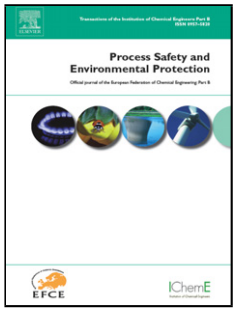

Title: THERMAL RISK IN SEMI-BATCH REACTORS: THE EPOXIDATION OF SOYBEAN OIL

Authors: Valeria CASSON MORENO, Vincenzo RUSSO, Riccardo TESSER, Martino DI SERIO, Ernesto SALZANO

PII: S0957-5820(17)30149-0
DOI: http://dx.doi.org/doi:10.1016/j.psep.2017.05.001
Reference: PSEP 1062

To appear in: *Process Safety and Environment Protection*

Received date: 1-7-2016
Revised date: 28-2-2017
Accepted date: 1-5-2017

Please cite this article as: CASSON MORENO, Valeria, RUSSO, Vincenzo, TESSER, Riccardo, DI SERIO, Martino, SALZANO, Ernesto, THERMAL RISK IN SEMI-BATCH REACTORS: THE EPOXIDATION OF SOYBEAN OIL.Process Safety and Environment Protection http://dx.doi.org/10.1016/j.psep.2017.05.001

THERMAL RISK IN SEMI-BATCH REACTORS: THE EPOXIDATION OF SOYBEAN OIL

Valeria CASSON MORENO[a], Vincenzo RUSSO[b], Riccardo TESSER[b], Martino DI SERIO[b], Ernesto SALZANO[a,]*

[a] Dipartimento di Ingegneria Chimica, Civile, Ambientale e dei Materiali, Alma Mater Studiorum – Università di Bologna, via Terracini 28, 40131 Bologna (Italy)
[b] Dipartimento di Chimica, Università di Napoli "Federico II", Complesso Universitario Monte S. Angelo, Via Cintia 4, 80126 Napoli (Italy)

*Corresponding author:
ernesto.salzano@unibo.it
Phone: +39 051 2090255, Fax: +39 051 2090247.

Highlights

- A model to account for decomposition of peroxides in epoxidation of soybean oil was developed
- Reactor stability criteria were applied to the model for semi-batch epoxidation
- Best operating and safest conditions for the semi-batch process were proposed
- The process is sensitive to feed rate, excess of reagents and heat transfer
- Very good agreement was found with experimental results on semi-batch epoxidation

Abstract

The interest in the epoxidation of vegetable oils is constantly growing in the chemical industry. The most common process is based on the oxidation of the unsaturated bonds by peroxyacids generated *in situ,* in the water phase, using concentrated hydrogen peroxide and the corresponding organic acid in presence of a mineral acid as catalyst**.** The overall epoxidation reaction is highly exothermic, hence operating conditions should be always addressed by safety considerations related to the possibility of runaway reactions.
In this paper, best operating conditions and safety considerations have been defined for a complex reaction network for the epoxidation of soybean oil, which includes the decomposition reactions of the performic acid generated during the epoxidation. Furthermore, sensitivity-based reactor stability criteria have been applied and compared, for the design of an adequate Early Warning Detection System for the process.

Abbreviations

DB: double bond
DEG: Degraded EVO
EVO: Epoxidized Vegetable Oil
EWDS: Early Warning Detection System
FA: formic acid