BIOMASS GASIFICATION-BASED OLEFINS PRODUCTION -PROCESS DESIGN AND MODELING

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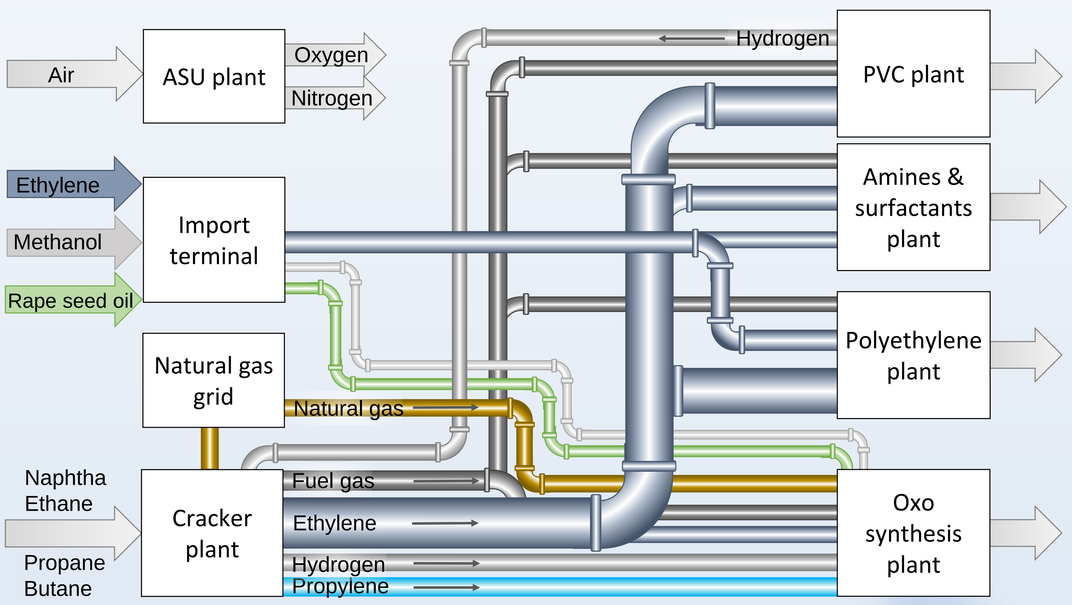
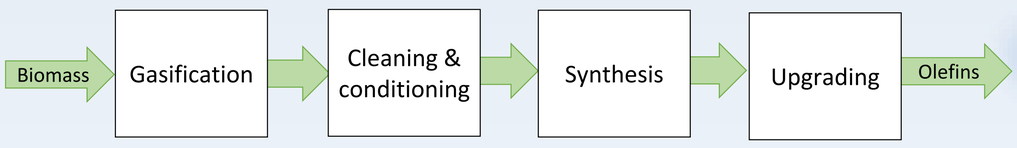
Chemical Process Cluster

A chemical process cluster on the west coast of Sweden is used as a case study to investigate different options to **switch to renewable feedstock**.

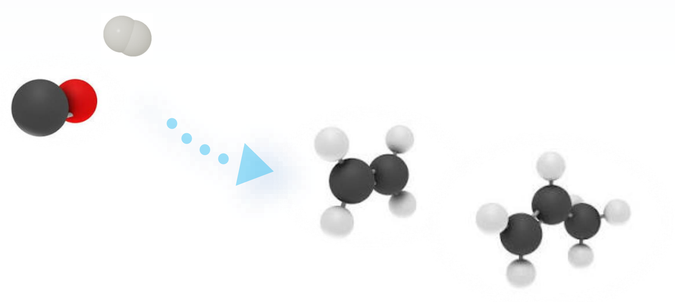


Biomass-Based Value Chain

The production of **light olefins** (ethylene and propylene) via thermochemical gasification of lignocellulosic biomass is one interesting opportunity.



Light olefins can be converted from syngas *e.g.*, via the methanol-to-olefins (MTO) and **dimethyl ether (DME)-to-olefins (DTO)** concepts. Chang and Silvestri [1] found the only difference between the two concepts to be the methanol dehydration, without effect on the hydrocarbon distribution. Accordingly, the difference basically lies within the choice of intermediate chemical and associated syngas conditioning and synthesis.

