Organic Matter and Humus

Introductory Microbiology (BSH-114)

Instructor
Dr. A. K. Sachan
Professor

Presented By
Dr. Anurag Dhankar
Teaching Associate

Department of Soil Science and Agricultural Chemistry C.S.A
UNIVERSITY OF AGRICULTURE AND TECHNOLOGY KANPUR(U.P.)
208002

FORMATION OF HUMUS

- Partially degraded crop residues that are no longer recognizable as plant material
- Decomposition by microorganisms and fauna
- Byproducts of humification is the Humus

ORGANIC MATTER FORMATION

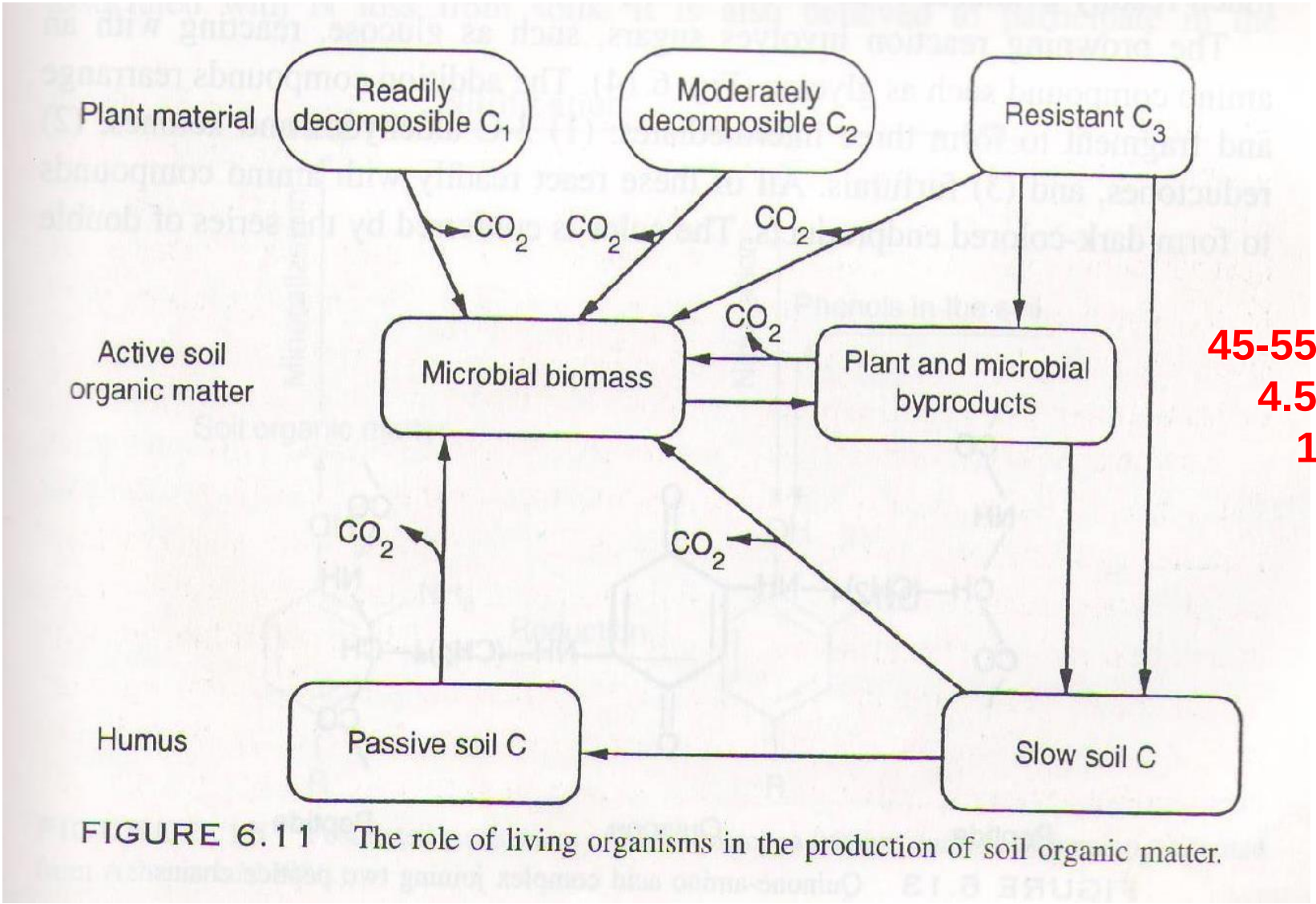

FIGURE 6.11 The role of living organisms in the production of soil organic matter.

