

# Direct Mass Spectrometric Analysis of PM<sub>2.5</sub> Filters Sampled in Dwellings using Low Temperature Plasma Ionization

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## Novel aspect

Novel approach for direct analysis of PM<sub>2.5</sub>-filters without sample preparation by use of one of the latest ionization techniques, LTP.

## Introduction

Respirable particles (PM<sub>2.5</sub>) is a known risk factor for adverse health effects such as cardiovascular diseases and respiratory symptoms. The particle size is not the only factor that determines the health effects. Different chemical components of the particles also contribute.

Five Danish dwellings were subject to an indoor air pilot study during a one-year period (2010/2011). In order to identify the chemical compounds on the PM<sub>2.5</sub> filters, a setup with low temperature plasma ionization (LTP) and a Q-TOF mass spectrometer was utilized. The LTP ionizes compounds directly from the filters without sample preparation and without the destruction of the filter. This yields a powerful method for fast and direct mass spectrometric analysis of particle filters.

## Methods

Samples were collected on Teflon filters with a flow of 4 l/min for 4 days resulting in a sample volume of 5700 l. A cyclone was used to size separate the PM<sub>2.5</sub> fraction. The filters were analyzed directly by use of an in-house built LTP probe [1] coupled to a Bruker microTOF-Q mass spectrometer. Helium was used as discharge gas at a flow of 0.4 L/min. The analyses were carried out under ambient conditions by use of both positive and negative mode. CID experiments were carried out for major compounds. The TIC signal ( $m/z$  45-3000) from an unexposed filter was collected and used for background subtraction. The data from samples was averaged 2-3 different spots on each filter.

## Preliminary data – Limit 300 words

In negative mode, the most abundant masses were  $m/z$  199, 227, 241, 255 and 283. These correspond to the homologous series of saturated fatty acids (C<sub>12</sub>-C<sub>18</sub>), with  $m/z$  241 as the only

ion with an uneven number of carbon atoms (C15). The dominating peak,  $m/z$  255 (C16), is the saturated form of the monounsaturated fatty acid, sapienic acid; this is a major component of human sebum [2], and therefore expected to be found in significant amounts in house dust. This indicates that a hydrogenation (reduction) of the double bond occur, either during aging of the dust or, most likely, during the ionization process. The preliminary results suggest that the presence of a dog in one home had an effect on the composition of the fatty acids found in the house dust. This can be found as an increase in the  $m/z$  283. Such an increase was not seen in the home with feline inhabitants.

In the positive mode, the most abundant masses were  $m/z$  113, 149, 167, 257, 285 and 391. The peaks of  $m/z$  149 and 167 are fragments characteristic of the phthalate backbone ( $C_8H_5O_3^+$  and  $C_8H_7O_4^+$ , respectively). The peaks of  $m/z$  113 and 391 are characteristic of di(2-ethylhexyl) phthalate (DEHP) or other phthalates with similar substitution ( $C_8H_{17}^+$  and  $C_{24}H_{39}O_4^+$ , respectively). The peak of  $m/z$  257 originated from the  $C_{16}$  saturated fatty acid, which was also observed in the negative mode.

The data showed significant differences in the composition both within the same dwelling, between dwellings and between seasons.

#### References:

1. Harper J.D., Charipar N.A, Mulligan C.C., Zhang X., Cooks R.G. and Ouyang Z. 2008. *Analytical Chemistry* 80(23), 9097-9104
2. Drake D.R., Brogden K.A., Dawson, D.V. and Werts P.W. 2008. *The Journal of Lipid Research*, 49, 4-11

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**Poster selection:** Direct ionization, applications