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2011

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Keywords: APM, AMS, wood stove, biomass combustion
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Combustion of biomass fuels for residential heating is considered to be a climate friendly option and is increasing globally. However, this implies potentially increased emissions of aerosol particles. $PM_{2.5}$, which is to a large extent comprised by combustion generated particle matter, co-varies with cardio vascular diseases (Kochbach *et al.* 2009). Soot and organic carbon which are produced under incomplete combustion conditions are considered to be more harmful to human health than ash particles produced under optimal combustion conditions (Kochbach *et al.* 2009). The aim of this paper is to study the change in aerosol properties due to different combustion conditions.

A total of five combustion cases were studied using three residential wood combustion appliances; *i*) a conventional wood stove operated with high load, *ii*) a conventional wood stove operated with low load, *iii*) a modern pellet burner operated under optimal conditions *iv*) a novel pellet reactor operating on optimal conditions *v*) a novel pellet reactor operating under air starved conditions. Conventional wood pellets or birch wood logs (14 % moisture content) was used. Gas concentrations and particle characteristics from the combustion cases are shown in table 1.

Table 1: Particle characteristics and gas concentrations from the five combustion cases.

Case	O_2 (%)	CO (mg/MJ)	Total conc. (#*10^7/cm^3)	Org (AMS) (mg/MJ)
i	9.3±5,4	3020	2.7±1.1	9.4
ii	11.8±2,4	2590	1.6±0.8	8.6
iii	8.2±1.0	110±38	8.4±0.4	0.32
iv	11.1±1.2	120±67	6.1±0.2	0.45
v	5.3±2.0	700± 1390	3.0±0.8	6.5

The aerosol from the combustion appliances was diluted 1000-3000 times to ambient concentrations, before sampling. A high resolution aerosol mass spectrometer (HR-TOF-AMS, Aerodyne research Inc.) was used for size resolved composition of compounds vaporised at 600°C. A scanning mobility particle sizer was used for mobility size distributions (10-600 nm) and an aerosol particle mass analyser operated downstream a differential mobility analyser and an optional thermodenuder (DMA-TD-APM) was used to determine the mass mobility relationship and assess the size dependent organic mass fraction.

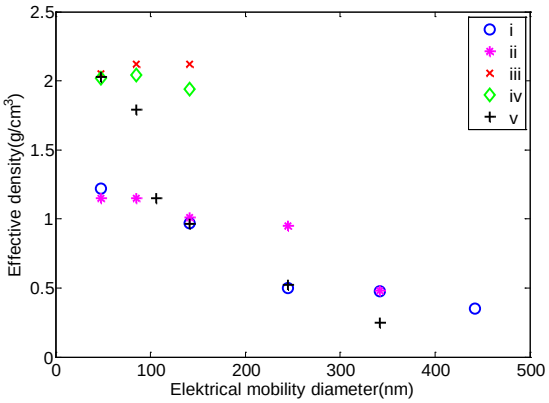

Figure 1: The effective density from the combustion cases.

The effective density from DMA-APM measurements (figure 1) gives an indication of the particle shape and composition. Salt aerosols have a relatively high effective density, which does not change with increasing mobility diameter, due to their spherical shape. Soot particle on the other hand have a lower effective density which is decreasing with increased size, due to their agglomerated shape. The aerosol from case *iii* and *iv* consists of spherical alkali salt particles, with little organic contribution. When the novel pellet reactor is operated under air starved conditions (*v*) the aerosol consists of both salt and soot particles, which are produced during different stages of the combustion cycle. The aerosols from case *i and ii* is dominated by soot particles and organic carbon.

The present on-line characterisation study gives novel detailed information of the aerosol emission properties from different kinds of biomass combustion.

This work was supported by the Swedish Energy Agency, FORMAS and METALUND.

Kocbach Bølling A., Pagels J., Yttri K-E., Barregard L., Sällsten G., Schwarze PE., Boman C. (2009) *Health effects of residential wood smoke particles: the importance of combustion conditions and physicochemical particle characteristics*. Particle & Fibre Toxicology, 6