Course Learning Objectives - CBE 350

Chemical and Bioengineering Reactor Fundamentals (3)

At the conclusion of this course, the student should be able to:

1. Formulate ideal reactor design equations for simple models of batch, continuous stirred flow (CSTR), and plug flow chemical reactors in terms of fractional conversion of limiting reactant, starting with the appropriate mole balances.
2. Size ideal homogeneous batch, CSTR, and plug flow reactors by analytical or numerical integration, when the reaction rate is given as a function of fractional conversion.
3. Evaluate multiple reactor configurations, e.g., combinations of reactors of various types in either series or parallel operation, when the reaction rate is given as a function of fractional conversion.
4. Determine reaction rate laws from experimental data by the differential and the integral methods, and determine the activation energy of the rate coefficients.
5. Use stoichiometric tables to express reactant concentration in terms of fractional conversion and the appropriate parameters of the system, for both liquid and gas phase systems.
6. Size batch, CSTR and plug flow reactors for isothermal homogeneous reaction systems, given the required production rate, rate law, and specified final conversion of the limiting reactant.
7. Calculate the production rate and fractional conversion of limiting reactant for isothermal, homogeneous batch, CSTR, or plug flow reactors of given size, when the rate law is known.
8. Size and develop catalyst requirements for a packed bed reactor, accounting for pressure drop, by numerical integration of the design equations.
9. Account for catalyst aging and deactivation in catalytic reactor design and operation.
10. Develop preliminary designs for non-isothermal batch, CSTR, and plug flow reactors by simultaneous integration of the material and energy balances.
11. Evaluate non-isothermal reactor designs for potential safety problems.
12. Select the proper contacting patterns to achieve maximum desired product yield in systems containing multiple chemical reactions occurring in series and in parallel.
13. Select the proper contacting patterns to achieve desired product selectivity in systems containing multiple chemical reactions occurring in series and in parallel.
14. Select the proper reactor type (e.g., batch, CSTR, plug flow) for a given application.