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What Is Humic Acid?

Humic and Fulvic acids are the final break-down constituents of the natural decay of plant and animal materials. These organic acids are found in pre-historic deposits. Humic matter is formed through the chemical and biological humification of plant and animal matter and through the biological activities of micro-organisms. Humic acids are complex molecules that exist naturally in soils, peats, oceans and fresh waters. The one source of humic acids are the sedimentation layers referred to as Leonardite. These layers were originally deep in the earth's crust, but over many years have been exhumed to near-surface location. Humic acids are found in high concentration in these layers. Leonardite is organic matter, which has not reached the state of coal and differs from soft brown coal by its high oxidation degree, a result of the process of coal formation, and has no value as fuel. The decomposition of concentrated organic acids is a lengthy process taking millions of years in the natural environment. Imagine, if you will, a prehistoric marsh or peat bog. Plants are harvesting carbon dioxide from the atmosphere and using the sun's energy to build plant biomass. These plants feed insects and vertebrates. As plants and animals die they contribute their carbon back to the bottom of the bog. Over millions of years this cycle of organic matter is concentrated and compressed into layers in the earth.

Where Does It Come From?

One of the first recognized reserves of Leonardite came from the Dakotas, (named after a Mr. Leonard). These strata were not very deep which allowed for simple mining techniques. Since this early beginning, the term Leonardite has been widely used as a name for all humic and fulvic acid containing mined products.

A recent discovery has been made in New Mexico of a concentrated organic acid reserve in Oxidized Lignite. These strata (or deposits) occur naturally very close to the surface. For this reason and over the last several thousand years they have become oxidized. This natural process has concentrated the humic acid content to upward of 70 percent. It is possible, through artificial means, to chemically or mechanically oxidize Leonardite. However, using sources that have been oxidized naturally is much more economical.

What Is It Used For In Agriculture?

Leonardite is not a fertilizer. It acts as a conditioner for the soil and as a bio-catalyst and bio-stimulant for the plant. Humic acids are an excellent natural and organic way to provide plants and soil with a concentrated dose of essential nutrients, vitamins and trace elements. Compared to other organic products, Leonardite enhances plant growth (biomass production) and fertility of the soil. Another advantage of Leonardite is its long-term effectiveness, as it does not get consumed as quickly as animal manure, compost or peat. Leonardite decomposes completely, therefore it does not enter into nutritional competition with plants for nutrients like nitrogen. This is not the case with partially decomposed compost, whereby the organic substances in soil are rapidly consumed by micro-organisms and mineralized entirely without humus formation.

The Economic Benefits Are?

Humic acids chelate nutrient compounds, especially iron, in the soil to a form suitable for plant utilization. Thus, the nutrient supply of plants is optimized. Increases up to 70% in yield, accompanied by a reduction up to 30% in the use of fertilizers and pesticides, as well as better and healthier growth of green grass, ornamentals, agricultural crops and woods can be attained with the regular application of first-quality humic acids. Furthermore, water holding capacity of soils is increased considerable, which means that the use of water can be reduced substantially.

Best economic results can be obtained in light and sandy soils poor in humus, as well as on recultivation fields. The diverse positive impacts of humic acids are to be observed particularly in such soils. This is true for almost all soils in dry and warm regions. As a result of the high mineralization rate of organic substances, providing these soils with stable humic acids is indispensable for the maintenance and improvement of soil fertility.

Current scientific studies show that the fertility of soil is determined to a very large extent by the content of humic acids. Their high cation-exchange capacity (CEC), the oxygen content as well as the above average water holding capacity are the reasons for the high value of using humic acids for improving soil fertility and plant growth. The most important feature of humic acids lies in their ability to bind insoluble metal ions, oxides and hydroxides, and to release them slowly and continually to plants when required. Due to these properties, humic acids are known to produce three types of effects: physical, chemical and biological.

