

EMISSIONS OF HARMFUL ELEMENTS AND ORGANIC POLLUTANTS FROM SMALL SCALE WOOD COMBUSTION SYSTEMS

HANS RUPPERT^{1*}, TORBEN SEIDEL¹, JUERGEN ORASCHE²

¹*Geoscience Center, University of Goettingen, Goettingen, 37077, Germany*

²*HelmholtzZentrum Muenchen, Institute of Ecological Chemistry, Neuherberg, 85764, Germany*

hrupper@gwdg.de

The application of wood as a heat supplier may reduce the greenhouse gas effect, the shortage of fossil energy sources and the dependency from fossil fuels. Wood combustion in Europe is widely applied e.g. for residential heating in stoves and boilers. About 14 Million out of 40 Million households in Germany own small-scale wood-burning furnaces. We investigated how the air quality changes due to the emissions of harmful elements and organic pollutants during wood combustion. Especially compounds bound on fine (<1µm) and ultrafine (<0.1µm) particles or gaseous compounds may enter the alveoli of the lung and trespass into the blood.

Methods Some systematic burning experiments with wood pellets, chips and logs were performed by using state-of-the-art small-scale combustion systems. The wood-burning furnaces tested already hold optimized emission characteristics. To collect the hazardous fly ash, an innovative filter holder consisting of PTFE with a 150mm diameter is used in our study. It guarantees sufficient material for the analysis and assures a low contamination background.

Results **Heavy metals:** To get a reliable reconstruction of element fluxes for input/output balances, we analyzed beside the wood samples all the originating ashes e.g. grate ash, heat exchanger ash and fly ash. The element amounts of Cd, Zn, Sn, Tl, Pb, Bi, and Sb contained in the ashes were 10-80 % lower than their amounts contained in the fuel even if emission reduction facilities such as a flue gas condenser or an electrostatic precipitator were installed. This takes effect in all automatically fuelled furnaces. This insufficient retention suggests that portions of these elements are quasi-gaseous and can leave the furnaces as gas or as very fine nucleated particles and are presumably able to trespass cell membranes. **Organic pollutants:** The concentration of organic compounds strongly depends on the kind of the fuel, the furnace and on the combustion conditions. The emission of the pollutant PAH (especially Benzo(a)pyrene) is below detection limit in the wood pellet boiler, is increasing in the wood- chip furnace and is above a factor 100 higher in a wood log fuelled fireplaces indicating inappropriate conditions for complete oxidation. This is very critical because 6 Million fireplaces exist alone in Germany. Other organic parameters such as levoglucosane, abietic acid and oxidized PAH show a similar trend. An effective reduction of the emissions is necessary.

Keywords: wood burning, heavy metal emission, organic pollutant emission