The co-firing of biomass with coal in retro-fitted pulverised fuel power stations is seen as one cost-effective opportunity to reduce carbon dioxide emissions. Currently either higher shares of high quality biomass (e.g. wood) or limited ratios of low quality biomass (e.g. straw) are co-fired. Ash-related problems, namely fast deposit built-up and corrosion due to high potassium-chloride content in low-quality biomass, have limited the amount of co-fired difficult biogenic materials. Therefore, a measurement campaign in an externally heated entrained flow reactor co-firing two types of bituminous coal with straw at elevated shares was performed. The goal was the investigation of the release and the reaction path of chlorine during co-combustion of blends with a share of 0, 10, 25, 40, 60, 100 % straw on dry energy basis. Therefore, the HCl amount in the flue gas was quantified using conventional IR-methods and wet-chemical analysis according to DIN EN 1911. Extensive fuel and ash analysis comprising of proximate & ultimate analysis, ash analysis,
computer-controlled scanning electron microscopy and chemical fractionation were implemented. Combustion experiments were conducted at 1200 °C reactor temperature and an excess oxygen ratio of 3 – 5 vol-% resembling power plant conditions. Fuel input was kept constant at 8 kWth for every fuel blend. The HCl content in the flue gas was measured at one position in the heated zone of the reactor and in the flue gas duct at approx. 350 °C. Gaseous HCl emissions measured by IR method in the flue gas duct increased from 9.6 mg/Nm³ dry 6 % O2 for pure coal combustion to a maximum 215.3 mg/Nm³ dry 6 % O2 for the 40 % Straw/Columbian coal blend, dropping to 170.2 mg/Nm³ dry 6 % O2 for pure straw combustion. This indicates a higher release of KCl during straw combustion and therefore decreasing alkali capture by chemisorption in alumina-silicates for blends with a straw share exceeding approx. 40 %. For the second fuel blend of South African coal and straw the maximum HCl content in the flue gas is 245.7 mg/Nm³ dry 6 % O2 at 60 % straw. Therefore, a better alkali capture at higher straw shares during co-combustion with South African Coal is assumed. Additionally, chemical equilibrium calculations have been performed using the Software package FactSage 7.0 ®. Calculated concentrations of HCl are in good agreement with the measured values.

Stichworte: Chlorine; straw; coal; co-firing; pulverised-fuel; alkali-chlorides; hydrogen-chloride; sulphation; chemisorption; alumina-silicates

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