

APPLICATIONS

At the National Environmental Research Institute we have analysed many different types of samples ranging from meteorites, dinosaur eggs, commercial plastics, various biological samples to sediments and fly ash. But the main application at the PIXE facility of the National Environmental Research Institute is aerosol analysis. The PIXE measurements are an integrated part in the air quality monitoring programs in Denmark. The analyses are accredited according to the ISO 17025 standard. At present around 7000 samples per year are analysed in three national networks – a background network, an urban network in several cities and an urban network in the Greater Copenhagen Area.

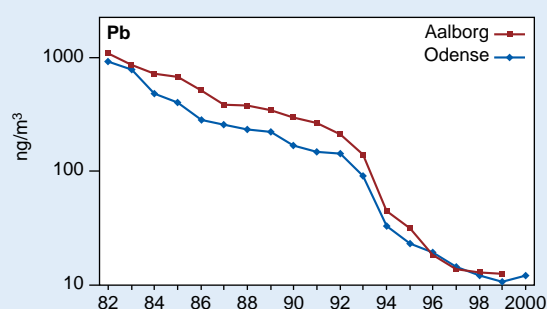
PIXE analyses are also performed in the arctic measuring programmes in Greenland. Aerosols have been collected both in the far Northeast and on the ice cap. The many numbers enables a reliable statistical interpretation of trends and source contributions by means of time series analysis and multivariate statistics. Some examples, which illustrate the different types of results, are discussed in the following.

Effects on air pollution of the structural changes in Eastern Europe

Two Danish measuring stations have been collecting daily samples since 1979 as a part of an European monitoring network for assessment of the long-range transport of air pollutants. Based on calculations of back trajectory the measurements are divided in eight groups corresponding to transport from North, Northeast, East etc. Source apportionment – based on receptor modelling for long-range transport – has been calculated using simultaneous results from several measuring stations. There has been a steady decrease from Western Europe as a consequence of better emission control, while the East European contribution was increasing up to and shortly after the structural changes around 1990 and decreasing in the following years.

Trend in urban air pollution

Daily measurements of air pollution have been performed continuously in Danish cities since 1982. One of the most striking features during this period has been the result of the removal of lead from petrol. The concentration measured at busy streets was about $1 \mu\text{g}/\text{m}^3$ Pb in 1982, i.e. twice the guideline value recommended by WHO. Only 1-2 % remains today where Pb is no longer added to petrol. The present urban level is less than twice the level in rural areas. This means that a major part of the Pb even at busy streets comes from sources outside the city.



The figure shows the trend for the Pb concentration measured at busy streets in two Danish cities.

Air pollution in Northeast Greenland

During 11 years weekly measurements have been performed at Station Nord in the far northeastern corner of Greenland. Receptor model calculations, including 15 elements determined by PIXE, have been performed for the whole period. The model calculations show that a large amount of anthropogenic-derived pollution is transported from Asia and Europe across the North Pole during the winter season. Thus creating peak values of pollution at this very remote place at the same level as the average pollution in the northern part of Central Europe.

Further information

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