Sustainable Process Engineering
Chemical Reactor Engineering

TU/e EINDHOVEN UNIVERSITY OF TECHNOLOGY

Temperature dependent kinetics of toluene sulfonation using fuming sulfuric acid with varying sulfur trioxide concentrations

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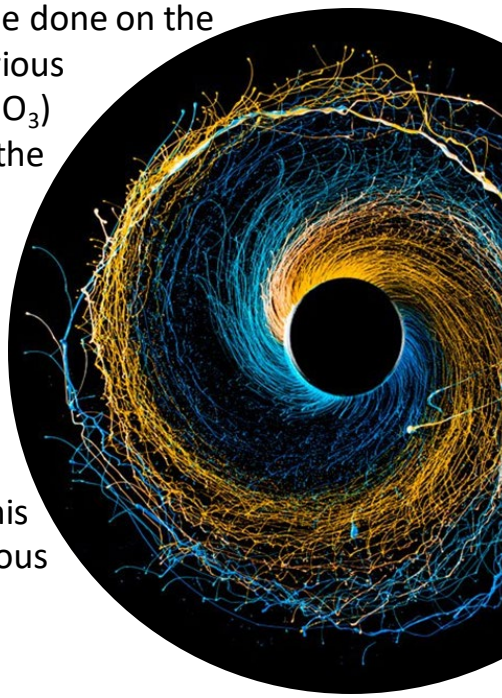
Introduction

The reaction of sulfonation of toluene using fuming sulfuric acid (FSA) is highly exothermic and reaction rates of similar chemical systems is said to be affected by local eddy dynamics [1-3]. This indicates the rate to be extremely fast, making a kinetic study challenging to perform in conventional stirred vessels. The use of a tubular milli reactor proposed in this research was, up until now, never considered.

Project summary

In this project, a temperature dependent kinetics study will be done on the sulfonation of toluene using FSA. The reaction rate of the various products will be measured for different free sulfur trioxide (SO_3) concentrations in FSA using a tubular milli-reactor. Likewise, the research should clarify the sudden decrease in reaction rate before reaching full conversion.

The project consists of experimental, theoretical, and modelling tasks. From an experimental perspective, the main task is to improve the existing set-up for performing the kinetic studies. Next, a proper mechanistic model should be developed, considering the kinetics possibly competing or even affecting local mass- and heat transfer. This model should then be implemented in Matlab such that various kinetic parameters can be fitted.



Project goals

Determine the kinetic constant and the activation energy as a function of free sulfur trioxide concentration of the reactant consumption as well as the formation of the different products. Furthermore, a well-tested explanation should found for the sudden stop of the reaction when it is done with an excess of toluene.

Contact information

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[1-3] A.A.C.M. Beenackers, W.P.M. van Swaaij, doi:10.1016/0300-9467(78)80034-3, doi:10.1016/0300-9467(78)80035-5, doi:10.1080/03086648108077509.