Understanding and Specifying Process Conditions

Good judgement comes from experience, and experience comes from bad judgement

Barry LePatner

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- Stream specifications and process conditions are influenced by physical processes as well as ecomomic considerations and are *not chosen arbitrarily*.
- The conditions used in a process most often represent an economic compromise between process performance and the capital and operating costs of the process equipment.

Separator and Reactor Operation

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- A decision to operate above 400 ^{o}C must be justified.
- A decision to operate outside the temperature range 40 ^{o}C to 260 ^{o}C requires special heating/cooling media, and thus must be justified.

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  - As temperature increases, specific reaction rate k increases.

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  - If competing reactions occur and different reactions have different activation energies, an appropriate temperature is needed to favor the desired reaction.

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  - Examples of material that are temperature sensitive are fragrance chemicals, flavor chemicals, pharmaceuticals.

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- Product cannot be easily separated from recycled feed material.
- Recycled product retards the formation of unwanted by-products formed from side reactions.
- Product acts as a diluent to control the rate of reaction.

Reading Assignment

Read Chapter 4 from TBWS.
In particular, please study the following tables in detail.

- Table 4.1: Possible reasons for operating reactors and separators outside the temperature range of special concern (page 120)

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- Table 4.3: Possible reasons for nonstoichiometric reactor feed compositions of special concern (page 122)

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- Table 4.3: Possible reasons for nonstoichiometric reactor feed compositions of special concern (page 122)
- Table 4.4: Changes in process conditions that are of special concern for a stream passing through a single piece of equipment (page 124)

Heuristics in Design

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- It can reduce the time to solve a problem.

Physical Property Heuristics

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  - When the concentrations in the feed vary widely but the relative volatilities do not, remove the components in order of decreasing concentration.

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- Tower height is limited to about 53 m.

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- Minimum temperature approach is 10^oC for fluids and 5^oC for refrigerants.

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In particular, please study the tables 9.2-9.18 (pages 337-352) in detail.