



Metals & Elements from arsenic to zinc

Analysis by ICP-OES, AAS and ICP-MS(/MS)

The heavy metals lead, cadmium, mercury as well as arsenic are omnipresent within our environment – not least due to various industrial processes. They find their way into the food chain by intake through water and soil as well as through atmospheric sediments. Main intake sources are fish and sea food, fruits and vegetables as well as nuts and cereals. In case of lead, drinking water is also of major importance. Since the toxicological effects of heavy metals on babies and infants are of special relevance, also baby food is in the spotlight.

Toxicology and Regulatory Provisions

Lead has a very low acute toxicity. Most essential long-term effects are its neurotoxicity for infants and its effects on the cardiovascular tissue of adults.

Cadmium is primarily nephrotoxic and may cause bone demineralisation.

Mercury mainly occurs as methyl mercury in fish and seafood, and is thus extremely toxic on the nervous system. Other foods

usually contain less toxic inorganic mercury.

Arsenic also occurs in organic and inorganic compounds, of which the latter is clearly more toxic and found responsible for cancer of skin, lungs and the urinary tract.

The European Food Safety Authority (EFSA) provides risk assessments of the various metals that may be present as food contaminants. In Regulation (EU) 2023/915, the EU-Commission has laid down maximum limits for lead, cadmium, mercury, (inorganic) arsenic and inorganic tin. Maximum limits for mercury and copper are regulated in the Regulation (EC) No. 396/2005. Sample taking procedures and analytical methods for metals are harmonised in Regulation (EC) No. 333/2007.

Additionally, the regulations for drinking water as well as the one for mineral and table water set up maximum values for a number of metals and elements.

Our experts have long-term experience in analysing metals and elements. The trace analysis of the classic contaminants is also part of our portfolio like the analysis of the amount of minerals and trace elements in food supplements, babyfood or feed premixes.

Due to the introduction of the ICP-MS/MS, lead, cadmium, mercury, arsenic, antimony and nickel may now be analysed more selectively and even with a much higher sensitivity. The significantly reduced limits of quantification are displayed in Table 1. Thus, ICP-MS/MS allows a safe revision of already planned and potentially further reductions on maximum levels of metals and elements in food.

Metal/ Element	Conventional Analysis of Metals/Elements	ICP- MS/MS
Lead	0.5 – 0.02	0.001
Cadmium	0.1 – 0.005	0.001
Mercury	0.005	0.001
Arsenic	0.5 – 0.05	0.001
Antimony	0.5 - 0.05	0.001
Nickel	0.1	0.010

Tab. 1: Limits of quantification [mg/kg] for the analysis of lead, cadmium, mercury, arsenic, antimony and nickel using different analytical methodologies.

Of course, the differentiation of organic and inorganic arsenic as well as the determination of a number of further metals and elements via AAS and ICP-techniques are part of our portfolio. A new HPLC-ICP-MS analysis for the determination of methyl mercury and differentiation of arsenic species is currently under development.

