

JOHN'S CORNER:

MINERALS - The Elements and What They Do (Part 9)

by John Ferguson

16) Sulfur (S) - Found in igneous rocks at 260 ppm, shale at 2,400 ppm, sandstone at 240 ppm, limestone at 1,200 ppm, fresh water at 3.7 ppm, sea water at 885 ppm, and soil at 700 ppm, marine plants at 12,000 ppm, land plants at 3,400 ppm, marine animals 5,000-19,000 ppm, land animals at 5,000 ppm.

Sulfur is one of the few elements that is found in pure form in nature and has a yellowish color. It is often found in association with salt domes that create many of our oil reservoirs. Sulfur occurs in several forms, however, in nature sulfur is most commonly found and used as the compound sulfate (SO_4^{-2}).

The mineral pyrite or iron sulfide (FeS_2) is known as fool's gold, manganese sulfate (MnSO_4) is used as a fertilizer and as a supplement in animal feed, gypsum or calcium sulfate (CaSO_4) is often used to release excess sodium in clay soils and used in many fertilizer formulations, iron sulfate (FeSO_4) is sometimes used in gardening. When in college I remember Lake Nacogdoches being constructed. As the construction crews built the dam, they excavated several hillsides exposing the buried layers. In one of them were beautiful large (3-5" long) clear crystals of a mineral known as selenite which is calcium sulfate with two water molecules attached.

Sulfur is a basic ingredient of gunpowder, hydrogen sulfide (H_2S) smells like rotten eggs and is dangerous at high concentrations; it is a common ingredient in smog from burning diesel fuel or coal. Sulfur is used in car batteries in the form of sulfuric acid (H_2SO_4). Many of the scents we consider odorous contain sulfur.

Sulfur is found in many enzymes and vitamins, it is a main component of keratin, which composes our hair and nails or feathers. Sulfur is an important structural element used in most proteins and many



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amino acids. Sulfur is a component of vitamins, coenzymes, thiamin, biotin, lipoic acid and participates in many enzymatic reactions.

Deficiency of sulfur results in degenerative types of arthritis involving cartilage, ligaments, tendons, Systemic Lupus, Sickle cell anemia and various collagen disorders. Sulfur helps detoxify the body, increase blood circulation, reduces muscle cramps and back pain, helps remove inflammation, and helps the body have more energy that is useful.

Sulfites, sulfur dioxide (SO_2) and sulfites (SO_3^{-2}) are a common preservatives and antimicrobial agents added to foods and medicines (think wine) as they kill microbes. Sulfites can trigger adverse reactions in sensitive people, from asthma issues to behavior in autistic children, the FDA records that several deaths have occurred to excess sulfites used in foods.

Sulfur is essential for good health; eggs, onions, garlic, and cabbage are good sources of sulfur.

Gardening and Landscaping Problems Associated with Sulfur (S)

In soils up to 90% of sulfur is tightly bound to humus, so SO_4^{-2} is the major exchange anion. It is interesting that soils around the world have carbon to sulfur ratios of 100:1 and most sulfur in soils only occurs in organic forms. Sulfur is a structural component of humic and fulvic acids essential to healthy soils.

Sulfur is considered a primary plant nutrient (.05-1% of a plants tissue contains sulfur) and it is used by plants only in the sulfate form. Soil microbes are responsible for converting sulfur into a sulfate form that plants can use and then plant roots extract sulfate ions (SO_4^{-2}) from the soil.

Nitrogen fixing plants (legumes) require adequate sulfur for good nodule development. If there is not enough sulfur in the soil or it is out of balance in relation to other elements in the soil, then the plant-microbe system cannot obtain nitrogen from the air and fix it in the soil. All organisms from microbes to earthworms use sulfur in the form of the amino acids (cysteine and methionine) that are used to build proteins.



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Plants use a lot of sulfur as it is required in the production of proteins and seeds plus it improves the taste of our foods.

A few plants have been found to emit carbon disulfide (CS₂) from its roots to protect them from parasitic nematodes. Excess sulfates in the soil reduce selenium absorption by plants and can create soils that are too acidic for most plants.

Sulfur is one of the easiest leached of all mineral nutrients and it is easy to mistake a sulfur deficiency as a nitrogen deficiency as well as magnesium, iron or potassium deficiencies. Shortages of sulfur are signaled by sick crops, insect, bacterial and fungal attack, upper leaves may turn yellow, stems stay small and woody, root become long and slender, symptoms often resemble a nitrogen shortage.

Sources: compost, native mulches, molasses, sulfates, gypsum, elemental sulfur, feathers, green sand, fish emulsion.