Humic acids *physically* modify the structure of the soil, with benefits such as:

- Improved structure of soil: Prevents high water and nutrient losses in light, sandy soils, simultaneously converting them into fruitful soils by way of decomposition. In heavy and compact soils, aeration of soil and water retention is improved; cultivation measures are facilitated.
- Prevents soil cracking, surface water runoff and soil erosion by increasing the ability of colloids to combine.
- Helps the soil loosen and crumble, and thus increases aeration of soil as well as soil workability.
- Increases water holding capacity of soil and thus helps resist drought.
- Darkens the color of the soil and thus helps absorption of the sun's energy.

Humic acids *chemically* change the fixation properties of the soil, with benefits such as:

- Neutralizes both acid and alkaline soils; regulates the pH-value of soils.
- Improves and optimizes the uptake of nutrients and water by plants.
- Increases buffering properties of soil.
- Acts as natural chelator for metal ions under alkaline conditions and promote their uptake by the roots.
- Becomes rich in both organic and mineral substances essential to plant growth.
- Retains water soluble inorganic fertilizers in the root zones and reduces leaching.
- Possesses extremely high cation-exchange capacities.
- Promotes the conversion of nutrient elements (N, P, K + Fe, Zn and other trace elements) into forms available to plants.
- Enhances the uptake of nitrogen by plants.
- Reduces the reaction of phosphorus with Ca, Fe, Mg and Al and liberates it into a form that is available and beneficial to plants. The productivity of particular mineral fertilizers is increased considerably.
- Liberates carbon dioxide from soil calcium carbonate and enables its use in photosynthesis.
- Helps to eliminate chlorosis due to iron deficiency in plants.
- Reduces the availability of toxic substances in soils.

Humic acids *biologically* stimulate the plant and the activities of micro-organisms.

- Stimulates plant enzymes and increase their production.
- Acts as an organic catalyst in many biological processes.
- Stimulates growth and proliferation of desirable micro-organisms in soil
- Enhances plant's natural resistance against diseases and pests.
- Stimulates root growth, especially vertically and enable better uptake of nutrients.
- Increases root respiration and root formation.
- Promotes the development of chlorophyll, sugars and amino acids in plants and aid in photosynthesis.
- Increases vitamin and mineral content of plants.
- Thickens the cell walls in fruits and prolongs storage time.
- Increases germination and viability of seeds.
- Stimulates plant growth (higher biomass production) by accelerating cell division, increasing the rate of development in root systems and increasing the yield of dry matter.
- Increases the quality of yields; improves their physical appearance and nutritional value.

The Ecological Benefits Are?

The ecological benefits of humic acids are diverse and present profitable and effective solutions for environmental problems and the preservation of the environment.

First of all, soils with a high content of humic acids are a guarantee for low nitrate leaching and for optimum nutrient efficiency. A well-developed root system, which is achieved by a high content of humic acids, prevents nitrate and pesticides mixing in with ground water. Furthermore, a low content of nitrate is an indicator and a prerequisite for appropriate "organic animal feeds". It happens very often that growers use more fertilizers than plants can take up. This leads to nitrate concentration in soil, which is later to be found in ground water.

Secondly, humic acids reduce the over-salination problem in the application of water-soluble mineral fertilizers. Humic acids are able to decrease high salt contents in soils and thus the resulting toxicities. The NH4-toxicity of fertilizers containing ammonia is greatly reduced, which is of particular importance to young plants. Generally, humic acids reduce root burning which comes about through excessive salt concentrations in soils after fertilization; in case of permanent high levels of salt in soils, these are reduced. Furthermore, when humic acids are mixed with liquid fertilizers, the undesirable odor is reduced.

Thirdly, humic acids are an effective means to fight against soil erosion. This is achieved both by increasing the ability of soil colloids to combine and by enhancing root system and plant development.

SOURCES:

- "So What's the Difference" – by Judy and Todd Zehr of SoilBiotics and Bruce and Joel Reid of Mesa Verde Resources.
- "Where Does Humic Acid Come From?" - prepared by Mesa Verde Resources, based on an article in BioScientific 2010 authored by John Olivas.
- "What are Humic Acids and Their Sources?" - a summary report, by committee for Veterinary Medicinal Products Humic Acids and Their Sodium Salts.