Development of microreactor-based FTIR workflow for time-resolved analysis of plastic degradation

Master Thesis at the Institute of Technical Biocatalysis

Introduction

Plastic waste represent a major environmental challenge due to the persistence of conventional polymers in the environment. Enzymatic degradation has emerged as a promising strategy for plastic recycling, as specialized enzymes such as PETases and cutinases can depolymerize poly(ethylene terephthalate) (PET) into its monomeric building blocks under mild conditions.

Monitoring enzymatic PET degradation remains challenging, as conventional analytical methods such as HPLC require manual sampling and extensive sample preparation. Fourier-transform infrared spectroscopy (FTIR) offers a non-destructive alternative with the potential for automated, time-resolved measurements.

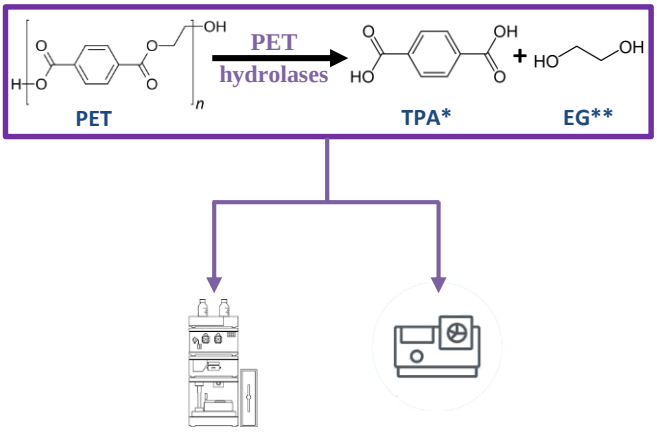
This thesis aims to evaluate the FTIR system as a platform for automated monitoring of PET degradation. A microreactor platform will be developed and optimized to enable repeated FTIR measurements with minimal manual intervention. The feasibility of position-specific measurements and the correlation between the FTIR signal and PET degradation progress will be investigated.

Beginning: Immediately

Content of the Thesis

During this thesis:

- Develop and optimize a microreactor platform compatible with FTIR measurement for plastic degradation experiment.
- Establish an automated FTIR workflow, including time-resolved and position-specific measurements.
- Perform plastic degradation experiments and monitor degradation progress using FTIR spectroscopy.
- Validate and interpret FTIR results with HPLC analysis.



*TPA = Terephthalic acid
**EG = Ethylene glycol

Contact

Name: Sherliana Setiawan
Institute of Technical Biocatalysis
Denickestr. 15 (K), Room: 2504
Phone: +49 40 30601 4472
Email: sherliana.setiawan@tuhh.de