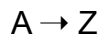


AFCoKaRE Practice Problem 31.1 Solution

Purpose: This problem will allow you to practice the quantitative analysis of a recycle PFR.

Problem Statement: Problem 30.1 described a thermally backmixed PFR. Suppose that instead of passing the effluent from that reactor through a heat exchanger to heat the feed, part of the feed was recycled at a recycle ratio of 1.0. How does the conversion compare to that of the thermally backmixed PFR (72%)? Specifically, liquid phase reaction (1) is exothermic with a constant heat of reaction of $-75.6 \text{ kJ mol}^{-1}$. The second order (in A) rate coefficient has a pre-exponential factor of $5.22 \times 10^3 \text{ m}^3 \text{ mol}^{-1} \text{ min}^{-1}$ and an activation energy of 62.8 kJ mol^{-1} . A solution of 1 M A at $20 \text{ }^\circ\text{C}$ is fed to the process at a rate of 1.25 L min^{-1} . It is mixed with the recycle stream from the outlet of a 0.5 m^3 PFR operating adiabatically with a recycle ratio of 1.0. The heat capacity of the solution is constant and equal to 2 J mL K^{-1} . What percentage of the A in the feed will be converted and at what temperature will the final process stream leave the reactor?



(1)