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Humic Substances in Organic Wastes and their Effects on Amended Soils

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Soil humic substances (HS) are universally recognized to play a major role in a wide number of agronomic and environmental processes. For example, soil HS are able to bind mineral particles together, thus promoting a good soil structure, constitute an important source of nutrients for plants and microorganisms, contribute largely to the acid-base buffering capacity of soils, and exert a marked control on the biological availability, physico-chemical behavior, and environmental fate of toxic metal ions and xenobiotics. For these reasons, the knowledge of the short- and long-term effects of organic amendments on the status, quality, and reactivity of indigenous soil HS is of paramount importance.

The objective of this presentation is to provide an overview of the chemical and physico-chemical data available in the literature for the evaluation of the effects of organic wastes of various origin and nature used as soil amendments on the composition, structure, and chemical reactivity of native soil HS. In general, HS-like components of organic wastes are typically characterized by a relatively larger presence of aliphatic, amide, and polysaccharide structures, simple structural components of wide molecular heterogeneity, smaller contents of oxygen, acidic functional groups, and organic free radicals, and smaller degrees of aromatic ring polycondensation, polymerization, and humification than native soil HS. Further, with respect to native soil HS, HS-like fractions from organic wastes generally exhibit smaller binding capacities and affinities for metal ions and organic xenobiotics.

Appropriate treatment processes of raw organic wastes able to produce environmentally safe and agronomically efficient soil amendments, such as composting, yield HS-like fractions characterized by chemical and physico-chemical features that approach those of native soil HS. In general, aliphatic, polysaccharide, and lignin structures and S- and N-containing groups of the HS-like fractions of organic wastes can be partially incorporated into native soil HS determining modifications at various extents of their composition, structure, and chemistry. The changes occurred in amended soil HS are more evident when untreated organic materials are used. However, with increasing time after land application, the effects observed become less and less apparent with a clear trend to approach the molecular properties typical of native soil HS.