Essential elements for all living things 2021-12-12

In the table below, Sune Pettersson, professor at the Swedish University of Agricultural Sciences, has illustrated what the dry mass of plants contains and in what form the essential elements are taken up during photosynthesis. These elements are found in all living things, including humans.

Tabell 1. Essentiella grundämnen för de flesta högre växter och de inre koncentrationer som anses tillräckliga. — *Essential elements for most higher plants and internal concentrations considered adequate*

Grundämne *Element*	Symbol *Symbol*	Form tillgänglig för växter *Form available to plants*	Atom-vikt *Atomic wt*	Koncentration i torrmassa *Concentration in dry tissue* ppm	%	Rel. antal atomer *Rel. no. of atoms*
Molybden	Mo	$MoO_4=$	95.95	0.1	0.00001	1
Koppar	Cu	Cu^+, Cu^{+2}	63.54	6	0.0006	100
Zink	Zn	Zn^{+2}	65.38	20	0.0020	300
Mangan	Mn	Mn^{+2}	54.94	50	0.0050	1 000
Bor	B	H_3BO_3	10.82	20	0.002	2 000
Järn	Fe	Fe^{+3}, Fe^{+2}	55.85	100	0.010	2 000
Klor	Cl	Cl^-	35.46	100	0.010	3 000
Svavel	S	$SO_4=$	32.07	1 000	0.1	30 000
Fosfor	P	$H_2PO_4^-$, $HPO_4=$	30.98	2 000	0.2	60 000
Magnesium	Mg	Mg^{+2}	24.32	2 000	0.2	80 000
Kalcium	Ca	Ca^{+2}	40.08	5 000	0.5	125 000
Kalium	K	K^+	39.10	10 000	1.0	250 000
Kväve	N	NO_3^-, NH_4^+	14.01	15 000	1.5	1 000 000
Syre	O	O_2, H_2O	16.00	450 000	45	30 000 000
Kol	C	CO_2	12.01	450 000	45	35 000 000
Väte	H	H_2O	1.01	60 000	6	60 000 000

The literature contains information on elements that are considered to be stimulating for the plants, for example cobalt (Co), chromium (Cr), nickel (Ni), vanadium (V), ten (Sn), lithium (Li), fluorine (F), selenium (Se), silicon (Si)…
Recycling of nutrients from the world's cities is said to be less than 2 percent (Cities and circular economy for food - Executive summary | Shared by Food (thirdlight.com)). The lack of plant nutrients is compensated in cultivation systems with mineral fertilizers that are produced with energy-intensive methods. Therefore, the SBRS concept should be further developed (http://biotransform.eu/).

Bioenergy - The table shows that the elements hydrogen, carbon, and oxygen make up 96% of the dry mass and can be considered as the bioenergy content of the plant biomass. Both during biological conversion and combustion, carbon dioxide (CO_2) and water (H_2O) are formed. The basic difference is that biological oxidation goes in small steps and life continues despite various emissions, while the chemical oxidation during incineration proceeds rapidly, all living things are killed, the ash remains and the air is polluted with nitrogen oxides (NO, NO_2), sulfur dioxide (SO_2), particles, etc. All living things die when thermal or chemical transformation methods are used – negative for biodiversity.

Plant nutrients - Since only 4% of the dry matter of plants is plant nutrients, there is a tendency to overlook its importance. Everyone who is educated in the cultivation systems is familiar with Liebig's minimum law, which means that “a deficit of one growth factor (light, heat, nutrient, etc.) cannot be compensated by a surplus of another. The plant nutrient that is furthest away from a satisfactory level will determine the plant's growth restriction.”

Access to bioenergy and the essential chemical elements that have been stored during photosynthesis is a prerequisite for all life. Decision-makers must realize that it is unsustainable to recycle only nitrogen and phosphorus with very costly methods.

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