

Determine the mixing efficiency of the static mixer in a plug flow reactor using the Fourth Bourne Reaction.

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Introduction

Sustainable energy has become increasingly important nowadays. Therefore, researchers are always looking for improvements in the technology of sustainable energy.

The project is focused on the application of nanoparticles (TiO_2) that can improve the efficiency of greenhouses and solar cells by reducing light reflection. Nowadays, these nanoparticles are manufactured in a batch process. To improve reproducibility of the synthesis of these TiO_2 nanoparticles, a continuous process is required.

This research focusses on the mixing efficiency of the static mixer from the PFR. The method to determine the mixing performance of the PFR, will be tested by using the Fourth Bourne reaction.

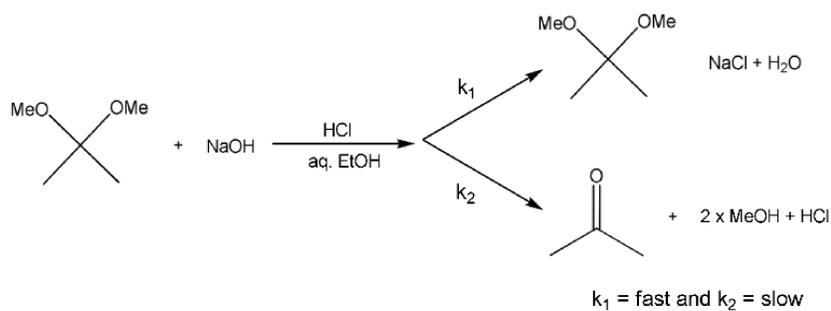


Figure 1 – Fourth Bourne reaction. (Bourne, J. R. 2003)

The main question of this research is:

How does the presence of SiO_2 nanoparticles influence the mixing efficiency within the static mixer of the PFR?

Reactor setup



Figure 2 – Reactor setup

Results and discussion

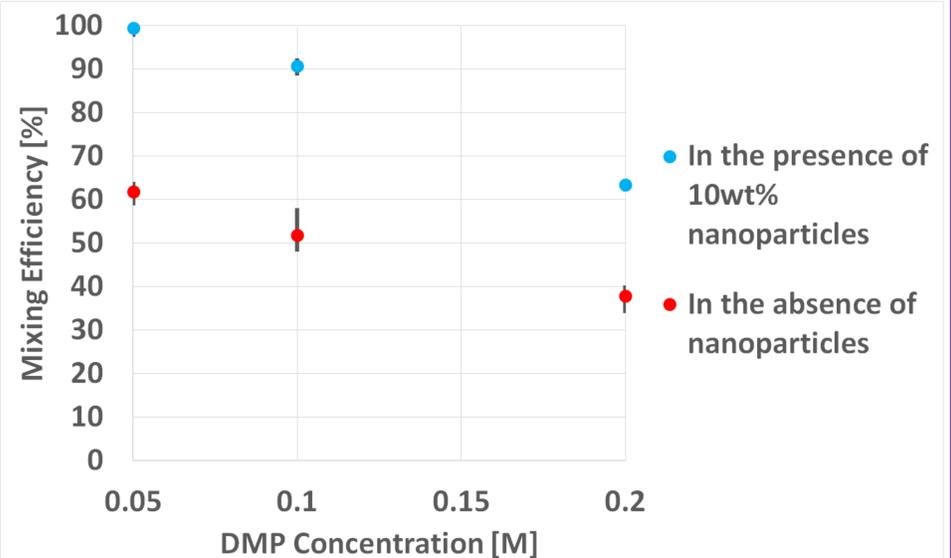


Figure 3 – Increase of concentration with presence and absence of Nanoparticles at a flow rate of 6 ml/min per pump.

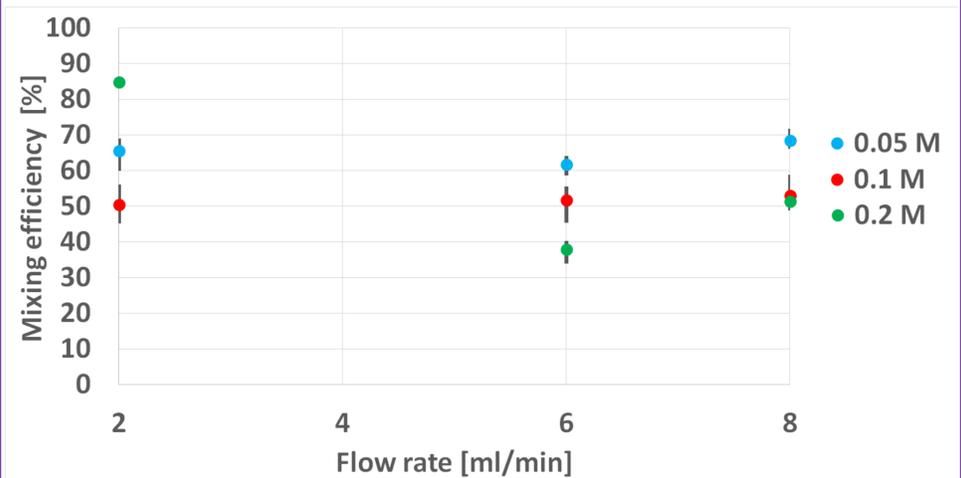


Figure 4 – The effect of the flow rate on the mixing efficiency

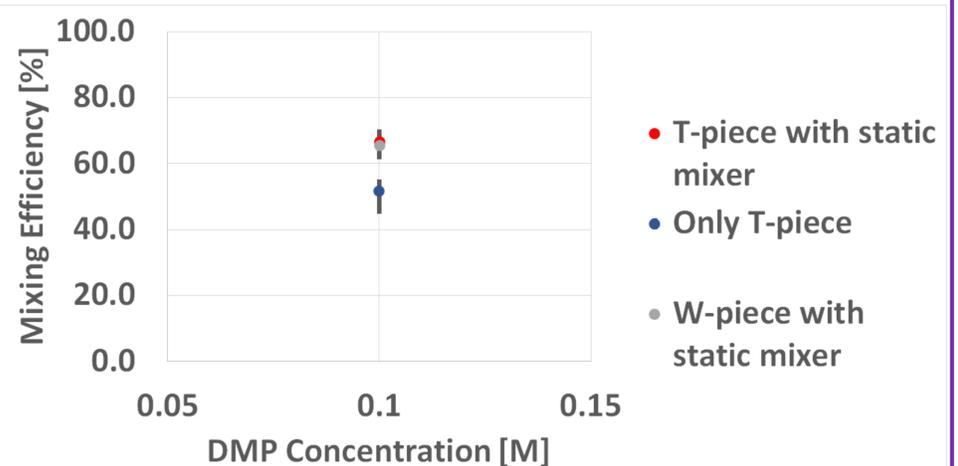


Figure 5 – The influence of the static mixer in absence of nanoparticles with a flow rate of 2ml/min.

Conclusion and recommendation

- Lower DMP concentrations lead to a higher mixing efficiency.
- The flowrates do not have a significant effect on the mixing efficiency.
- The presence of nanoparticles improves the mixing efficiency.
- The mixing efficiency is not determined in the static mixer, but mainly in the T-piece for the static mixer.

- Investigate the influence of the flow rate in the presence of nanoparticles.
- Investigate the influence of different weight percentages and particle size of nanoparticles.
- Investigate the reproducibility of all above experiments