An investigation on the behaviour of nitrogen based impurities over a water gas shift stage and a biodiesel scrubber

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Hydrogen plays a major role in chemical industries. Refineries have huge demand on hydrogen for their hydro processing stages, which is mainly based on fossil fuel. To fulfil EU aims, an alternative way of hydrogen production was investigated.
Between 2012 and 2015 a pilot plant for hydrogen production out of lignocellulosic feedstock was installed on the side of a commercial fluidised bed gasifier in Güssing, Austria (CHP). The function of the plant was proven and first experimental results could be obtained.
Now optimisation processes are ongoing focussing, on the optimization of the plant for lower feedstock quality, which results in lower operation costs. In this work, the behaviour of nitrogen based impurities over a water gas shift (WGS) stage and a biodiesel scrubber used together as a gas treatment stage for a hydrogen production plant based on biomass gasification were investigated. Raw gas is extracted from the CHP after a dust removal. At the gas outtake temperatures of 150 °C are common. A Fe/Cr based water gas shift catalyst was used. To investigate the behaviour of impurities, extensive chemical analyses were carried out. The activity of the Fe/Cr catalyst was determined, by measuring the CO concentration in the tail gas. Also the performance of the biodiesel scrubber was observed and samples of biodiesel were taken.
A stable CO conversion over several days could be detected. Also a hydration of HCN could be observed over the water gas shift stage. An ammonia reduction could be measured over the whole gas treatment stage. Results show, that the gas treatment stage is able to remove nitrogen based process poisons, which are problematically for a hydrogen production plant.
Beside hydrogen production the gas treatment setup seems also to be a promising application to adjust the CO to H_2 ratio and clean gas for synthesis gas applications like methanation, Fischer Tropsch synthesis, dimethyl ether synthesis and mixed alcohols production.

Keywords: hydrogen, gas cleaning, gas treatment, impurities, ammonia, hydrocyanic acid