

③ side by side :-

→ Reaction may be H^d or Series → Not dependent upon Concentration of A or R.

→ $\phi < 0.3$, $\eta = 1$ → Uniform poisoning
 → $\phi > 0.3$, $\eta = \frac{1}{\phi}$ → Extension to interior poisoning
 } Depends upon poison rate constant
 K_d is small.
 K_d is large.

④ Temperature :-

→ Structural Modification.
 → Sintering (Aging) of Catalyst surface → Due to Extreme Cond.
 Dependent upon: Time, Temp Environment.

Activity w.r. to t : $-\frac{da}{dt}$.

-ve sign → As Activity is decreasing.

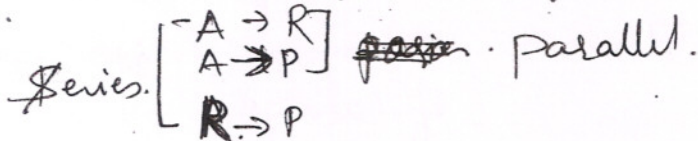
$$-\frac{da}{dt} = K_d C_A^m a^d \rightarrow \text{Parallel.}$$

$$-\frac{da}{dt} = K_d C_R^m a^d \rightarrow \text{Series.}$$

$$-\frac{da}{dt} = K_d C_P^m a^d \rightarrow \text{Side by side.}$$

$$-\frac{da}{dt} = K_d a^d \rightarrow \text{Temperature.}$$

⇒ If Rxn is parallel as well as series i.e. A also poisons Catalyst and product formed 'R' also poisons Catalyst.

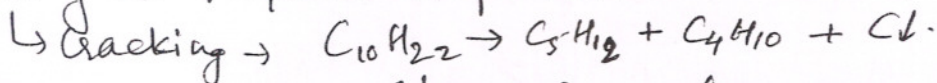


$$-\frac{da}{dt} = K_d (C_A + C_R)^m a^d.$$

Types of Catalyst Deactivation :-

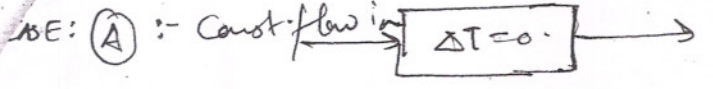
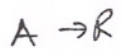
→ By Aging → Temp.

→ By fouling → Physical Deposition

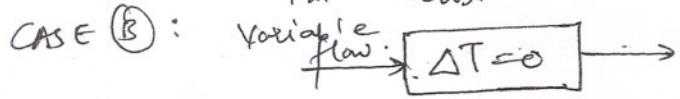


→ By poisoning → Chemical
 $Cl_2(PT) + O_2 \rightarrow CO_2$

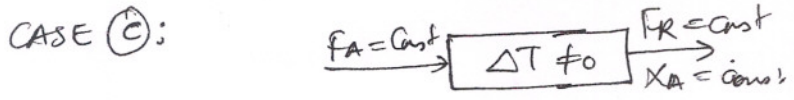
Design:



$X_A \rightarrow$ Decreases
 $F_R \rightarrow$ Decreases.
 $F_A \rightarrow$ Const.



$X_A \rightarrow$ Constant
 $F_R \rightarrow$ Constant
 $F_A \rightarrow$ Decreases

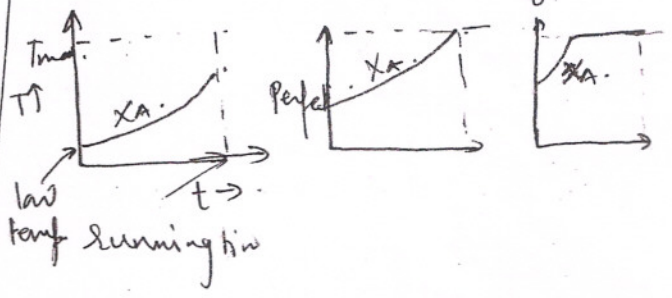


$F_A \rightarrow$ Constant
 $F_R \rightarrow$ Constant
 $X_A \rightarrow$ Constant

\rightarrow dT/dt is very Temp sensitive.
 Compared to $P_{\text{ran}} \rightarrow$ Use Case (C)
 Don't go for max temp at which it will get structural changes.
 But boost the temp.

$\rightarrow -\frac{da}{dt}$ is less temp sensitive
 Use (A) or (B), $\Delta T = 0, T_{\text{op}} = \text{Max}$.

\rightarrow For catalyst rapidly deactivate packed bed are impractical.
 we should use solid-flow.



① Solid Catalysed rxn. The Knudsen diffusivity depends upon:- (96)
 \rightarrow a) molecular velocity only b) Pore 'r' only c) Mean free path only d) All of Above

② 1st ordn rxn - porous catalyst, $\phi = 10, \eta = 9$
 a) 1 b) 0.5 c) 0.1 d) 0 $\phi > 3, \eta = 1/\phi = 1/10 \Rightarrow 0.1$ (96)

③ The rxn $A \rightarrow B$ occurs $\Delta T = 0$ Catalyst pellet, under steady state condn. diffusion in A into pellet is rate controlling step, the rate of diffusion of A is:- (88)
 a) Faster than the rate of rxn. b) Slower than rate of rxn
 c) Equal to rate of rxn. d) may be faster or slower, depend upon kinetics.

④ For 1st ordn isothermal chemical rxn in a porous catalyst, the $\eta = 0.3$, The η will increase if the. (97)
 1) D is small & ~~increased~~ catalyst diffusivity is reduced.
 2) D is small & catalyst diffusivity is increased.
 3) D is large & η is increased.
 4) D is large & η is decreased.
 Boxed text: $\phi > 3$ for $\eta = 0.3, \eta = 1/\phi$
 $\phi \leq L\sqrt{\frac{k}{D}}$
 $\phi \downarrow \rightarrow D \uparrow, k \downarrow, L \downarrow$

⑤ A first order rxn $A \rightarrow B$ in an isothermal porous catalyst pellet of spherical shape. If the Conc. of A at the centre of the pellet is much less than that at the external surface the process is limited by:-

- a) Diffusion within the pellet
 - b) Rxn.
 - c) External M.T
 - d) None of the Above
- Boxed text: $C_{\text{center}} \ll C_s \rightarrow$ More prediff. resistance, i.e. diffusion is slowest step.