Karlsruher Institut für Technologie

Institute for Technical Chemistry (ITC)

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Master thesis

Sustainable feedstocks for the chemical industry: Fluid Catalytic Cracking of plastic pyrolysis oils

The increasing amounts of plastic waste and the urgent need to reduce global CO_2 emissions make innovative recycling solutions indispensable. Chemical recycling of mixed plastic waste, in particular, offers the opportunity to recover materials from plastics that are difficult to recycle mechanically and replace fossil resources with more sustainable alternatives. Plastic pyrolysis oils, obtained through the thermal decomposition of plastics waste, show great potential as substitutes for conventional fossil feedstocks in the chemical industry.

Description of Task:
A promising approach is the integration of plastic pyrolysis oils into existing petrochemical processes, such as **Fluid Catalytic Cracking (FCC)**. The FCC process is currently used to convert high-boiling fractions of crude oil into valuable products, such as olefins and gasoline. The aim of this thesis is to investigate the integration of plastic pyrolysis oils, with their wide boiling range, into this process. The work is divided into four main steps:

1. Process modeling of an FCC process with conventional feedstocks based on literature data
2. Analysis of the effects of integrating plastic pyrolysis oils on the process balance
3. Development of a process balance for an olefin-yield-optimized FCC operation
4. Comparative process evaluation of the different process variants using methods of Life Cycle Assessment (LCA)

What We Offer:

- Continuous and close supervision
- The opportunity to work at the interface of process development, process modeling, and process evaluation

Your Profile:

- Master student in Chemical Engineering, Process Engineering, Industrial Engineering, or a related field
- Independent, structured work style
- Solid knowledge of mass and material balances
- Optional: Experience in process modeling (e.g., Aspen Plus) or Life Cycle Assessment

Start: October 2025 or later
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