmol/h

$$\tilde{\dot{H}}_0 - \dot{Q}_c = \tilde{\dot{H}} + \Delta_R h \} \Rightarrow \underline{\dot{Q}_c = 4601{,}8 \text{ kJ/h}}$$

$$T - T_c = \frac{Q_c}{K \cdot A} = \frac{4601{,}8 \text{ kJ/h}}{84 \frac{\text{kJ}}{\text{m}^2 \cdot \text{K} \cdot \text{h}} \cdot 7{,}5 \text{ m}^2} = 7{,}3 \text{ K}$$

$$\underline{T_c = 362{,}8 \text{ K}}$$