Measurement of Fine Particle Emissions from Two Commercially Operated Medium Sized Biomass Fired Boilers

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CHARACTERISATION OF FINE PARTICLE EMISSIONS FROM TWO COMMERCIALLY OPERATED MEDIUM SIZED BIOMASS FIRED BOILERS

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There is a directive from the European Union limiting the particle concentration in air corresponding to PM10 and PM2.5 respectively to avoid negative effects on the human health and the environment. It is therefore of interest to minimize the particle emission also from biomass combustion in medium scale combustors. Ash-forming constituents have an effect on plant operation and emissions from the combustion process. The inorganic vapor present in the flue gas may also form and change the particle-phase via nucleation, chemical surface reaction and condensation. For instance, during grate combustion of straw (Christensen 1996) and fluidized-bed combustion of willow (Valmari 1998), submicrometer ash particles of KCl and K_2SO_4 were observed. Detailed information about fly ash particle characteristics and ash transformation mechanisms are desirable in order to develop methods to decrease both ash deposition problems and the fine particle emission.

Measurements on fine particle emissions were performed in two grate fired boilers of similar design. The boilers are designed for an effect of 1.0 and 1.5 MW respectively and were in commercial use during the measurements. Boiler no.1 was fueled with woodwaste (high humidity) and boiler no.2 was fueled with dry sawdust from furniture industry. A multicyclone after the burner removes coarse particles. All particle sampling were performed between the multicyclone and the stack. A dilution probe was used to sample the flue gases. A cyclone (calculated cut off point 4 micrometers) was used to remove coarse particles penetrating the multicyclone. Fine particle emissions were studied using an electrical mobility spectrometer (SMPS, TSI), a low pressure cascade impactor (Dekati) and a time of flight instrument (APS, TSI). The impactor substrates were analysed using PIXE in order to achieve size resolved elemental composition.

Preliminary results show a sub-micrometer mode between 100- 200 nm (number weighted size distribution) in both boilers. Particle concentrations (14 – 800 nm) in the flue gas range between 1 – 4*10E7 particles per cm3.

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Topic: Combustion/Combustion

We wish a poster presentation

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