Bio-SNG production from biomass gasification: duration tests with MILENA/OLGA/ESME

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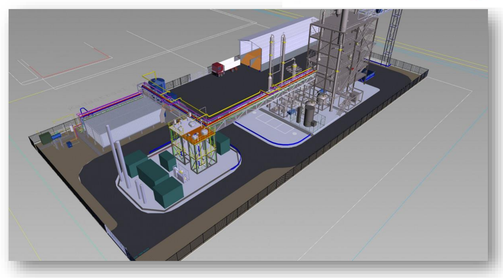
Towards less costly green gas production – creation of 'gas hubs'

- The problem: need for lower production cost of green gas (bio-SNG) and biofuels.
- The proposed solution: development of gas hubs (robust, flexible gas upgrading trains) in gasification plants.
- Flexibility in terms of biomass feedstock and application (bio-SNG, liquid biofuels, H_2 production).
- Final duration tests: demonstration of long-term performance of selected commercial catalysts and sorbents under real gasification conditions → application at AMBIGO bio-SNG plant.

AMBIGO project: 4 MWth bio-SNG plant to be located in Alkmaar (The Netherlands).



MILENA indirect gasification + OLGA tar removal system + ESME methanation = improved efficiency to bio-SNG .

Experimental setup

Beech wood gasification (T < 800° C)

Overview of ESME reactors

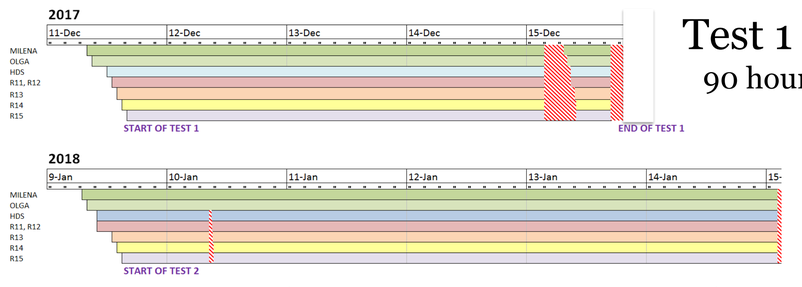
ESME reactor	Catalyst/sorbent	Inlet gas T (°C)	GHSV (1/h)
Hydrodesulfurization	$CoMo/Al_2O_3$ extrudates	310	~ 300
S removal (ZnO bed)	ZnO particles	250	~ 300
Pre-reformer (R13)	N-based tablets	350	~ 2000
Methanation reactors (R14, R15)	Ni-based tablets	250	~ 2000

Conclusions

- Commercial sorbents and catalysts successfully tested for > 220 hours using product gas from wood gasification.
- Complete conversion of organic S compounds, acceptable removal of H_2S and COS, complete conversion of BTX in pre-reformer, complete conversion of CO in the methanation reactors: proper performance of catalysts.
- No signs of catalyst deactivation throughout the experiment.
- Knowledge built to be used as input for the operation of the AMBIGO bio-SNG plant.

Overview of duration tests

Test 2 – 130 hours

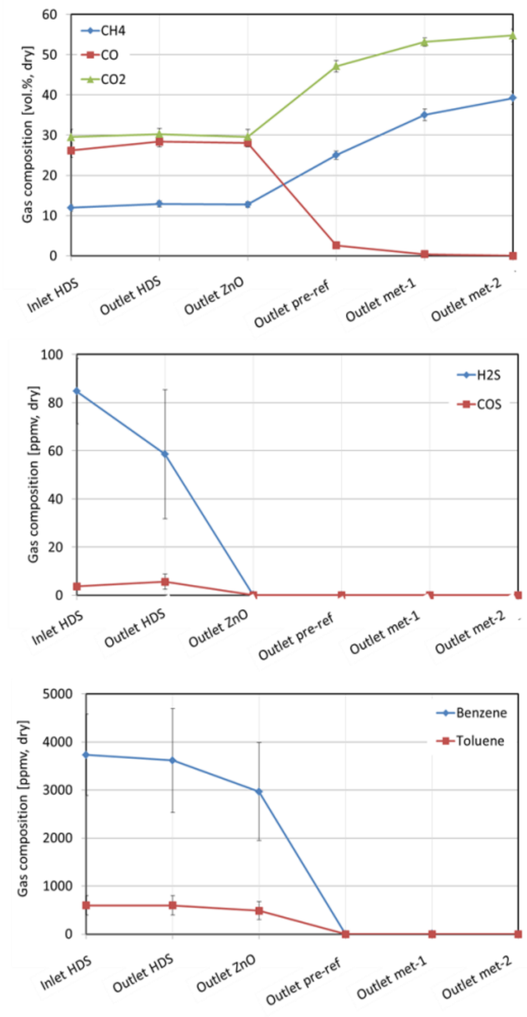


Test 1 – 90 hours

> 90% overall availability

Evolution of gas composition along ESME (test 2)

- Total conversion of CO after the second methanation reactor R15.
- Raw bio-SNG gas : ~40 vol.% CH_4, 3 vol.% H_2 and ~ 50 vol.% CO_2
- Satisfactory operation, of HDS catalyst: complete conversion of organic S compounds and unsaturated hydrocarbons
- ZnO sorbent able to reduce H_2S down to 0.2-0.3 ppmv (acceptable for AMBIGO plant).
- Thiophene- and mercaptan derivatives are largely converted in the top part of the HDS catalyst bed.
- Towards the end of the test, certain signs of shift in the reaction front observed.
- No signs of deactivation due to carbon deposition observed in pre-reformer and methanation catalysts.



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