Chemical Reaction Engineering I

Self Test 3

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QUESTION 1

An elementary liquid phase reaction is follows;

$$3A + 2B \rightarrow 4C$$

Determine the rate of reaction solely in terms of conversion, X. The inlet flowrate to the batch reactor is equal molar and the initial concentration of A is 2 mol/dm^3. Use 0.01 (dm^3/mol)^{4}1/s as the equilibrium constant, k_A

a) Construct the stoichiometric table

b) Repeat (a) if the phase of the reaction now is in gas form

c) What is the rate law?

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QUESTION 2

The gas phase pyrolysis reaction of ethane producing ethylene (C_2H_4) and hydrogen (H_2) is as follows:

$$C_2H_6 \rightarrow C_2H_4 + H_2$$

The reaction was to be carried out in a continuous stirred tank reactor (CSTR) and a plug flow reactor (PFR). As an engineer, you are required to analyze the use of both reactors. As a novice, you strategized yourself to perform the following tasks:

a) Construct the stoichiometric table and express the concentration of each species in the reaction solely as a function of conversion when 33mol/min pure ethane enters the reactor at 6 atm and 1100 K with k is 4.32min^{-1} at 1100K. (Assume the reaction is isothermal and isobaric).

b) Develop the reaction rate solely as a function of conversion, i.e.,(Assume the reaction follows an elementary rate law)

c) Construct the table for Levenspiel Plot.

d) Design the single CSTR and PFR to achieve 80 % conversion of ethane.

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