

## **NEWS FROM THE WONDERFUL WORLD OF SOIL AND PLANTS**

**By John Ferguson**

**A** question I often get asked is “What is humus?” Simply - *Humus is the most important part of a healthy fertile soil!*

Humus (humic substances) come from organic matter that has decayed (composted native mulches, leaf mold compost, humates, and even some types of coal).

A healthy soil should contain 4-8% organic matter by weight (8% by weight is about 25% by volume). Most gardeners have soil organic matter less than 2% and this is one of the reasons they experience poor growth, diseases, insect problems, drought problems, weeds, less heat, and cold tolerance, etc.

Humus is composed of chains of carbon atoms linked together into complex structures. The material we call humus is composed of several components: humic acid, fulmic acid, ulmic acid and humins. These are very weak organic acids chemically speaking.

These components are all similar but distinguished by their solubility in water and the length of their carbon chains that form the individual molecules.

Humate is the solid form of humic acid, fulmate is the solid form of fulmic acid, etc. and humins are the longest carbon chains and most resistant to further decomposition.

Humus can be obtained from several sources, compost, composted native mulches and humates.

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Humates are mined from ancient plant deposits that never became coal or oil, and the best humates come from areas with volcanic activity nearby when they were formed as this allows extra elements to be captured and held by the humus.

All life requires energy. Soil microorganisms get their energy from eating (combining carbon atoms with oxygen thus releasing energy just like when wood is burned in a fireplace). By eating carbon containing molecules found in humic substances, microbes get the energy for various metabolic processes from growing and reproducing, creating soil structure to fighting disease and pathogens.

All forms of humic substances improve a soils water holding capacity and the efficiency of how plants use the water. They also create soil structure that allows water and air to enter the soil holding the water in the root zone where plants can use it. Humic substances can easily hold over seven times their weight in water and some types up to 15X.

A question I often get asked is what is the difference between compost and humates? While a good product, humates are not compost.

A few years ago, I looked at some data on compost on the USDA website and it showed that even an average compost will contain over 350 pounds of humic substances (humus) per cubic yard of compost. These humic substances will contain humic acid, fulmic acid, ulmic acid and humin just like humates.

Compost has more long chain and extremely long chain carbon atoms than humates which is why good compost provides benefits over several years even from one application. As one can see there is an overlap in function of compost and humates. However, a good compost also has complex sugars, carbohydrates, growth hormones,

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and many other compounds that are required by microbes and plants that are not in humates.

The biggest difference is that compost is alive with billions of beneficial microbes per pound of compost and tens of thousands of species. Humates work best when used with a good compost to provide the diversity and quantity of microbes need to best utilize the resources contained in humates.

For those that want a little more technical explanation on the chemistry of humates see the paper: "Organic Matter, Humus, Humate, Humic Acid, Fulmic Acid and Humin: Their Importance in Soil Fertility and Plant Health" by Robert Pettit, PhD, Emeritus Associate Professor Texas A&M University.

For those that want a detailed technical discussion see the book: "Humus Chemistry - Genesis, Composition, Reactions by F. J. Stevenson, ISBN 0-471-59474-1

Note: As readers of this newsletter know, there are a lot of garbage compost products being sold in our area since Texas does not have labeling laws. Similarly, the same applies to humates.

In Houston we are lucky that San Jacinto Environmental Supply distributes a high quality humate product called "Microlife Humates Plus" in bags to the better area retailers. These are the same folks whom make the best organic fertilizer (Microlife™) I have ever tested and the one I use personally.

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One of the environmental problems we are facing is a shortage of phosphate for use in fertilizers that our plants and all life require. Most clean safe phosphate deposits have already been mined out. Several years ago, the USGS has warned that the remaining deposits are contaminated with heavy metals like cadmium to radioactive elements.

Another reason to only use organic fertilizers is that cadmium is highly toxic if we have too much, where it will damage kidneys and other organs (in high levels it is also toxic to plant tissue).

The human body tries to remove cadmium from our bodies by transporting it to our kidneys in an attempt for it to be eliminated. However, it binds tightly to many enzymes and can be stored for over 30 years! Cadmium replaces zinc and binds over 300 times tighter to the enzymes. Therefore, having sufficient zinc in our diets is very important as it prevents most cadmium from being absorbed. For a more detailed discussion, see page 90-91 in "Nature's Building Blocks - An A-Z Guide to the Elements, John Emsley, Oxford University Press, 2011, ISBN 978-0-19-960563-7".

Sewage and the waste water produced, has a lot of phosphates in it. Researchers at the Nanyang Technological University in Singapore has discovered a bacterium (*Candidatus accumulibacter*) that absorbs and hyperaccumulates phosphorous from waste water at very warm temperatures. The bacteria can then be filtered from the water and processed to recover the phosphorus. Journal Water Research, 2022.

Speaking of toxic water from waste water treatment plants, the city of Los Angeles has proposed filtering it and adding it back to the public water supply.

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