

Barium

Chemical structure

56

Ba

Barium

137.327

Barium is a silvery-white, alkaline earth metal that can be found in the environment. It exists naturally combined with other chemicals, such as sulfur, carbon or oxygen, is very light and its density is half that of iron.¹ Barium sulfate (BaSO_4) is the most common naturally occurring ore of barium. Barium oxidises in air, reacts vigorously with water to form the hydroxide, liberating hydrogen and reacts with almost all the non-metals, forming often poisoning compounds.

Sources

Barium is plentiful in the earth's crust and is the 14th most abundant element, so barium is sometimes found naturally in drinking water and food.² Barium sulfate and barium carbonate are common underground ore deposits, but amounts in water are small as these forms not very water soluble.

Barium sulfate ore is mined and used to manufacture other barium compounds that are widely used in industry. They are more soluble in water, provide a greater health risk and can end up in drinking water when the water is contaminated by barium compounds that are released from waste sites. Barium sulfate is used by the oil and gas industries in the manufacture of paints, bricks, tiles, glass, rubber and has an application in medical tests to x-ray the gastro-intestinal system.

Some foods, such as Brazil nuts, seaweed, fish, and certain plants, may contain high amounts of barium. Kelp extracted from polluted waters often contains excessive levels of barium.³ High levels of barium in ecosystems and workplaces can originate from quarrying for barium ores and/or use of barium in paper/foundry/welding/textile/oil and gas well related industries; also from its use as an atmospheric aerosol spray for enhancing the signaling of radio waves along military jet flight paths and missile test ranges.⁴ Barium is also found in chlorides (used in sucralose and Splenda), in nitrates and sulfides.⁵

Applications for barium compounds include the manufacture of ceramics, insect and rat poisons, oil and fuel additives, and as components in paper manufacturing and refining of sugar, animal and vegetable oils.⁶

Absorption and Excretion

Ingested barium is poorly absorbed and little is retained by the body.⁷ Ingested or inhaled barium is excreted mainly in faeces and urine, normally within 1–2 weeks. Most of the small amount of barium that remains in the body is deposited in the bones and teeth.⁸

Functions

Barium has not been shown to be an essential nutrient and it has been shown to inhibit absorption of calcium and have similar properties to lead and cadmium.⁹

Toxicity / Excess

The amount of barium that is detected in food and water usually is not high enough to become a health concern.¹⁰ Information on health problems caused by long-term exposure to low levels of barium in food and water is still being established. Animal and human studies show exposure to barium in the air causes damage to the lungs and the EPA and IARC have not classified barium as to its carcinogenicity.

Those at greatest risk from toxicity are workers in the barium industry, due to inhalation of dust containing barium sulphate or barium carbonate.¹¹ People that live near hazardous waste sites are also at risk due to breathing dust, eating soil or plants, or drinking water that is polluted with barium. Skin contact may also occur.

Barium chloride and other water-soluble barium salts are highly toxic. Ingesting very large amounts of these compounds that dissolve in water or in the stomach can cause changes in heart rhythm or paralysis in humans.¹² Some people who ingest somewhat smaller amounts of barium for a short period may experience vomiting, abdominal cramps, diarrhoea, breathing difficulties, blood pressure alterations, muscle weakness, changes in nerve reflexes, swelling of brains and liver, kidney and heart damage.¹³

High level contamination of barium has been identified in the ecosystems and workplaces that are associated with high incidence clustering of multiple sclerosis (MS) and other neurodegenerative diseases such as the transmissible spongiform encephalopathies (TSEs) and amyotrophic lateral sclerosis (ALS). It is hypothesised that abnormal levels of barium salts combine with sulphate and lead to alterations in growth and structural integrity of the myelin sheath.¹⁴ High levels of barium in water supplies have been associated with high blood pressure and cardiovascular disease.¹⁵ Attention must be given to calcium balance in order to normalise barium levels. Antioxidants such as Vitamin A, C and E are also useful. In addition, alginates like kelp can facilitate excretion of barium and may reduce the intestinal absorption.¹⁶

Analysis in HTMA

There is no routine medical test for determining barium exposure or potential health effects. Barium in body tissues and fluids can be measured using very complex instruments. This is normally done only for cases of severe barium poisoning and for medical research.¹⁷ Transient high levels in hair may be of small clinical significance.¹⁸ Persistent elevated levels of hair tissue barium are often a result of diagnostic medical tests.¹⁹ The biological significance of low HTMA levels cannot be described at this time.²⁰
