Rubidium

37
Rb
Rubidium
85.4678

Chemical Structure

Rubidium is a soft, ductile, silvery-white metallic element of the alkali metals group. It is one of the most electropositive and alkaline mineral elements and can be liquid at ambient temperature with a melting point of about 40°C. Rubidium ignites spontaneously in air and reacts violently with water and has a yellowish violet coloured flame.[1] As so with all the other alkali metals, it forms amalgams with mercury, alloys with gold, iron, caesium, sodium, and potassium.[2]

Sources

Environment

Rubidium is the twenty third most abundant mineral element in the earth's crust. It occurs in the minerals pollucite, carnallite, leucite and lepidolite, from which it is recovered commercially.[3] It is a relatively abundant element when compared to lead, copper, zinc or cesium. No minerals have rubidium as the main constituent.[4] Potassium minerals and brines also contain this element and are a further commercial source.

Diet

Rubidium has no known biological role but has a slight stimulatory effect on metabolism, probably because of its similarity to potassium.[5] Both elements are found together in soils, although potassium is much more abundant than rubidium. Rubidium competes with potassium ions for entry into the body.[6] Plants will adsorb rubidium quite quickly, in this way rubidium enters the food chain and so contributes to a daily intake of between 1 to 5 mg. The best known food source of rubidium is unprocessed Brazil nuts. Some fruits and vegetables have been found to contain about 35 ppm,[7] which include; bean sprout shoots, spinach leaf, parsley, bilberry fruit, rhubarb, dandelion leaves, asparagus, cashews, knotweed, and beets. There is no established Recommended Daily Intake (RDI), deficiency or toxicity levels established for rubidium.[8]

Absorption and Excretion

Chemically, rubidium is like potassium, and in some animals it can replace potassium in certain functions, though this does not seem to be the case in humans. Rubidium and potassium share the same transportation system in the body. Rubidium can act as a potassium antagonist in regard to absorption and utilization. Rubidium, like sodium and potassium, almost always has +1 oxidation state when dissolved in water, including its presence in all biological systems. The human body tends to treat rubidium ions as if they were potassium ions, and therefore concentrates rubidium in the body's intracellular fluid (i.e. inside cells).[10] The ions of rubidium are not particularly toxic; a 70kg person contains on average 0.36gm of rubidium, with a biological half-life in humans measured at 31 to 46 days.[11] Rubidium is absorbed easily from the gut and is found generally throughout the body, with the least in the bones and teeth; it is not known to concentrate in any particular tissue.[12]

Functions and Applications

Rubidium and its salts have limited applications and commercial uses. The metal is used in the manufacture of photocells and in the removal of residual gases from vacuum tubes. Rubidium salts are used in glasses and ceramics and in fireworks to give them a purple colour. Potential uses are in ion engines for space vehicles, as working fluid in vapour turbines, and as getter in vacuum tubes. It is also extensively studied as a potential heat transmission material in space vehicles, as fuel in motors of ionic propulsion, as electrolyte in low temperature alkaline batteries, etc. Some rubidium compounds are used in preparing soporific, sedatives and in the treatment of epilepsy.[12]

Toxicity and Excess

Rubidium is non-toxic because of its chemical similarity to potassium. We may absorb it from our food. Moderate toxicity may occur via ingestion. It is slightly radioactive and so has been used to locate brain tumors, as it collects in tumors but not in normal tissue.[13] Very high rubidium partnered with low potassium can put muscles into a state of semi-paralysis.[14] Rubidium will take the place of potassium in the sodium-potassium pump. Excess rubidium is eliminated from the body mainly in the urine.

The main health effects of rubidium are associated with thermal burns. Rubidium readily reacts with skin moisture to form rubidium hydroxide, which causes chemical burns of eyes and skin.[15] Signs and symptoms of overexposure include skin and eye burns, failure to gain weight, ataxia, hyper irritation, skin ulcers, and extreme nervousness. Medical conditions aggravated by exposure may include heart problems due to potassium imbalance.

Analysis in HTMA

Rubidium is analysed and measured in HTMA as an additional mineral element. In HTMA, low levels below 0.0010 ppm, may not be of any clinical significance. The presence of elevated levels above 0.0190 ppm may correlate with previous exposure from an external or environmental source. This may be of some clinical significance with its antagonistic effect with other minerals, in particular potassium, and also sodium, calcium and iron.[16]