Decentralised SNG production

The SNG production through gasification and subsequent catalytic methanation forms a possibility for an efficient and flexible utilization of solid fuels. In Europe small- to mid-scale decentralised SNG plants are the more viable concepts resulting in specific boundaries:

- A fully developed gas grid for SNG distribution
- Small- to mid-scale due to limited feed-in capacities of the gas grid
- Reduced process complexity

The presented SNG concept originates from the CO2freeSNG2.0 project which was originally dedicated to lignite but can be easily applied for renewable biomass sources.

SNG production in project CO2freeSNG2.0

The combination of CO2 removal with removal of impurities in a single process step reduces the total process complexity. Hence, the proposed process consists of three main steps:

- Isothermal steam gasification in fluidized-bed
- Warm gas scrubbing with K2CO3 for integrated sulfur and CO2 removal
- Two-stage methanation with intermediate water sequestration (Figure 1)

Influence of warm gas scrubbing on methanation step

The integrated CO2 removal upstream of the methanation unit results in a major impact on the fixed bed methanation due to modified C/H/O ratio.

Experimental Results

The experimental campaign with 100 kW Heatpipe Reformer, pre-pilot K2CO3 scrubber and fixed-bed methanation in slip-stream of clean syngas revealed a high methane content after methanation though the CO2 concentration was still very high due to insufficient CO2 removal in the scrubbing step.

Fig. 4 - Gas composition of SNG process chain with 100 kW Heatpipe Reformer, pre-pilot scrubber and fixed-bed methanation in slipstream of clean syngas

Figure 5 summarizes the global deactivation of the fixed-bed within a series of experiments with one single catalyst batch.

Conclusion

The proposed simplified SNG concept is suitable to reach a high methane content, whereas the C/H/O conditioning has to be accomplished within a narrow range in order to reduce catalyst consumption.

Fig. 5 - Global deactivation of catalytic fixed-bed in a series of experiments with real syngas (ignite and biomass derived)