45-55% C
4.5% N
1% S

1. POLYPHENOL MECHANISM

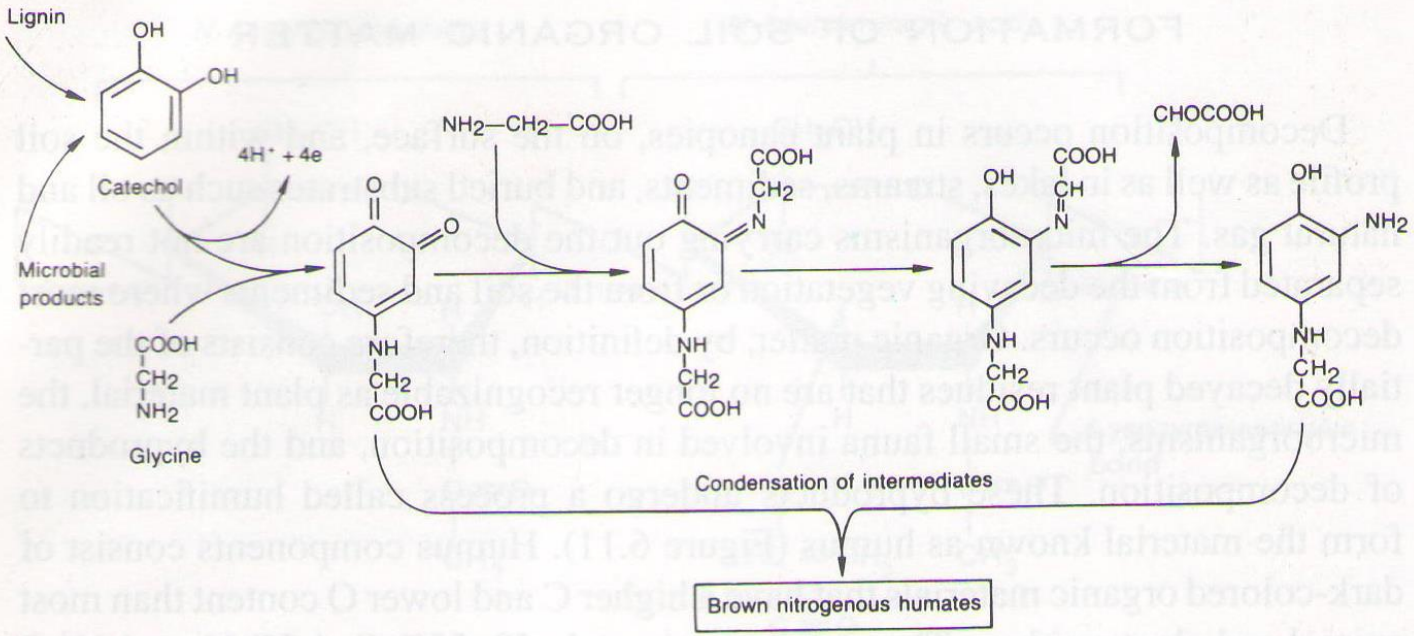

FIGURE 6.12 Polyphenol mechanism for the formation of humates, showing the reaction of a phenol (catechol) and an amino compound (glycine).

- **Catechol derived from the partial degradation of lignin or microbial pigments produced by *Epicoccum* fungus**

