

# Biomass Combustion in Stoves – Influence on Emissions and Toxic Potential of Particles

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Wood stoves are widely used and can emit high fractions of gaseous and particulate matter (PME) depending on several impacts such as wood log size, fuel mass loaded per batch, moisture content and fuel type. From the obtained results recommendations for fuel properties and reloading strategies are given.

Measurements were performed using two different chimney stoves and one tiled stove insert. One of the chimney stoves used was suitable for coal combustion. All stoves were fired usually with beech wood which was prepared as cuboid-shaped test fuels in accordance to the Norwegian test standard NS 3058. The log size of the test fuel shape was varied between 5x5 cm, 7x7 cm and 9x9 cm. The fuel load applied ranged between 30 and 167 % based on the nominal heat output of the stoves using the medium sized logs with 7x7 cm. Measurements on particle and gaseous emissions were performed. The combustion test stand was equipped with a parallel sampling of particles from a diluted and undiluted flue gas in order to allow the identification of excessive particle emissions due to condensation of hydrocarbons for all test trials. The collected particle emission from the diluted flue gas were further chemically analysed for e. g. polycyclic aromatic hydrocarbons (PAH).

The determined PAH values were used for the estimation of the toxic equivalents (TEQ) of the emitted PM based on the weighing factors of the different 16 EPA PAH using the proposal of the DFG since different PAH have different health risk potentials. During the measurements gaseous emissions such as CO and organic gaseous carbon (OGC) as well as particle emission in the undiluted (hot) and diluted (cooled) flue gas were also determined.

The PME measurement in the diluted flue gas (samples taken at temperatures below 50°C) clearly shows more pronounced effects on combustion conditions compared to PME measurement done in the hot (undiluted) flue gas as it is typically done for type testing. But if PAHs are also considered in this comparison some differences are observed.

For example the mass loaded per batch was varied for 3 combustion appliances. For all furnaces there was a good agreement on the PME trend from low load to an overload. With respect PME only, one could also conclude that the second chimney stove performs better than the first chimney stove, see Figure 1. But if PAH-emissions are considered the opposite conclusion can be drawn. Figure 2 shows that chimney stove 2

causes a higher toxic potential (TEQ) at low load and at overload compared to the first chimney stove.

Such investigations were also performed with variable fuel moisture contents (spruce and beech wood) using chimney stove 1. In addition, results shall also be presented for several other fuels which were burnt in all three appliances including wood and pure bark briquettes.

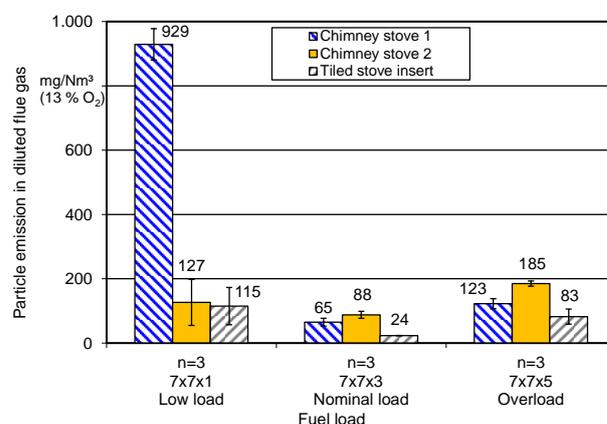


Figure 1. Influence of fuel mass loaded per batch on PM emissions determined in the diluted flue from 3 different appliances (fuel used: beech wood logs)

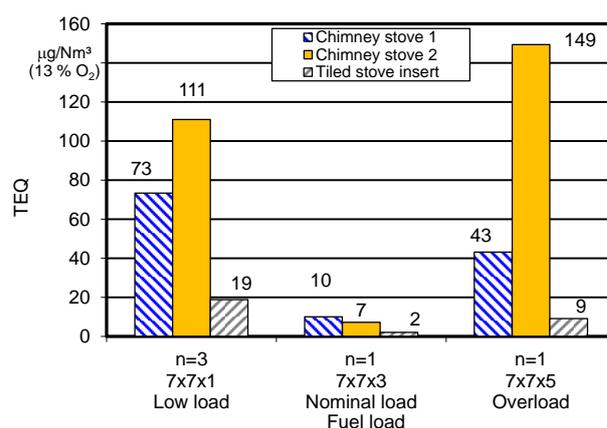


Figure 2. Influence of fuel mass loaded per batch on PAH emission, expressed as toxic potential (TEQ), from 3 different appliances (fuel used: beech wood logs).

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