The Real Dirt on Humic Substances

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Humic substances (HS) are the least understood component of soil, yet one of the most important materials found in a healthy balanced soil system. While much has been discovered over the last 40 years, scientists who have experience working with HS realize that the more we know the more there is to learn about these versatile materials. Over the past 15 years hydroponic growers have also proven that soluble carbon, in particular humic substances, are a limiting factor in aqueous based cultures and soilless media. Today most gardeners are familiar with HS on some level and have seen the benefits, yet many are still scratching their heads when it comes to understanding the labelling. The focus of this article is not to readdress the qualities and benefits of HS. Instead it is to explore the confusion surrounding analysis, registration issues, and misconceptions about humic and fulvic products in general.

Currently, there is considerable buzz about humic and fulvic acid, which is no surprise to people who have experience using a high quality product. But confusion due to product labelling has many people questioning the humic substance industry. The way a product is described, guaranteed and marketed is largely governed by state agricultural regulatory departments. Unfortunately, there is no "standardized" analytical method for quantification, and accepted labelling practices often vary greatly from state to state. For example, in California and Oregon the term fulvic acid is not allowed to be used on any product label. Instead these state agencies consider fulvic and humic acid the same substance and require that only humic acid be used on labels. This creates analytical challenges and mass confusion for those products that are fulvic isolates, having no measurable humic acid in them. This might help to explain why some products will guarantee a product as 0.01 per cent and others may be claiming eight per cent. To help sort these issues out further we will review some of the commonly used, commercially available analytical methods as well as their advantages and disadvantages. First, to better understand the focus of this article we must define HS and the fractions thereof. For the sake of this article we will use definitions without too many details:

Organic matter - All the non-living material of biological origin in a soil system. These are found in various stages of decay.

Humus - Stable portions of organic matter that are well "rotted" but not yet having gone through the humification process.

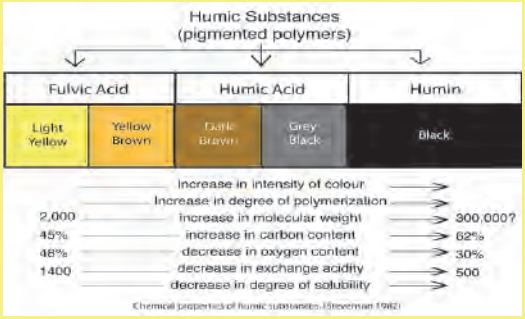
Humic substances (HS) - This is a broad heading that encompasses all fractions of the total material and can be defined as organic matter that is very stable; has been through the humification process; and is more resistant to microbial degradation. They are the end result of microbial degradation of once living organic material. Also often referred to as humate even though this is a bit of a misnomer.

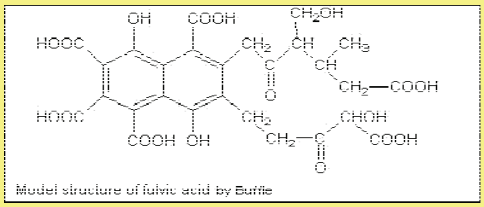
Humic acids - The fraction of HS only made soluble under alkaline (high pH) conditions and which is insoluble in dilute acid environments. They have a high molecular weight and are brown to black in color.

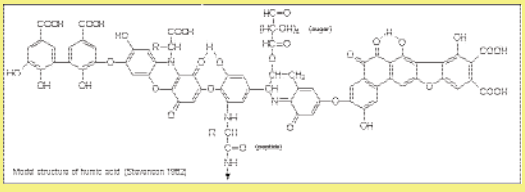
Fulvic acids - The fraction of HS that is soluble in water under all pH conditions. They remain in solution after removal of humic acid by acidification. Fulvic acids are golden to yellow-orange in color.

Humin - The fraction of humic substances that is not soluble water at any pH value. Humins are black in color.

Humate and fulvate - The salts of humic and fulvic acid respectively. When HS are extracted using chemical reagents these salt forms are created.







A CLOSER LOOK: We can gain more insight from the following diagrams. **Figure 1** shows how molecular weight can be directly related to the color of an extraction or product. Molecular weight is correlated to size of a molecule. The higher the molecular weight the larger the molecule's structure is. While some may find this a tedious detail, it is an important fact because humic acids are actually too large to be absorbed into a plants roots or leaves, while fulvic acid is small enough to be easily assimilated. This is why humic acids are more closely associated with soil conditioning properties and feeding soil microbes. This is in contrast to the smaller fulvic acid, which is better for increasing nutrient efficiency and uptake, lateral root growth, building plant immunity and also stimulating microbes. **Figure 2** provides us a "flavor" of what a fulvic acid molecule is like. It is important to note that HS are analogous to snow flakes because they are mixtures of similar types of molecules but not all are alike. This is due to the fact that they were created from a variety of different plants and other once living things. **Figure 3** is a proposed humic acid molecule. These diagrams make it easier to envision the idea of molecular size and how it influences humic and fulvic's functions in plant and soil systems.