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Behaviour and Control of Slags from the „bioliq®“-Gasifier

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Abstract

Thermal conversion of low-grade biomass has the potential to produce high-quality and flexible end products. The bioliq®-process developed at KIT in Karlsruhe is one example for such a conversion process. Straw is used as feedstock which is initially converted via fast pyrolysis. The formed intermediate fuel consists of organic condensate and char. This bioslurry is fed into a pressurized entrained flow gasifier in the following step of the process chain. The gasification product is a tar-free, low-methane containing syngas for the production of biofuel.
The high temperatures of entrained flow gasification with pure oxygen as gasification agent lead to melting of the ash components of the slurry. The formed slag flows down the inner wall and protects the cooling screen against corrosion. For a smooth operation a continuous removal of the slag is essential. Therefore, a defined range of viscosity has to be achieved to prevent a break of the protective layer at too low viscosities and avoid blockages of the reactor outlet at too high viscosities.
At first, viscosities of slags from the gasifier were measured using a high temperature viscosimeter. Thereby, a benchmark was defined to describe the viscosity range for ideal working conditions in the gasifier. Additionally, the determined chemical composition of the slags was used to calculate viscosity values and validate them with the experimentally obtained results. The bioliq-slags are characterized by high Si-contents which tend to form a slag with high viscosity. Therefore, higher temperatures in the gasifier are needed to prevent blockages. Since high temperatures shall be avoided for economic reasons, the addition of alkaline metals is an appropriate alternative. The network modifying properties of alkaline oxides lead to a lower viscosity. The influence on the slag viscosity is investigated experimentally and by calculation. Based on the obtained results economically feasible flux materials are suggested to adjust the desired range of viscosity in the gasifier.