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Experimental assessment of the hydroconversion of plastic pyrolysis oil and mixtures with diesel

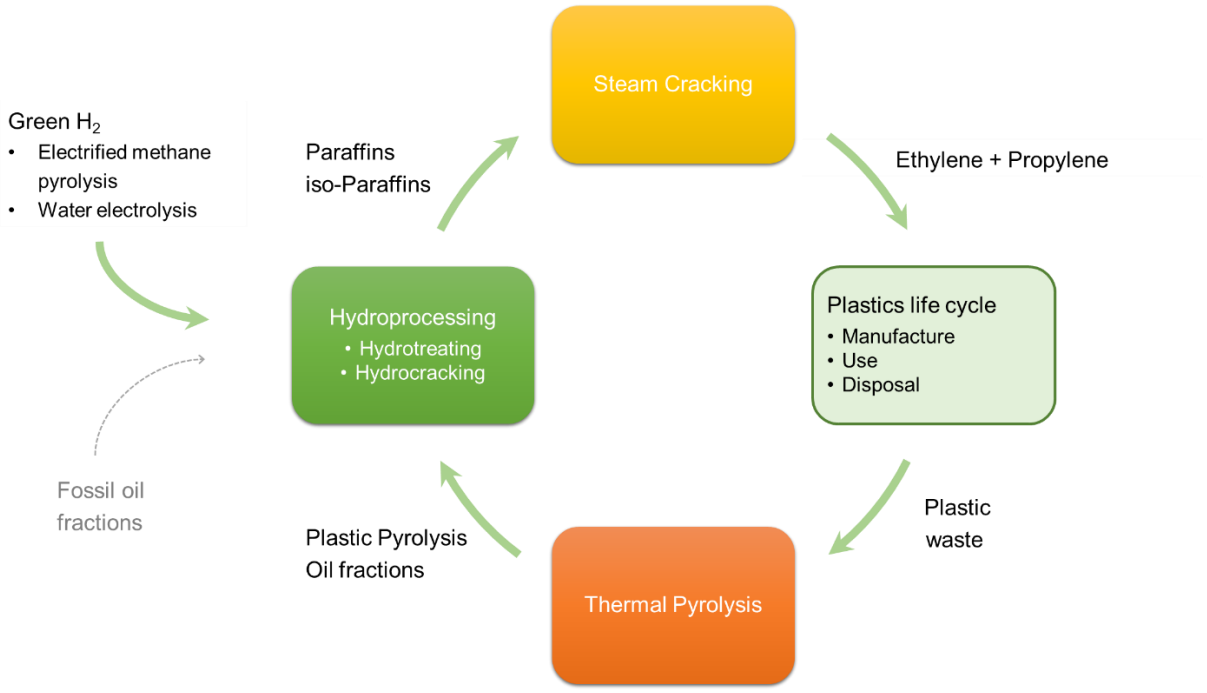
Aim

Experimentally evaluate the hydroprocessing of mixtures of plastic pyrolysis oil and fossil cuts in the diesel range.

Justification

The hydrocarbon industry will be facing important changes in the coming years. Alternative sources of energy and chemicals, such as heavier oils, renewables and plastics derived streams will systematically replace conventional fossil hydrocarbons as the main feed.

The hydroconversion process converting heavy fossil fractions into lighter ones such as naphtha, diesel and jet fuel is well-established. Recently, other process configurations pointing towards circularity have been proposed where the hydrocracker is used as central element in for the production of a synthetic steam cracker feed. An entirely circular scheme can be reached with this configuration if the feedstock also comes from circular sources, such as pyrolysis oil. Mixing pyrolysis oil with fossil fractions in the diesel range as feed for hydrocracking is a representative case study of a circular process scheme. The experimental evaluation of green naphtha, that is suitable for feeding an existing steam cracker for production of sustainable ethylene and propylene that will ultimately be used to produce plastics, will be taken as the basis for this study.



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Program

The evaluation of green naphtha production will be targeted by fulfilling the following steps:

- Short literature survey on the production of circular steam cracker feed, in particular focusing on plastic waste pyrolysis oil and mixtures with crude oil (fractions).
- Map the impact of different operating conditions on the catalytic hydroconversion of pyrolysis oil on the reaction kinetics and product spectrum. Therefore, in particular, the following operating conditions will be experimentally assessed in the Robinson-Mahoney setup:
    - Operating temperature
    - Hydrogen to hydrocarbon ratio
    - Spacetime (i.e. $W_{cat}/F_{hydrocarbons}$)
    - Total pressure
- Experimentally determine the green naphtha yield and composition for mixtures with different ratios of pyrolysis oil to fossil fractions in the diesel range by relying on the kinetic information acquired during the detailed assessment of pure pyrolysis oil.