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# Entrained flow gasification of ash containing slurries for the production of bio-based syngas in the bioliq™ demo-scale plant

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Within the bioliq™ process, solid biomass is converted into synthetic high value liquid fuel components or chemical products. The process chain uses low grade, residual biomass with a low energy density as feedstock that is difficult to use in other processes [1]. The process consists of two main stages: synthesis gas production and synthesis of chemical products. The complete process has been successfully demonstrated and inaugurated in November 2014 and the plant has been operated in several campaigns since. Air Liquide Global E&C Solutions has jointly developed with the Karlsruhe Institute for Technology (KIT) and constructed the first stage of the process, comprising the feed conditioning (pyrolysis) and the gasification unit, based on its own technologies.

The gasification unit consists of intermediate storage tanks, an entrained flow gasifier with cooling screen reactor, water quench, and slag hopper as well as a raw gas washing and cooling part. The plant is equipped with numerous measuring devices and sampling points to study the process in detail. The unit is designed for operating pressures of 40 or 80 bar at a maximum load of 5 $MW_{th}$ or 1000 kg/h feedstock. The gasification is capable to process a wide range of highly viscous slurries (up to 1000 mPas at burner inlet) produced from the products of the biomass pyrolysis. These slurries contain different amounts of bio-tar, charcoal, ashes (chlorine content in feed up to 10,000 ppm), and light condensates (mainly water and organic acids).

Experiments with different slurry types (bio-tar based slurry and charcoal based slurry), both with approx. 3 – 5 wt% ash, were used for the first experiments to verify the design basis and to derive and validate different tools. Heat- and mass balancing of the plant showed a very good accuracy. Special focus was put on the carbon conversion and the slag thickness distribution on the cooling screen. A simplified model for the calculation of the slag thickness during operation has been developed and will be presented. Based on the extracted heat flux from the reactor, the model is capable to predict the local slag thickness or vice versa for both process pressures. Additionally, the distribution of slag or ashes within the unit has been analysed. Particle size distribution and elementary composition were carried out with samples collected from the slag hopper.

Reference

[1] www.bioliq.de.