- **Glycine + Catechol gives aminoquinone and Oxidized to Quinone**

- **Condensation reaction leads to brown coloured, high MW nitrogenous humates**

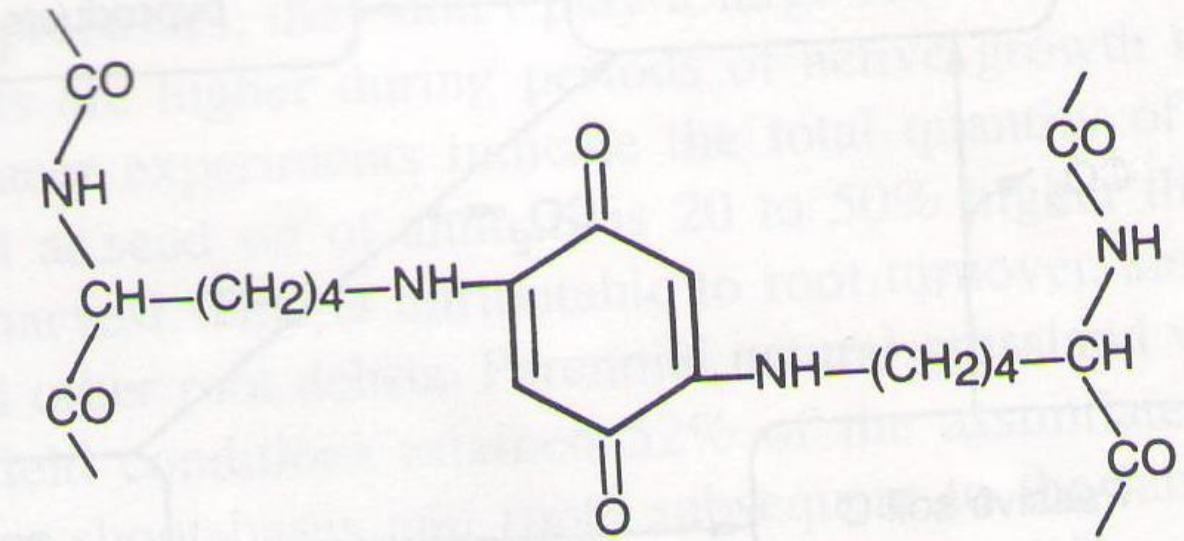

FIGURE 6.13 Quinone-amino acid complex joining two peptide chains.

