



INTERNATIONAL MOLYBDENUM ASSOCIATION  
THE VOICE OF THE MOLYBDENUM INDUSTRY

A woman with long, curly brown hair tied back is running away from the camera on a dirt path through a field of bright yellow flowers. She is wearing a white tank top and dark green leggings. The scene is captured from a low angle, emphasizing her movement and the vibrant colors of the field under a clear blue sky.

# Molybdenum – Essential for Life



# Molybdenum: An essential element

Molybdenum is a naturally occurring element, found all around us in rocks, soil and rivers. It is also present in low concentrations in humans, plants and animals. In common with a handful of other elements – such as copper, iron and zinc – molybdenum is also *essential*, meaning that life cannot be sustained without it.



Molybdenum plays a vital role in the production of enzymes which help to digest food, produce energy and remove waste products from our bodies. Molybdenum-dependent enzymes are also required to speed up chemical processes enabling plants to take up nitrogen.

Molybdenum was even present in the early stages of the evolution of life on earth, converting inorganic matter into the building blocks of life.

So, molybdenum has always been *essential for life* – and still is today.

**Molybdenum is  
element  
number 42 in  
the periodic table**

# A life-sustaining element



Molybdenum is an essential part of several enzymes which play a vital role in bodily processes. These enzymes manage chemical reactions of sulfur and nitrogen compounds, helping our bodies to get rid of toxins and waste products from digestion. Likewise, they play a role in producing cellular energy. It's fair to say that without molybdenum we could not exist.

There are three main enzymes which depend upon the presence of molybdenum:

- Xanthine oxidase regulates the production of uric acid within the body. Low dietary molybdenum, and a deficiency or absence of xanthine oxidase can lead to kidney stones and possible renal failure.
- Aldehyde oxidase is required for a number of important processes within the body. The full role of this enzyme is not yet fully understood, but it is thought to be necessary for healthy lungs and blood circulation, making steroid hormones and processing vitamin A within the body.
- Sulfite oxidase is necessary for the elimination of sulfite (a nerve poison) from the body. Without it, in rare genetic cases, neurological problems develop.

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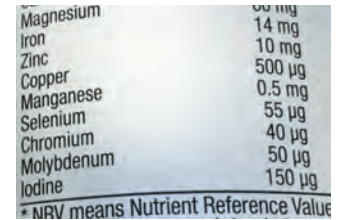
# Natural sources and availability

Molybdenum is found naturally in many foods and in water, so a normal diet usually supplies more than enough. Good sources include lentils, nuts and wholegrains, cows' milk and vegetables such as cauliflower, spinach and kale. Amounts within each food type vary widely depending on the molybdenum content of the soil.

The recommended dietary allowance (RDA) for molybdenum is 45 micrograms ( $\mu\text{g}$ ) for an adult. The tolerable upper intake level for adults is 2000  $\mu\text{g}$  per day, but it's highly unlikely that anyone would get close to this under normal circumstances.

Molybdenum is included in many over-the-counter dietary supplements, usually about 50  $\mu\text{g}$  per day, although a normal diet will almost always supply an individual's total requirement. Any excess is simply excreted thanks to a mechanism called *homeostasis*, which prevents accumulation and keeps levels within an optimal range.

Like other elements, molybdenum can be harmful in excessive concentrations, but not at the levels found in consumer products and household items. Indeed, the amount of molybdenum needed to pose a risk is greater than many other elements and it should not be associated with so-called 'heavy metals', which are recognized as toxic.



Magnesium	50 mg
Iron	14 mg
Zinc	10 mg
Copper	500 $\mu\text{g}$
Manganese	0.5 mg
Selenium	55 $\mu\text{g}$
Chromium	40 $\mu\text{g}$
Molybdenum	50 $\mu\text{g}$
Iodine	150 $\mu\text{g}$

\*NRV means Nutrient Reference Value

**The RDA for  
molybdenum  
is 45 micrograms**

# A healing element



The unique properties of molybdenum and its interaction with other elements have led to its use in the treatment of certain diseases.

Wilson's disease, an inherited genetic disorder, blocks the body's ability to metabolize copper, causing harmful accumulations in tissue which can lead to neurological or psychiatric symptoms and liver disease. Tetrathiomolybdate – a molybdenum compound – is used to reduce copper absorption, helping to remove excess copper from the body.

**Molybdenum  
compounds  
are being trialled  
to treat cancer**

Some molybdenum compounds are also being trialled in patients with advanced cancers, with the aim of preventing disease progression or relapse. Pilot trials have shown promising results in the treatment of metastatic kidney and colorectal cancer as well as breast cancer.







# Essential for plants and animals

Molybdenum is an essential micronutrient for plant growth. Without it, plants are unable to fix nitrogen from the air and soil. A lack of molybdenum causes nitrogen deficiency and leads to poor growth. Molybdenum deficiency in Australian cropland has been estimated to reduce cereal yields by as much as 30%.



Correcting this deficiency can significantly boost agricultural output. A study in Egypt demonstrated that the addition of molybdenum to mandarin trees increased fruit yield by 37%.

In animals, as in humans, molybdenum is used to help rid the body of waste products from digesting food, as well as playing a part in producing cellular energy. Molybdenum also influences protein synthesis, and the metabolism of phosphorus, sulfur, potassium, iron, copper, zinc, and iodine.

Some animals have different digestive mechanisms and can be susceptible to molybdenum accumulation. In molybdenum-rich areas, ruminant animals such as cows and sheep can develop a form of copper deficiency called molybdenosis – although this can be easily remedied by supplementing feed with copper.

**Treating mandarin trees with molybdenum increased fruit yield by 37%**



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