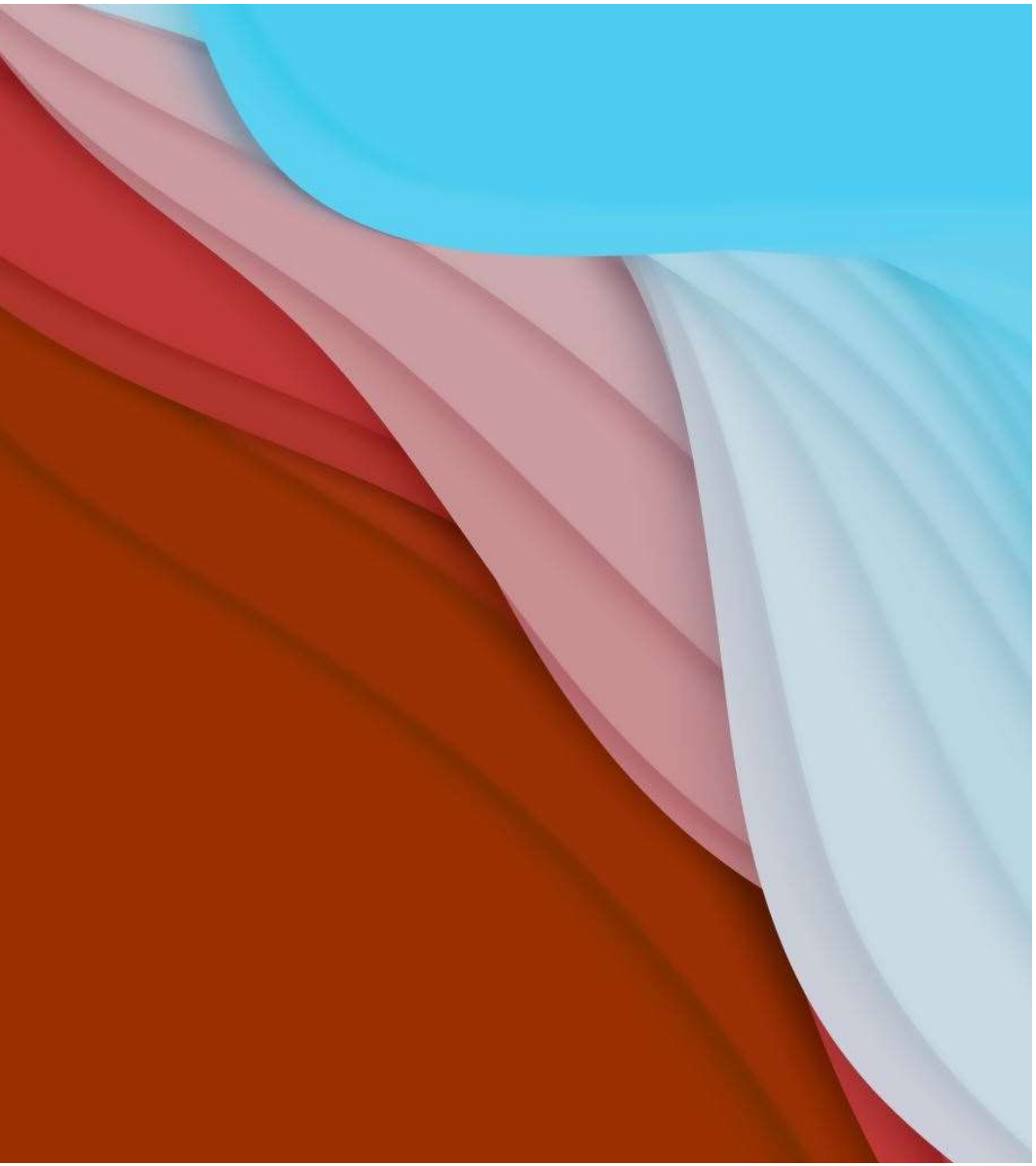


CEN416
PROCESS DESIGN II

- In many industrial production processes, **multiple reactions** occur frequently.

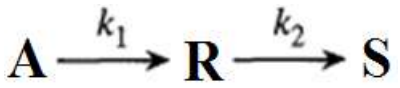
- In addition to the reactor performance, the design should be made to ensure that the *product distribution* is *as desired*.

- One of the key factors in the economic success of a chemical plant is the *minimization* of *undesired side reactions* that occur along with the *desired reaction*.

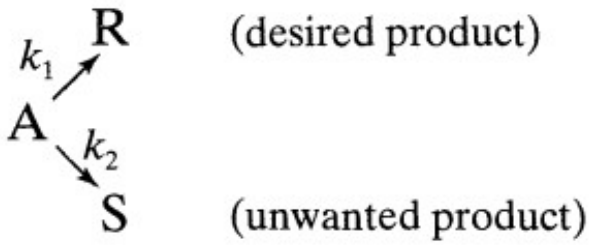
- In the case of multiple reactions, the performance of the reactors and how the reaction products are affected by the flow pattern in the reactor should be presented.

- *Single reaction* requires only one rate expression to describe its kinetic behavior whereas *multiple reactions* require more than one rate expression

- **Series (Consecutive) Reactions**



- **Parallel (Competing) Reactions**



- *Complex reactions:* when there is a combination of parallel and series reactions.

- Whether the **initial investment** or the **input** and **separation costs** should be low depends on *economic discretion*.

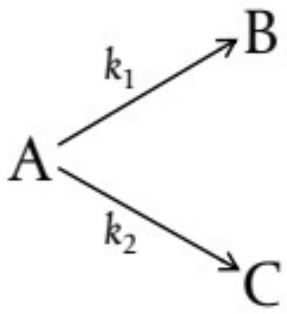
- Generally, **product distribution** is the **main parameter** in multiple reaction system designs.

- Therefore, **product distribution optimization**, which is not seen in single reactions, should be done.

Yield, (Y): It is the fraction of input that turns into a particular product.

Yield of B: $Y_B = \frac{C_B - C_{Bo}}{C_{Ao}}$

Yield of C: $Y_C = \frac{C_C - C_{Co}}{C_{Ao}}$



$$x_B \rightarrow Y_B$$

$$x_C \rightarrow Y_C$$

$$x_B + x_C = x_t$$ **(Total conversion of *A* to *B* and *C*)**

REFERENCES

1. Sinnot, R.K. 1999, Coulson's & Richardson's Chemical Engineering, Volume 6, Chemical Engineering Design, ButterWorth Heinemann, Oxford.

2. Turton R., Bailie R.C., Whitin W.C., Shaeiwitz J.A. 1998, Analysis, Synthesis and Design of Chemical Processes, Prentice Hall, New Jersey.