

Aristotle University of Thessaloniki ENVILAB Prof. Konstantinos Fytianos; Christoforos Christoforidis	Environmental Analysis
---	-------------------------------

Environmental Pollution Analysis

THE DETERMINATION OF LEAD (Pb) IN AIRBOURNE PARTICULATE MATTER

Lead is an extremely toxic heavy metal, known to cause a great number of environmental problems, due to its wide use in numerous technological applications and its increased toxicity and bioaccumulation properties. The main pollution sources are the lead-containing compounds extensively used as gasoline additives in the past. Moreover, it has been used in pigments, lead pipes, batteries, and it is a by-product of coal combustion, foundries, steel and metal plating industries.

It is extremely toxic, mainly due to its effect on the central nervous system and biochemical mechanisms of the brain. Lead can be transferred in the human organism through breathing, water and food intake, although respiration is the main intake route (50% absorption).

Sampling of particulate matter

An air-sampler is used, equipped with filters with pores $<0.3\mu\text{m}$ in diameter and large volume sampling capacity. The sampler is capable of pumping $1.2\text{-}1.7\text{ m}^3\cdot\text{min}^{-1}$

Method of determination

The determination of lead is accomplished using Atomic Absorption Spectroscopy after the desolventation of lead with extraction using acid solutions ($\text{HNO}_3\text{-HCl}$) in an ultrasound bath. The use of ultrasound accelerates the extraction output without heating.

After the extraction of lead, the extract is centrifuged and the supernatant collected and analyzed for lead using Graphite Furnace Atomic Absorption Spectroscopy. The quantification of the heavy metal is based on the comparison of the Absorption values with the absorption values of the standard solutions (calibration curve)

Reagents used:

1. Acid solutions: 167 mL c. HNO_3 with 77 mL c. HCl
2. Standard solution of $\text{Pb}(\text{NO}_3)_2$ 10 mg/L



Aristotle University of Thessaloniki ENVILAB Prof. Konstantinos Fytianos; Christoforos Christoforidis	Environmental Analysis
---	-------------------------------

Procedure:

A quarter of the filter is placed in a beaker with 15 mL of the acid mixture in an ultrasound bath for 30 min. The solution is centrifuged and the procedure is repeated with 15 mL of deionized water. The extracts are joined and diluted to the volume of 50mL.

Lead is analyzed in a GF-AAS instrument at 283.3 nm and with the following heating program.

HEATING PROGRAM:

Pb	T (°C)	Ramp time	Hold time	Int.flow
	100	5	10	250
	140	10	10	250
	700	10	10	250
	1800	0	5	0
	2600	1	5	250

5 standard solutions are prepared from the stock standard solution with appropriate dilutions. The absorptions of a blank solution and of the standard solutions are measured and a calibration curve is formed as the best fitted curve (least squares method-regression method). Based on the standard curve, we can quantify unknown samples.

The student is given the overall volume of air that has passed during the 24 hour sampling period and the mass of the Total Suspended Matter contained on the filter. The results are given in ng Pb / m³ air and ng Pb / mg Total Suspended matter.