Accepted Manuscript

From semi-batch to continuous tubular reactors: a kinetics-free approach

Federico Florit, Valentina Busini, Giuseppe Storti, Renato Rota

PII: S1385-8947(18)31511-0
DOI: https://doi.org/10.1016/j.cej.2018.08.044
Reference: CEJ 19658

To appear in: *Chemical Engineering Journal*

Received Date: 23 June 2018
Revised Date: 6 August 2018
Accepted Date: 7 August 2018

Please cite this article as: F. Florit, V. Busini, G. Storti, R. Rota, From semi-batch to continuous tubular reactors: a kinetics-free approach, *Chemical Engineering Journal* (2018), doi: https://doi.org/10.1016/j.cej.2018.08.044

From semi-batch to continuous tubular reactors: a kinetics-free approach

Federico Florit[a], Valentina Busini[a], Giuseppe Storti[b], Renato Rota[a,*]

[a] *Politecnico di Milano, Dipartimento di Chimica, Materiali e Ingegneria Chimica G. Natta, via Mancinelli 7, 20131, Milano, Italy*

[b] *ETH Zürich, Department of Chemistry and Applied Biosciences, Vladimir-Prelog-Weg 1-5/10, HCI F 125, 8093 Zürich, Switzerland*

Abstract

A methodology, which does not require any kinetic information, for the rigorous transformation of an isothermal, homogeneous semi-batch process into an equivalent continuous side-fed tubular reactor was developed. Once the semi-batch process parameters are known, the proposed methodology allows for easily defining all the process parameters of a side-fed tubular reactor that guarantees the same performances as the original semi-batch process, in terms of conversion and product characteristics.

Two different case studies were selected to investigate the potential of the proposed approach: a copolymer synthesis and the production of a fine chemical, clearly showing the need of a rigorous transformation of the semi-batch process into the continuous one since productivity and product quality are strongly affected by the feeding policy.

Keywords: semi-batch to continuous, process intensification, kinetics-free, tubular reactor

1. Introduction

Fine chemicals and specialties are generally produced via discontinuous or semi-continuous processes. This is mainly due either to discontinuous market needs (seasonal campaigns), which require a high degree of flexibility in the synthesis, or to complex and dangerous reaction processes, which are carried out in semi-batch reactors, SBRs, for safety reason [1, 2].

An effective way to reduce costs and enhance reproducibility of such processes is to transform discontinuous ones into their continuous counterpart. This way reactor volumes are usually reduced, the intrinsic process safety is increased thanks to the lower hold-up, and investment costs are also decreased [3]. Moreover, overall process times can be reduced and more constant quality is achieved, with a general decrease in

*Corresponding author
Email address: renato.rota@polimi.it (Renato Rota)