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Optimization of Mixed Plastic Waste pyrolysis process: Production of py-oil for steam-cracking to attain plastic circularity

Aim

The objective of this master's thesis is to investigate and optimise the pyrolysis process of mixed plastic waste (MPW) in an industrial plastic pyrolysis pilot plant. The optimization study aims to increase the yield of naphtha phase by reducing the final boiling point of the produced py-oil to below 300°C. The master thesis work will be a part of Horizon-eLECTRO project in collaboration with the R&D centre of Pyrme Cleantech NV.

Justification

Sustainable and economical recycling of mixed plastic wastes (MPW) has the potential to reduce the production of fossil-based virgin plastics therefore reducing the energy utilisation, and emission of greenhouse gases, thus minimising the overall impact on the environment over the life cycle of the product. Therefore, clean, sustainable and economic recycling of plastic waste has gained significant interest in recent times. Pyrolysis of MPW has emerged as a promising technology as the plastic waste can be converted to smaller molecules thus converting them into useful chemical building blocks.



Pyrolysis of plastic waste occurs between 300°C to 600 °C in an inert environment to produce liquid, gas, and char. The produced py-oil feed is used as feed for steam cracker for production of monomers of polyethylene and polypropylene. The yield and composition of the produced oil and gaseous products during pyrolysis are influenced by the type of reactor, operating temperature and pressure, heating rate, and retention time. Therefore, the optimization of the pyrolysis process is of critical importance.

Program

- Literature survey on current trends in pyrolysis of mixed poly-olefins.
- Performing pyrolysis experiments in the pyrolysis pilot plant.
- Investigate and optimise the effect of pyrolysis operating factors and feed on yield of oil, gas and char.
- Perform characterization of produced pyrolysis products using GC×GC, GC-RGA, CHNO, FTIR, ICP, CIC etc.