Antimony (Sb)
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Introduction

Antimony (Sb) is physically and chemically very similar to arsenic, but with a lower toxicity. It is a non-essential metal and was formerly used for a number of medicinal purposes, such as inducing sweating and vomiting or in the treatment of leishmaniasis [1]. However, human exposure to antimony is increasing, due, for example, to the use of antimony trioxide as a condensation catalyst in the manufacture of polyethylene terephthalate for the food packaging industry. Since antimony has no biological function in man there is concern about the long term effects of this exposure.

Environmental exposure to antimony

Antimony is used as an alloy with other metals to increase their hardness, in the manufacture of semiconductors, and in some plastics, in the manufacture of paints, ceramics, glass, solders, type-metal, explosives, batteries, bearing metals and semiconductors. Antimony compounds are also used as flame retardants and as abrasives and may be found as a fire retardant component in paints. The trivalent Sb compound *tartar emetic* was discovered in 1918 to be effective in anti-schistosomiasis therapy. A few over-the-counter flu remedies also contain antimony [2]. Sb is present in the soil and hence in food and drinking water; however, manufactured food and drink is frequently in contact with excess Sb in packaging materials before consumption. This is due to the use of antimony trioxide as a catalyst in the manufacture of polyethylene terephthalate [3].

Toxicity

Toxicity may induce a haemolytic anaemia in the short term (as with lead and other heavy metals) and inhibition of pyrimidine 5'-nucleotidase. Long term exposure to antimony is associated with neurological damage. At one time Sb in infant mattresses was suggested as a cause of cot death.

Antimony has similar properties and biological activity to arsenic; although acute exposure causes loss of hair, dry scaly skin and weight loss. Damage to the heart, liver and kidney can result, with subsequent death from myocardial failure. With industrial chronic exposure, there may be effects on the skin (antimony spots), mucous membrane (irritation) and pneumoconiosis. Treatment of Leishmaniasis (Kala-azar) or Schistosomiasis (Bilharzia) with antimony compounds can produce toxic effects. Inhalation of the highly toxic gas stibine (SbH_3) can result in headache, nausea and vomiting, jaundice and anaemia [1].

Specimen requirements

Urine samples for antimony analysis should be taken from a 24-hour or 6-hour collection.

For blood antimony measurement, the sample should be collected into an 8 ml trace element-free potassium EDTA tube. Collection tubes and needles can be supplied by Biolab. If a number of blood tubes are being taken at the same collection, the trace element-free tube should be filled first to avoid cross-contamination. Postal samples (overnight delivery) are acceptable.

Methodology

Antimony determinations are carried out by inductively coupled plasma-mass spectrometry (ICPMS).

Interpretation of results

The route of excretion of antimony depends on the type of Sb ingested. Excretion of pentavalent and organic Sb is primarily through the urine, with trivalent Sb being excreted through the faeces [1]. Both blood and urine measurements can be used to monitor antimony exposure and absorption.

The reference interval for urine antimony is ≤ 2.6 umol/mol creatinine.

The reference interval for blood antimony is 6 – 70 nmol/L

There statutory maximum permitted level of antimony in drinking water is 5.0 μg/L [4]

References

1. Tylenda CA, Fowler BA. Antimony. In: Handbook on the toxicology of the metals, 3rd edition. Eds: Nordberg GF, Fowler BA, Nordberg M, Friberg LT Elsevier, publishers, Amsterdam 2007; pp 353-365.
2. McCallum RI. The Industrial Toxicology of Antimony. J Royal College Physicians of London 1989; 23: 28-32.
3. Keresztes S, Tatr E, Mihucz VG et al. Leaching of antimony from polyethylene terephthalate (PET) bottles into mineral water. Sci Total Environ 2009;407:4731-4735.
4. Drinking Water Inspectorate, 55 Whitehall, London SW1A 2EY http://www.dwi.gov.uk.