

416d Product Design and Process Design -- Together at Last!

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Product design is becoming a popular new topic to add to chemical engineering curricula. Unfortunately, many believe that product design is a completely separate topic from process design. Further, many treat the molecular insights needed for successful product design as a subject alien to the traditional teaching of chemical engineering. The result is extra pressure on a curriculum already squeezed into too few hours of teaching.

We would like to demonstrate that successful product and process design are based on a uniform set of engineering design strategies that can be taught in a very effective combined course. The initial design analysis of a product design problem identifies constraints on physical and chemical properties, e.g., the product must be an azeotrope, the product must be emulsified in water, or the product must retain its flexibility even after years of UV exposure. These constraints are used to generate design candidates that may have different compositions and possibly different forms. The composition, form, and physical properties of each of these product candidates determines the required processing operations for its production, e.g., the product must be coated, the liquid components must be mixed with emulsifier at high speed, or various additives must be blended into product. Finally economic, environmental, health, and safety analyses must be performed on the product and process to provide metrics for evaluating between alternatives and ultimately deciding if the design is viable.

Basic concepts and several examples will be discussed to demonstrate that teaching process and product design strategies in a combined course need not only serve to meet the strict hour limitations... but is also the most meaningful way to teach Chemical Engineering Design.