

## **Opinion of the Human Biomonitoring Commission of the German Federal Environmental Agency**

### **Aluminium**

The relevance of aluminium to environmental medicine is based essentially on three aspects:

- Human exposure is unavoidable (third most common element of the earth's crust),
- it is clearly neurotoxic for humans (dialysis patients exposed to high Al levels), and
- the element may play a role in the pathogenesis of Alzheimer's disease.

For monitoring internal exposure, three indicator media (blood, urine, hair) and the DFO test need to be discussed.

#### **Blood**

Aluminium is usually determined in serum or plasma. Levels in whole blood and serum correlate closely. The reference range for Al in serum is < 5 µg/l. Since contamination during sampling and sample preparation cannot be excluded completely, even when applying great care, the real levels could be below the AAS detection limit of < 1 µg/l. The Al concentration in serum does not correlate with the total body burden, nor is it related to the concentrations in different organs. Due to the short half-life of aluminium elimination from plasma (about 30 minutes according to data from animal experiments), the Al concentration in this medium only represents the most current uptake and is not therefore well-suited for environmental medicine related investigations. Even dialysis patients with proven Al intoxication may exhibit normal serum Al levels within a few days of discontinuing daily administration of (Al-based) phosphate-binding medication.

#### **Urine**

Incorporated Al is effectively excreted via the kidneys, even in case of high exposures (e.g. patients who have received infusions contaminated by Al). The provisional reference value is < 15 µg/l. For occupationally exposed persons, a link has been found between external inhalative Al exposure and renal Al excretion. Increased urinary excretion of Al was also shown to occur after oral ingestion of Al-rich beverages (e.g. sour fruit juices in plasticised cardboard cartons, tea). However, the Al concentration in urine likewise only reflects the current, last few hours' exposure, so that Al determination in urine should only be carried out in exceptional cases for the investigation of enviro-medical aspects.

#### **Hair**

Both studies on animals and studies with dialysis patients show that Al determination in hair cannot be recommended for environmental medicine. Increased build-up of Al in rabbit hair was found only at excessively high doses. Similarly, an increase in Al concentrations in the hair of dialysis patients was observed only under unfavourable conditions (home dialysis without water treatment, a practice no longer used in Germany).

#### **DFO Test**

The DFO test is used in hospitals to diagnose Al intoxication, mostly in patients with renal insufficiency. In this test, the complexing agent deferoxamine is administered intravenously (5 mg/kg bw) and the rise in serum Al levels is evaluated. An increase to levels above 150 µg/l indicates distinct aluminium loading. The use of the DFO test for environmental medicine is practically excluded.

Further reading: Wilhelm, M.: Aluminium. In: Beyer, A., Eis, D. (eds.): *Praktische Umweltmedizin*. Springer-Verlag, Berlin, 1994