Illegal “fuel” in Private Wood-Burning Stoves

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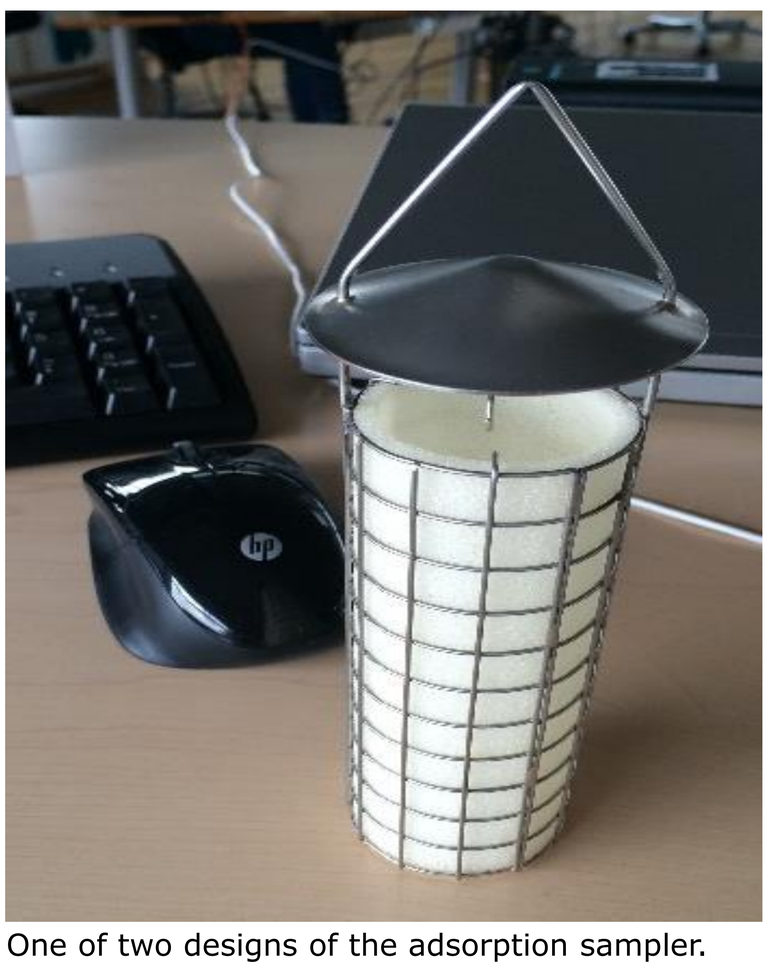
Introduction

Burning of illegal “fuel” in private wood-burning stoves is an area that the Danish authorities in recent years have been giving increased focus. “Fuel types” comprise CCA-wood (copper, chrome and arsenic impregnated wood), creosote wood (old railroad sleepers and telephone poles), painted wood, wood with remains of PCB containing joint filler (polychlorinated biphenyl), paint and lacquer, a combination of milk cartons, gift wrapping paper and catalogues, pallet wood, and laminate wood.

Danish municipalities

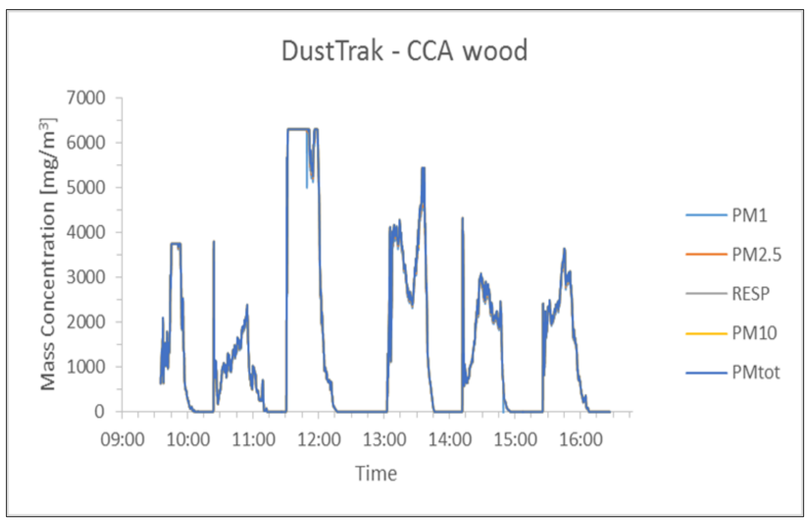
Participated along with chimney sweepers in order to find the optimum solution for detecting burning of illegal “fuels”. A comprehensive survey among all Danish municipalities and most chimney sweepers showed how profound the use of illegal “fuels” are in Denmark.

