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110362, PIXE ANALYSIS OF ENVIRONMENTAL SAMPLES

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Particle induced X-ray emission (PIXE-)analysis constitutes a fast reliable method for multielemental analysis with low detection limits. The method is especially suited for small samples (1 μg - 1 mg total mass). Its mass calibration is checked within a minute or two. The possibility of simultaneous applications of other nuclear techniques for the analysis of lighter elements extends the merits of PIXE for some types of environmental samples considerably.

At our laboratory routinely 2.5 MeV protons are used to induce X-rays, which are detected in 135° in a 80 mm² Si(Li)-detector. Work is in progress to optimize the arrangement and the parameters for simultaneous PIXE and low Z backscattering analysis. A sample typically requires 1 - 4 minutes for analysis. Before and after the analysis of every container holding 40 samples, a two-element standard is run. The arrangement is very stable and the results of the standard runs are routinely reproducible at the 5 % level.

The PIXE method is well suited for studies of elemental composition of airborne particulates. Due to its capability to analyse small samples, small and convenient samplers may be used. Due to its speed and low cost many samples may be analysed. Thus PIXE offers the possibility of good time, size and site resolution. These features will be illustrated by results from two investigations performed in Sweden. In the first of them a 6-stage single orifice cascade impactor was used. It was e.g. found that air masses coming from the south-west contained 10 to 30 times more of the antropogenic small particle elements sulfur, lead and copper than those coming from the north-west. In the second investigation a sampler of a special continuous time sequence design (J.W.Nelson, Dept of Physics, FSU, Tallahassee) was used. This filter sampler gives a time resolution of about 2 hours and a sample from more than one week is contained in a 5 mm wide and about 170 mm long streak.

Detection limits for trace elements in e.g. sea and rain water below the 0.1 ppb level are obtained by using a technique involving complex-binding and adsorption on activated carbon.