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Esterification reactions: Should one go continuous?

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PURPOSE OF THE ABSTRACT

In the field of biomass transformation into valuable building blocks as alternatives to fossil-based molecules, acids and alcohols hold a very special place as they are often the primary derivatives obtained by chemical or biochemical transformation of carbohydrates and lipids. For a wide variety of applications, those products are further derivatized in order to obtain the right functionalities. In particular, organic esters are very often targeted as they have numerous industrial applications in polymers, plasticizers, lubricants, surfactants, fragrances, solvents, intermediates, actives, etc. Whether they are new or drop-in molecules, the question of the best process to industrialize the production of those esters in a technically efficient and cost-effective manner is critical to position the bio-based alternatives in their competitive market environment.

Recent trends in the manufacturing of fine chemicals show an increasing interest in shifting towards continuous processes that are presented as processes allowing to improve production capacities and reduce downtimes and production costs. Besides, the focus is frequently oriented towards flow chemistry in tubular reactors, giving a particular attention to miniaturized devices and microreactor technologies that are claimed to permit better controlled reactions, in particular when dealing with fast, exothermic, dangerous and/or complex reactions. But classical esterification (Fischer esterification) does not fall into this category as this reaction is typically slow and limited by chemical equilibrium, generally involves non explosive reagents, products and intermediates and has a negligible reaction heat.

On this basis, should we conclude that this reaction is stuck in the batch production mode or are there attractive continuous options for its industrial implementation? Using several representative case studies and a rationale approach, the aim of this presentation is to show trends in the selection of the best reactor configurations to carry out esterification reactions. Whether the best option is batch or continuous, its selection relies above all on the careful analysis of the reaction system to identify the chemical and physical phenomena occurring, as well as on the right definition of production objectives and the understanding of possible industrial constraints.

FIGURES

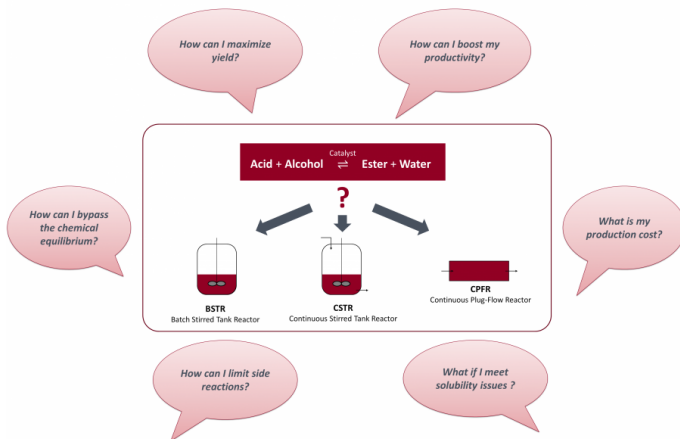


FIGURE 1

FIGURE 2

KEYWORDS

esterification | reactor performances | process design | batch or continuous processes

BIBLIOGRAPHY