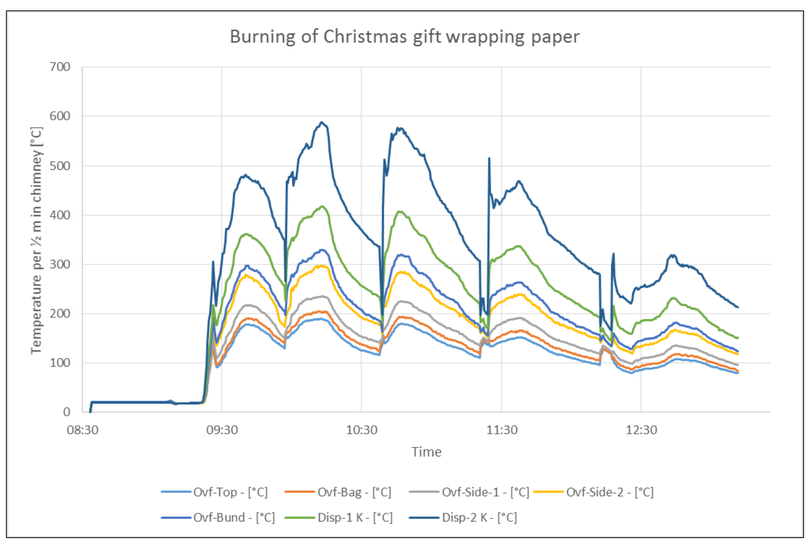


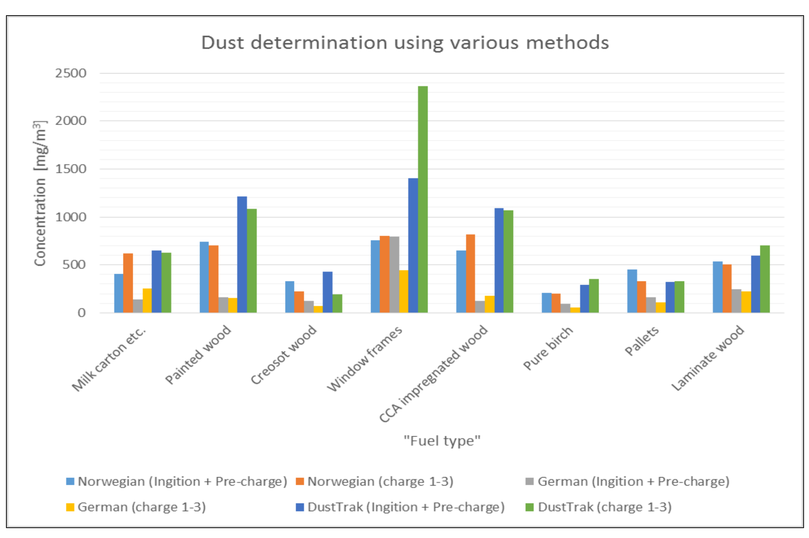
One of two designs of the adsorption sampler.

Adsorption sampler for powder materials.

PM and temperature







Development of adsorption sampler

The idea was to develop an adsorption sampler to fit all chimneys. The sampler should passive adsorb the unique chemical components/particles from the various illegal burned “fuel types”. New methods in the chemical laboratory for soot and ash analyses were also developed.

Particle measure-ment methods

Particle emissions have been measured using an SMPS (14-710 nm), DustTrak and P-Trak, all from TSI. A rotating disc diluter from Matter was used in the dilution tunnel before SMPS and P-Trak. DustTrak was used directly in dilution tunnel.

Results

- Adsorption sampler not obtainable
- Temperatures in chimney too high
- Alarming increase in dust gene-ration from illegal “fuels” – up to 7 times more than ordinary wood
- Burning of CCA wood can be detected in the ash
- Variations between different dust measurement methods (German, Norwegian and Online). Online fits within a factor of 2.

Particle emissions from creosote wood	Ignition phase	Pre-charge	1. charge	2. charge	3. charge
SMPS, avg. [#/cm³]	3.8E+07	3.0E+07	2.4E+07	3.3E+07	3.2E+07
SMPS, mean diameter [nm]	132	118	118	124	101
P-Trak, avg. [#/cm³]	2.9E+07	3.4E+07	2.1E+07	2.4E+07	2.4E+07
DustTrak, avg. PMtotal [mg/m³]	480	213	166	269	158
Particle emissions from (pure) birch	**Ignition phase**	**Pre-charge**	**1. charge**	**2. charge**	**3. charge**
SMPS, avg. [#/cm³]	2.8E7	1.9E7	2.1E7	2.5E7	2.9E7
SMPS, mean diameter [nm]	133	106	102	104	94
P-Trak, avg. [#/cm³]	2.5E7	1.7E7	2.4E7	1.8E7	1.7E7
DustTrak, avg. PMtotal [mg/m³]	271	154	142	504	335

This study is part of a recent completed Danish project, co-financed by the Danish Environmental Protection Agency, constituted by Danish Technological Institute, several Danish municipalities and chimneysweepers, e.g. the president and vice-president of their professional network.