2. Browning Mechanisms

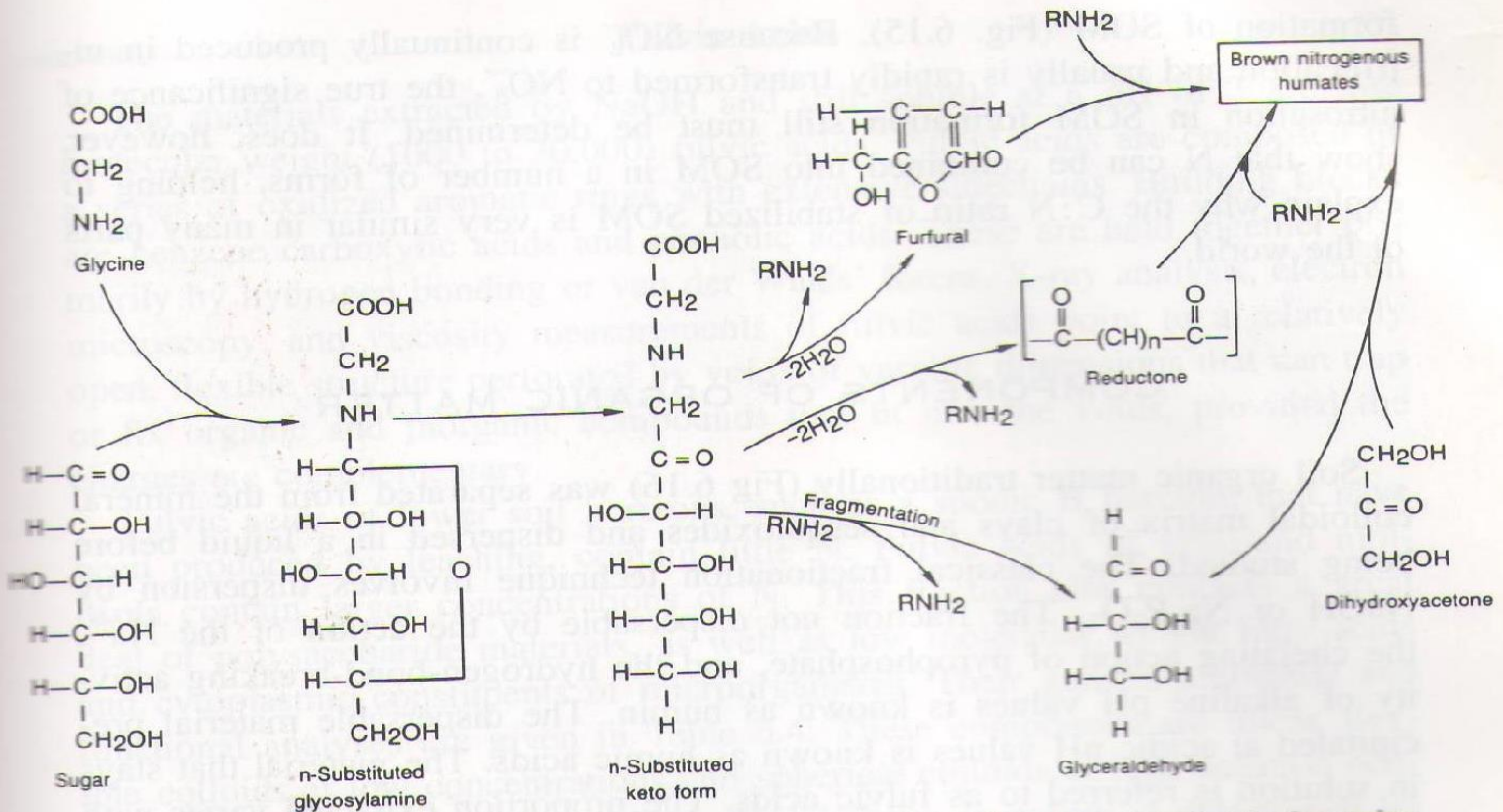

FIGURE 6.14 A generalized mechanism for the formation of humates, showing the browning reaction between the amino acid, glycine, and sugar; other amino compounds or reducing sugars can be involved.

3 C aldehydes and ketones, rectones and furfurols

3. NITROSATION REACTION

bonds. The amount of free radicals actually stabilized in soil is small. More details on humification are available in the publications by Aiken *et al.*, (1985), Haider (1992), and Stevenson (1994).

Nitrosation, a mechanism in which oxidized N reacts with phenols, is often associated with N loss from soils. It is also believed to participate in the

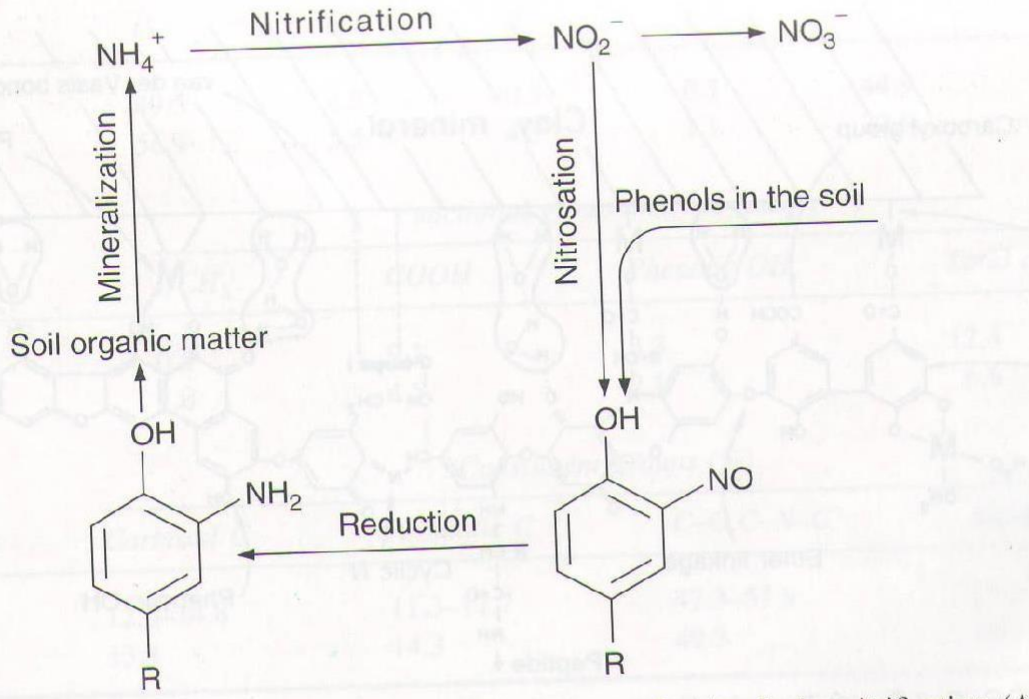

FIGURE 6.15 Postulated mechanism of nitrite-nitrogen fixation during nitrification. (Adapted from Azhar *et al.*, 1986.)

