472a Criteria for Successfully Combining a Reactor with a Separation Process

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There is today an ongoing effort in Industry and Government to simplify processes and reduce the investment costs by combining two or more unit operations into one step. Some of these efforts have been very successful, but the majority was not, and often it was understood only after large sums of money for research and development were spent. In this presentation we will review some of these cases, focusing on combining a reactor with a separation process. It will be shown why intensification is seldom successful, and a simple powerful methodology how to identify potentially profitable applications will be proposed and illustrated by examples. Two cases from reactive distillation will be discussed in detail. One successful example is the methyl acetate production, where the reactive distillation column is able to simulate a counter-current train of reactors with inter-stage separation, creating a strong synergism. The other example is reactive distillation for separation of isomers, a case in which the integration of reaction and separation creates no synergisms. For most uses, reactive distillation has penalties that are larger than the benefits. Our methodology allows recognizing both the potential advantages and problems of integrating reaction and distillation without extensive simulations or research. Other examples not involving distillation will also be discussed.