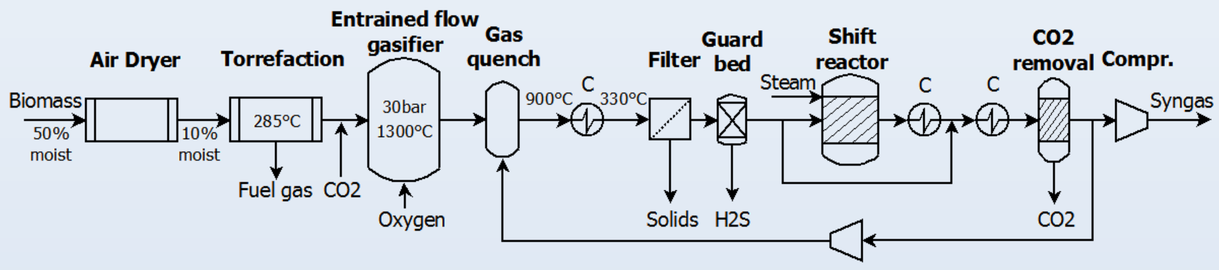


In this Study ...

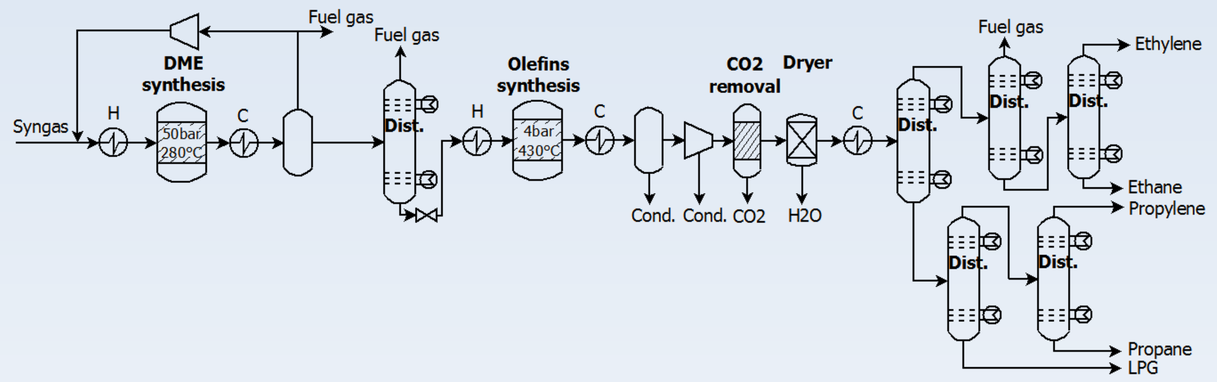
The **process design** and **process modeling** of a biomass-based olefins production process via thermochemical gasification and using dimethyl ether (DME) as an intermediate chemical were studied. Mass and energy balances were obtained by establishing process simulation models in Aspen Plus.

The process was sized to meet the propylene demand of the oxo synthesis plant.

Syngas Production:



Olefins Production:



Preliminary results indicate:
approx. 0.15 kg of light olefins (C2+C3) per kg dry biomass
approx. 0.23 kg of light olefins (C2+C3) per kg syngas
approx. 0.43 kg of light olefins (C2+C3) per kg DME (+MeOH)

Accordingly, to cover the propylene demand at the oxo synthesis plant (190 kt/y) approx. 4500 kt/y biomass (50% moisture) would be required. In addition, approx. 160 kt/y of ethylene could be produced.

Future Study ...

The results from this study is to be used as input for a **process integration study** involving the steam cracker plant at the core of the chemical cluster. The bio-olefins route is also going to be compared with alternative switching opportunities within the cluster.

References: [1] Chang, C. D.; Silvestri, A. J. The conversion of methanol and other O-compounds to hydrocarbons over zeolite catalysts. J. Catal 1977:47(2)249-59.

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