LABORATORY FOR CHEMICAL TECHNOLOGY
Technologiepark 125 9052 Gent, Belgium

Coach	**Supervisor(s)**	**Funding**
Mohammadhossein Havaei	Kevin Van Geem Robin John Varghese	

Hydrothermal decomposition of thermally dechlorinated PVC waste

Aim

This thesis aims to explore the possibility of using supercritical water to degrade dechlorinated PVC waste. The work will focus on the possible benefits of a hydrothermal process compared to thermal pyrolysis in reducing the solid residue produced in PVC thermal pyrolysis and the compositional differences of the degradation products.

Justification

PVC waste is widely acknowledged as one of the more challenging categories of plastic wastes due to its limited end-of-life options. Most conventional methods of waste treatment result in products such as HCl or chlorinated organic molecules, thereby requiring specialized equipment that withstand corrosion and separation steps to remove the toxic chlorinated products. Thus far, a variety of methods have been adopted to deal with these challenges, including a separate dehydrochlorination step to remove the corrosive HCl products before further processing.

Though for the first step, a vast number of studies have reported high levels of dechlorination, less is known about the second step involving the degradation of the dechlorinated PVC. Regardless, high char production of PVC waste and promotion of char residue in plastic mixtures make pyrolysis a challenging process to treat PVC and PVC-rich waste, even when sufficient dechlorinated has been performed. That is why a combination of pyrolysis with another method can address one of the greatest challenges in PVC waste chemical recycling.

Hydrothermal treatments, and specifically supercritical pyrolysis of plastics, have been reported to reduce char production thanks to the enhanced solvent properties of water and its physical characteristics. Therefore, it might be a viable alternative to the thermal pyrolysis of dechlorinated PVC waste by utilizing more of the feedstock or producing a more valuable solid residue by limiting dehydrogenation and aromatization of the char.

For this purpose, a series of supercritical water pyrolysis and thermal pyrolysis experiments will be conducted on thermally dechlorinated PVC waste samples and the solid residue and the oil from comparable experiments will be analyzed and compared to hypothesize the effect of water on the process.

Program

- Literature review on the concept of hydrothermal decomposition of polymers and PVC at supercritical conditions.
- Initial monitoring of the effect of conditions on the conversion and composition of the products.
- Designing experiments at different conditions for dechlorinated waste PVC concerning their char production as a function of temperature, pressure, and time.
- Identifying and quantifying the byproducts using chromatography methods.
- Developing a simple kinetic model describing the hydrothermal degradation of dechlorinated PVC.