

## Trace elements in Swedish bio fuel stove ashes

MATTIAS BÄCKSTRÖM<sup>1</sup>

<sup>1</sup>Örebro University, Fakultetsgatan 1, 701 82 Örebro, Sweden

\*correspondence: mattias.backstrom@oru.se

Stove ashes were collected from private homes in order to determine primarily cadmium concentrations and potential human health issues. Elements were analysed in almost 150 samples. All stoves were used for heating and all of them used bio fuels either as firewood (n 146) or pellets (n 7). Some home owners have reported that minor amounts of painted wood, cardboard or other household waste has been incinerated. Despite using almost only bio fuels trace element concentrations were generally high; As 0.10-2 150 mg/kg (av. 47 mg/kg); Cd 0.05-30 mg/kg (av. 3.2 mg/kg); Cr 1.0-1 070 mg/kg (av. 55 mg/kg); Cu 27-3 100 mg/kg (av. 300 mg/kg); Pb 2.0-10 000 mg/kg (av. 110 mg/kg); Sb 0.06-76 mg/kg (av. 2.1 mg/kg) and Zn 130-10 000 mg/kg (av. 2 700 mg/kg). These ranges and averages exceed what is expected to be found from larger boilers using bio fuels [1] or even household and industrial waste [2].

High arsenic concentrations is an indication that impregnated wood (for instance CCA) has been incinerated. This is supported by the fact that the highest arsenic concentrations are followed by high concentrations of chromium and copper. High antimony concentrations is an indication that fire protected plastics may have been incinerated.

Wood pellets, that are supposed to consist of pure secondary wood materials (for instance sawdust etc) seem to generate ashes with the highest concentrations of cadmium (16.4 mg/kg for pellets compared to 2.6 mg/kg for firewood).

A more detailed sampling clearly shows that cadmium is enriched in fly ash fractions along the flue gas path. Cadmium concentrations as high as 500 mg/kg was noted in some fractions. Cadmium concentrations in the bottom ashes are very low, indicating that cadmium is being vaporized during incineration. From a human health perspective this is of importance since most people heating their homes with bio fuels will use their ashes in their gardens. Obtained results indicate that fly ashes should not in general be used for growing produce, while bottom ashes on the other hand in general is safe to use.

Relationships between different elements are also being discussed in relation to different firewood being used.

[1] Vassilev SV *et al.* (2014) Fuel **129** 292-313. [2] Saqib and Bäckström (2014) Waste Management **34** 2505-2519