

# Research Internship: Catalysts Application in Pyrolysis

## General Internship description

Pyrolysis is the core technology used at Waste4ME for waste streams valorization; it is defined as a thermo-chemical treatment, which can be applied to any organic (carbon-based) product. During pyrolysis, material is exposed to high temperature, in the absence of oxygen, and is submitted to chemical and physical separation into different molecules. The present Internship opportunity is about Investigating the potential application for all liquid, solid, and gaseous products to be used as fuels or chemical building blocks. For waste4ME, an on-going research focuses on the possibilities for upgrading and improving our pyrolytic system; specifically, the use of catalysts and their implementation, influences of reaction conditions and business case justification.

## Introduction

At our company Waste4ME BV we have developed a prototype pyrolysis system for waste reduction and energy generation at a local or small scale focusing on plastics waste streams. Catalytic pyrolysis poses several advantages over the noncatalytic route.

First, it drastically reduces the pyrolysis temperature by lowering the reaction activation energy. The use of catalysts has also demonstrated an increased selectivity toward desired pyrolysis liquid products. However, catalytic pyrolysis does suffer from some limitations.

The main limitation is related to catalyst performance deterioration with time. Hence, catalyst lifetime and regeneration in the process should be taken into account to maximize economic value, as well as keeping the whole system modular and portable, since it is the base vision of the company for developing our pyrolytic system. Waste4ME aims at building strong basis for the processing of specific mono/mixed waste plastics streams and shifting towards catalytic pyrolysis is crucial in order to yield marketable products of high standard quality.



## Internship assignments

- **General end goal:**
  - Research on the possible options for direct thermochemical liquefaction of (possibly heavily polluted) plastics for energy applications and chemical recovery.
  - Investigate the potential application for all liquid, solid, and gaseous products to be used as fuels or chemical building blocks.
- **Important research and implementation points:**
  - Research ways of Implementing catalysts into pyrolysis system (small lab scale reactor and big scale reactor) as:
    - in-situ (mixed with plastics feedstock or as heat-transfer medium)
    - ex-situ (close-coupled in the reactor above the bed or as a secondary reactor)
    - Possibly in-line with distillation apparatus
  - Several parameters for catalytic pyrolysis to keep in mind:

- How does a specific catalyst affect pyrolysis reactions, based on the following basic aspects:
  - Product yields
  - Composition
  - Properties
- Parameters of influence:
  - Plastics feedstock composition,
  - catalyst types and properties (also focus on re-usability)
  - Process parameters (residence time, temperature, mass flow rate etc.)
- **CAPEX/OPEX Analysis for financial feasibility based on 35kt plant**

### Profile Requirements

- Thesis level internship for bachelor in the following:
  - Chemical engineering/Process technology
  - General chemist, chemistry
  - Environmental sciences
  - Petrochemical-related studies
  - Dutch or international with an interest in circular economy
  - Ability to express yourself clearly, correctly and to the point in the English language
  - Ability to deal with and define legal uncertainties and form a vision

### Contact Details

If you are interested, send your cv and motivation letter, or even better accompanied with your first idea on how to approach the subject, to project manager Valentin Contin at [v.contin@Waste4me.com](mailto:v.contin@Waste4me.com).

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