Soil organic matter is defined as the dead material from plants and animals and the respective degradation and transformation products in and on mineral soil (Schachtschabel et al. 1989). The organic matter subjected to microbial decay in soils comes from several sources. The decomposition of organic matter provides energy for the growth of microorganisms and supplies carbon for the formation of new cell material.

Under aerobic conditions, frequently 60–80% of the substrate carbon is released as CO₂, or accumulates as waste products. The remaining 20–40% supplies organic compounds for the synthesis of microbial biomass (Gisi 1990). Fungi use a higher portion of transformed substrate for their own biomass than bacteria. Within 1 year, 2–5% of soil organic matter can be mineralized. Soil organic matter serves not only as substrate for microorganisms but plays an important role in the formation and stabilization of aggregates with clay minerals and amorphous colloids (Stotzky 1986). Soil organic matter of macroaggregates (>250 μm) can be decomposed more readily than microaggregates (Elliot 1986). Humic substances adsorb microorganisms and soil enzymes, preventing their rapid decomposition.

Humus consists of non-humic substances and the more reactive humic substances (Schachtschabel et al. 1989). The further classification of humic substances is based on chemical fractionation. Fulvic acids are soluble after acid treatment of extracts. The precipitated fraction includes humic acids. Dissolving the humic acids and adding an electrolyte results in solubilization of the brown humic acids and in precipitation of the grey humic acids. The mentioned fractions behave differently with respect to colour, molecular weight, degree of polymerization, and other chemical properties (Chen and Stevenson 1986).

Frequently, bases (e.g. 0.5 M NaOH) are used as extractants, which results in high yields of humic substances (Hayes 1985). Neverthe-
less, high pH-values promote oxidation processes, and thus alter
the characteristics of the humic substances (Danneberg 1973;
showed that the use of complexing agents (e.g. Na$_4$P$_2$O$_7$) is less detri-
mental. In contrast to NaOH extractions, high portions of grey humic
acids can be detected.

The degree of humification of soil organic matter can be charac-
terized by means of different parameters:

a) Relation of extractable organic carbon to total organic carbon
b) Relation of extractable optical density (400 nm) to total organic
carbon or humus content (C$_r$-factor)
c) Relation of extractable optical densities (400 nm) of humic and
fulvic acids
d) Relation of extractable “pure brown humic acids” to “pure fulvic
acids”, measured as mg C·g$^{-1}$ soil (Danneberg and Ullah 1982)
e) Relation of fulvic acid and non-humic substances to “pure fulvic
acids” and humic acids (Sequi et al. 1986)

Methods (a) and (b) require only the extraction and the subsequent
determination of organic carbon or the measurement of extinction at
400 nm. Information from method (a) is reduced by including the
non-humic substances. Method (c) requires the precipitation of
humic acids. Parameter (d) can be obtained by exclusion chromatog-
raphy of fulvic and humic acids with on-line measurement of extinc-
tion values and organic carbon contents (Danneberg 1979, 1981).
Parameter (e) is based on separation of the fulvic acid fraction into
non-humic substances and “pure fulvic acids” on polyvinyl-
pyrrolidon. The non-humic substances of the fulvic acid fraction are
set in relation to the “pure fulvic acids” plus the non separated humic
acids. Lack of information about non-humic substances in the humic
acid fraction weakens this method. The balance between expenditure
and information seems to be most reasonable for methods (b) and
(c).

A simple and widely used parameter for characterizing humic
extracts is the relation of optical densities or extinctions measured at
400 and 600 nm ($E_4/E_6$). This value is independent of concentration
and decreases with increasing condensation of humic substances
(Schnitzer and Khan 1972).