Abdelhafid BOUSSOUF University Center - Mila
Process engineering department
3rd year L.M.D – Homogeneous reactor
Dr. Imane MAYOUF

Homogeneous reactor
Series N° 02 (Chapter III)

Exercise 1:

Supposed we have the reaction: A -> B + C

This reaction is of order 2 compared to reagent A. It is carried out in a closed isothermal reactor.

At time t=0 we place a charge in the reactor: n_{a0} mole of A and n_I mole of inert.

1/ If v=cst; determine the expression for the residence time (t_r) to achieve a conversion rate X_{af} relative to reagent A.

2/ if we apply constant pressure (P=0); determine the expression of (t_r).

Exercise 2:

We consider the reaction A+B -> C+D

To study the kinetics of this reaction, we have a closed, perfectly stirred reactor with a volume of 01 liter. A preliminary study showed that the orders of the reaction with respect to A and B were identical.

To carry out the experiment, we put 5 moles of A and 5 moles of B in the reactor. the results obtained at T=30°C are gathered in the following table

Time (Hours)	0.5	1	2	5	10
C_A (mol/l)	4,35	3,85	3,13	2	1,25
V (mol/l.min)	$18,9.10^{-3}$	$14,8.10^{-3}$	$9,8.10^{-3}$	4.10^{-3}	$1,56..10^{-3}$

1/ determine the rate constant (ثابت السرعة) and the kinetic equation of the reaction.

This reaction is carried out in a closed, perfectly stirred reactor of $2m^3$. 240 kg of reagent A are introduced into this reactor and reagent B is added equimolarly.

2/ calculate the operating time to have a conversion of 90% of reagent A

3/ give the composition of the reaction mixture at the end of the reaction

we give: M_A=40g/mol; M_B=60g/mol

Exercise 3:

laboratory experiments have shown that the alkaline hydrolysis of ethyl acetate in aqueous solution and at 50°C is an irreversible reaction of global order 2 (order 1 with respect to each reagent) (K=28.6 L/mol.min

the reaction is as follows:

$$CH_3COOC_2H_5 + NaOH \rightarrow CH_3COONa + C_2H_5OH$$

$$A + B \rightarrow C + D$$

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1/ We use a perfectly stirred continuous reactor in steady state with a volume V_A = 14 liters with a feed rate Q = 120 liters/hour with C_{A0} = C_{B0} = 0.1 mol/l. What is the value of the output concentration C_{Aext} (concentration at the exit of reactor) and the corresponding conversion rate X_A?

2/ What would be the value of a piston reactor of the same performance powered under the same conditions?

3/ What would be the value of X_A at the exit of a piston reactor of the same volume as the perfectly stirred continuous reactor of 14 liters.