by Donald Lester

SHOPPING FOR HUMIC ACIDS

In the past, humic acids have been referred to as "The Black Gold of Agriculture." Due to several watered down and inferior grades of the product available on the market today, humic acids are getting a bad name. These inferior grade products give reduced performance, and as a result, reduced grower confidence. This is compounded by the fact that there are several analytical methods available for measuring the content and strength of humic acids. For example, California recently decided upon a particular method of analysis. When they tested products in the marketplace using this method they found that over half did not rate the strength claimed. Now manufacturers have a six month grace period to change their labels or adjust their products and ingredients to pass the new testing procedure. Regulatory agencies in several states are working to agree on one standardized analytical method used to ensure consistency of product in the marketplace. Once this is accomplished it will be easier to compare apples to apples when it comes to humic acid products. However, strength is not the only consideration when it comes to buying a quality humic acid. In this article I will point out other important characteristics to look for when shopping for humic acid products.

Humic acids are a source of concentrated organic matter derived from various sources. Plant materials go through several stages of decay: fresh plant material, green manure, compost, peat, brown coal, leonardite, and coal. These materials accumulate over time, and with heat and pressure they eventually form bands or layers in the soil each with a different composition of humic acids.

Average Content of Humic and Fulvic Acids Found in Various Source Materials

SOURCE	% Humic Acids	% Fulvic Acids
Leonardite	40	85
Black Peat	10	40
Brown Coal	10	30
Dung	5	15
Compost	2	5
Soil	1	5
Sludge	1	5
Coal	0	1

Humic acid is an umbrella term for humic substances. There are two main categories of humic acids or humic substances: humic acid and fulvic acid. Each group is a mixture of large molecules, much like gasoline is a mixture of varying sized molecules. Therefore, there is no one recognized chemical structure for humic acid or fulvic acid. The main distinction between humic acids and fulvic acids is their pH and solubility in water. There are theoretical models of the average sized molecule in each group which gives us an idea of the size and complexity of the compounds.

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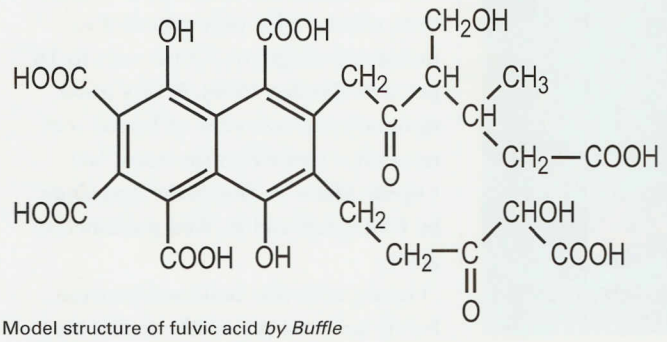
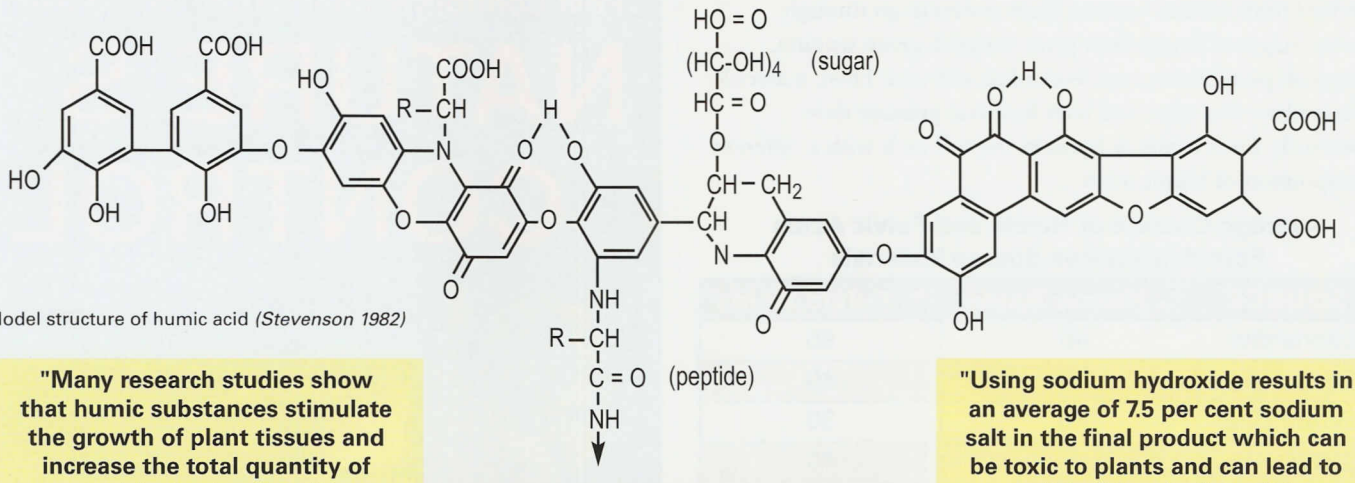
Structurally, humic acids are large molecules containing an abundance of oxygen and carboxyl groups. These oxygenated areas on the molecule attract and bind with trace minerals in the soil that would otherwise be unavailable to the plant. Some refer to this binding of material as a complex (1:1 ratio) and others refer to it as a chelation (two humic acid: one mineral ratio). The large humic acid molecule binds with many mineral ions in the soil to act as a bus to deliver these minerals to the



