

HUMUS

Information Sheet

*This is a collection of observations on the nature and properties of humus made by Dr. Selman A. Waksman (Nobel Prize for Medicine, 1952) from his work entitled **Humus** (Baltimore, MD: Williams & Wilkins, 1938), pp. 5-7.*

Humus is a complex aggregate of brown to dark colored amorphous substances, which have originated during the decomposition of plant and animal residues by microorganisms, under aerobic and anaerobic conditions, usually in soils, composts, peat-bogs, and water basins. Chemically, humus consists of certain constituents of the original plant material resistant to further decomposition; of substances undergoing decomposition; of complexes resulting from decomposition either by processes of hydrolysis or by oxidation and reduction; and of various compounds synthesized by microorganisms. Humus is a natural body; it is a composite entity just as are plant, animal and microbial substances; it is even much more complex chemically, since all of these materials contribute to its formation. Humus possesses certain specific physical, chemical and biological properties which make it distinct from other natural organic bodies. Humus, in itself or by interaction with certain inorganic constituents of the soil, forms a complex colloidal system, the different constituents of which are held together by surface forces; this system is adaptable to changing conditions of reaction, moisture, and action of electrolytes. The numerous activities of the soil microorganisms take place in this system to a large extent.

It is now definitely recognized that humus has resulted from the decomposition of plant and animal bodies, mainly through the agency of microorganisms although the possibility of certain chemical reactions taking place in the process is not excluded. Humus has, therefore, certain specific properties which distinguish it from other natural bodies. These properties can be briefly summarized as follows:

1. Humus possesses a dark brown to black color.
2. Humus is practically insoluble in water, although a part of it may go into colloidal solution in pure water. Humus dissolves to a large extent in dilute alkali solutions, especially on boiling, giving a dark colored extract; a large part of this extract precipitates when the alkaline solution is neutralized by mineral acids.
3. Humus contains a somewhat larger amount of carbon than do plant, animal, and microbial bodies; the carbon content of humus is usually about 55 to 56 per cent, and frequently reaches 58 per cent.
4. Humus contains considerable nitrogen, usually about 3 to 6 per cent. The nitrogen concentration may be frequently less than this figure; in the case of certain highmoor peats, for example, it may be only 0.5-0.8 per cent. It may also be higher, especially in subsoils, frequently reaching 10 to 12 per cent.
5. Humus contains the elements carbon and nitrogen in proportions which are close to 10:1; this is true of many soils and of humus in sea bottoms. This ratio varies considerably with the nature of the humus, the stage of its decomposition, the nature and depth of soil from which it is obtained, and climatic and other environmental conditions under which it is formed.
6. Humus is not in a static, but rather in a dynamic, condition, since it is constantly formed from plant and animal residues and is continually decomposed further by microorganisms.
7. Humus serves as a source of energy for the development of various groups of microorganisms, and, during decomposition, gives off a continuous stream of carbon dioxide and ammonia.
8. Humus is characterized by a high capacity of base-exchange, of combining with various other inorganic soil constituents, of absorbing water and of swelling, and by other physical and physico-chemical properties which make it a highly valuable constituent of substrates which support plant and animal life.

WHAT HAPPENS IN THE COMPOST PILE

ORGANIC MATTER

- leaves (not too many)
- grass - green or dry
- kitchen waste
 - peelings
 - egg shells
 - coffee grounds
- garden waste
 - weeds
 - prunings
 - dead plants
 - corn stalks (better chopped up)
- straw
- animal residues (not dog or cat)

is eaten and broken down by

MICRO ORGANISMS

- bacteria
- actinomyces
- protozoa
- fungi
- algae, moulds, yeasts, viruses
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- larger fungi
- mites, ants, termites, sowbugs, snails, slugs, millipedes, spiders, nematodes, etc.

which recombine and transform it into

worms, earthworms

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