1 | INTRODUCTION

Development of photochemistry in macroscopic batch reaction vessels is hampered due to inherent limitations: superficial light penetration and poor heat exchange result in inhomogeneous irradiation and hence to side-reactions or product degradation due to overexposure. The recent implementation of photochemical processes in microreactors under continuous-flow conditions appeared to be much more powerful than its batch analogue in terms of irradiation efficiency, light penetration and excellent heat exchange. Furthermore, the fine control of residence time ensures an accurate control of the irradiation time, avoiding side-reactions and degradation.

2 | Aim

The aim was to implement the photooxidation of (L)-methionine with singlet oxygen in microreactor under continuous-flow conditions to avoid the formation of undesired side-product and improve the efficiency of the reaction.

3 | Photooxidation in batch immersion well

Methionine + Rose Bengal in water with \( \text{O}_2 \) or Air bubbling

- \( \Rightarrow \) [Rose Bengal]
- \( \Rightarrow \) lamp intensity
- \( \text{O}_2 \) rather than air

Total conversion in 2 h

4 | \( ^1 \text{H NMR} \)

Singlet appearance (2.65) Triplet disappearance (2.55)

5 | Microreactors

Tube-in-tube

PTFE gas AND liquid impermeable

TEFLON AF-2400 gas permeable liquid impermeable

6 | Results

<table>
<thead>
<tr>
<th>Substrate solution</th>
<th>( \text{O}_2 )</th>
<th>BPR (bar)</th>
<th>Residence Time</th>
<th>Conversion</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>mL min(^{-1})</td>
<td>mL min(^{-1})</td>
<td>s</td>
<td>%</td>
</tr>
<tr>
<td>Methionine sulfoxide</td>
<td>0.1</td>
<td>15</td>
<td>8</td>
<td>20</td>
</tr>
</tbody>
</table>

Total conversion of (L)-methionine into methionine sulfoxide could be reached in only 20 min.
(Shorter residence times or lower \( \text{O}_2 \) flow rates were not sufficient and could not lead to 100% conversion)

7 | Conclusion

The photooxidation of (L)-methionine with singlet oxygen using Rose Bengal as a sensitizer was successfully implemented in a microreactor setup and led to total and selective conversion into methionine sulfoxide, an important building block for the organic synthesis of peptides or functionalized amino acid. The reaction was performed in 20 min while the same reaction in batch took 2h.

8 | Acknowledgements

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