Model structure of fulvic acid *by Buffle*



Model structure of humic acid *(Stevenson 1982)*

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plant root in a useable form. There are different amounts of oxygenation in each humic acid source. Leonardite has the most heavily oxygenated molecules yielding more nutrient binding sites. Humic acid extracted from manure or peat is usually not as effective in absorbing micronutrients as humic acid originating from leonardite.

Humic acids have several properties that are beneficial to plants because they are biostimulants; they chelate or complex many essential minerals necessary for plant growth; they increase the seed germination rate; and they act as a food source for beneficial soil micro-organisms.

When it comes to claims, growers often don't know which to believe. There appears to be confusion and doubt about the biostimulant effects of humic acids.

"Using sodium hydroxide results in an average of 7.5 per cent sodium salt in the final product which can be toxic to plants and can lead to salt build up in the soil."

The term biostimulant is ill defined and often thought of as merely a marketing term. However, humic acid substances do act as biostimulants (substances that stimulate growth) in hydroponics and sand culture, and especially in soils with low organic matter content. Many research studies show that humic substances stimulate the growth of plant tissues and increase the total quantity of nutrients absorbed. There is a large body of experimental evidence for enhanced growth in several crops and in different plant parts (i.e. roots, shoots, seeds), but primarily in shoot growth. One of the more famous humic acid studies is a California processor tomato trial conducted by Brownell et al. published in 1987 that demonstrated an average yield increase of 10.5 per cent. The same author conducted cotton trials in the same year and had a yield increase of 11.2 per cent. Grape trials in large unreplicated tests had increased yields ranging from three per cent to 70 per cent with an overall average of 25 per cent (Magdoff and Weil 2004). In other tests, wheat yields were reported to increase in ranges of 7.3 per cent to 18 per cent (Xudan 1986). A very good summary and overview of humic acid research is covered in the book *Soil Organic Matter in Sustainable Agriculture* by F. Magdoff and R. Weil published in 2004.

Humic acids also build soil structure. Fulvic acids are physically smaller than

High Quality Humic Acid	Low Quality Humic Acid
derived from leonardite	derived from coal, brown coal, compost, manure or peat
potassium hydroxide	aluminum hydroxide, sodium hydroxide, other alkalines
no heavy metals	heavy metals - lead, arsenic, mercury
organic certification	not organically certified
low usage rates indicate strength	high usage rates indicate weakness
fairly priced	you get what you pay for

humic acids. Being smaller in size the fulvic acids tend to break up heavy clay soils by absorbing the materials that bind soil particles together. The larger humic acids tend to bind soil particles together like glue so they are better at building and creating soil structure in sandy soils.

Of all the raw materials mentioned, leonardite is the best source of humic acids. Leonardite is a mineral that forms on top of coal beds. It is not to be confused with the minerals leonhardite or leonhardtite (Jackson, Mehl, and Neuendorf 2005). In its natural mineral form leonardite is insoluble and unavailable to plants. The humic acids have to be released from leonardite using a solvent. The refining process of leonardite involves reacting the mineral with sodium hydroxide, aluminum hydroxide, potassium hydroxide or other alkaline materials. Using sodium hydroxide results in an average of 7.5 per cent sodium salt in the final product which can be toxic to plants and can lead to salt build up in the soil. Aluminum hydroxide releases aluminum into the soil which, under certain pH conditions, ties up or competes with other nutrients to make them unavailable for plants to use. Look for humic acids that have been manufactured using potassium hydroxide as a solvent, because it results in potassium remaining in the final product; potassium is a desirable essential plant food. Potassium is the K in the N-P-K number of fertilizer labels.

Finally, look for humic acid products that have organic certification. Organic certification ensures that the humic acid you are buying is not loaded with heavy metals, pathogenic organisms, animal by-products, sewage materials or other fillers and impurities.

Features you should look for in a high quality humic acid product can be found in the table above. MY

An easily downloadable humic acid reference is available at www.maximumyield.com