An industrial example of converting a batch fine-chemical process into a continuous one

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This work was carried out at Firmenich in the framework of a broad multi-team effort to reduce the cost of an important perfumery ingredient produced via a multistep synthesis. Most of the production steps are carried out batch-wise in multipurpose equipment, so that one potential axis of improvement consists, for some key unit operations, of switching from batch to continuous processing in order to reduce production overheads and raw material costs. In this study we focus on assessing the possibility of running one of the key steps—consisting of a heterogeneous liquid-liquid reaction with a complex reaction network—in continuous mode.

An in-depth study of the process including the evaluation of 5 commercially available laboratory scale continuous reactors is described. The reaction kinetics were measured, modelled and used as a tool to optimize the reaction conditions. Based on our data, we conclude that a cascade of CSTRs is the best option, as this reactor type provides an advantageous combination of high productivity and selectivity, ease of scale up, as well as robustness and flexibility, allowing to meet the targeted conversion, selectivity, molar yield and quality at a significantly reduced cost.