Optimization of a Chemical Process with Risk criteria through simultaneous process flowsheeting and safety assessment in a composite model

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This study aims to design an optimal process which meets the risk criteria in a preliminary design stage. Conventional risk-based design procedure starts from a base case then assess the risk separately. If the risk exceeds certain criteria, then the design is modified in a recursive loop until the modification lowers the risk to an acceptable range. This sequential loop is time-consuming and expensive. To reduce the time consumed in the loop, this study developed a composite model integrating process flowsheeting simulator with safety assessment. Mass and heat balance calculation and risk quantification are simultaneously performed in this composite model. The optimization results in a design with the lowest energy consumption at a tolerable safety level by applying risk criteria as an additional constraint. Target process is the natural gas liquefaction process with DMR cycle. Consequently, the final design meets the risk criteria with similar efficiency compared to the base case of which the risk exceeds the acceptable range.