Components of Organic Matter

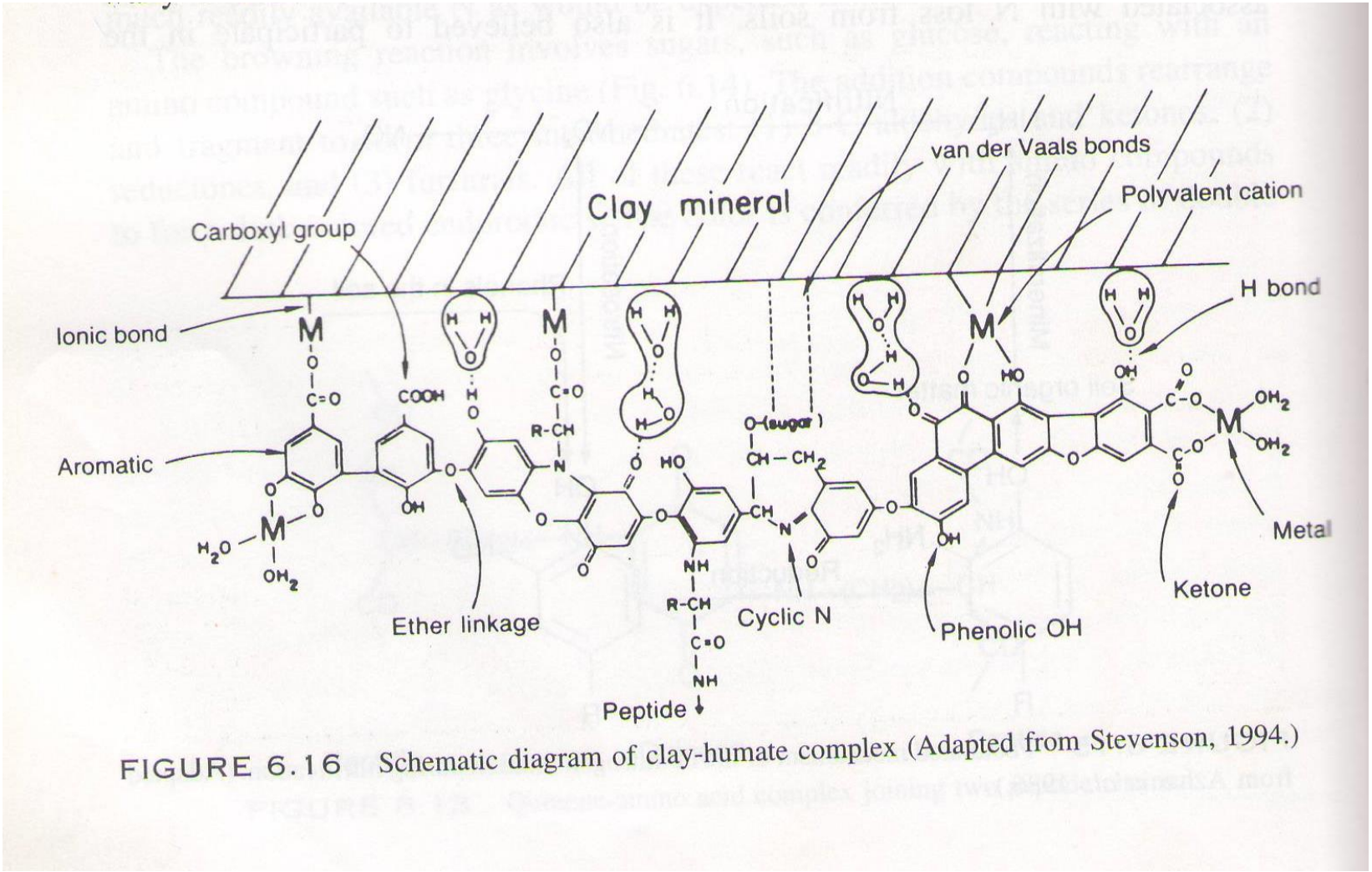

FIGURE 6.16 Schematic diagram of clay-humate complex (Adapted from Stevenson, 1994.)

TABLE 6.4 Elemental, Functional-, and Constituent-Group Analysis of Humic and Fulvic Acids[a]

Sample	Elemental analysis (%)					
	C	*H*	*N*	*S*	*O*	Ash
Fulvic acid	49.5	4.5	0.8	0.3	44.9	2.4
Humic acid	56.4	5.5	4.1	1.1	32.9	0.9

	Functional-group analysis (meq g^{-1})			
	OCH_3	*COOH*	*Phenolic OH*	*Total acidity*
Fulvic acid	0.5	9.1	3.3	12.4
Humic acid	1.0	4.5	2.1	6.6

	Constituent groups (%)			
	Carboxyl C	*Aromatic C*	*C–O,C–N–C*	*Aliphatic C*
Range	12.0–14.8	11.3–17.7	47.3–51.9	21.3–24.6
Average	13.4	14.3	49.3	23.0

[a]Adapted from Haider (1992).