32 Nitrogen—Organic Forms

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32-1 INTRODUCTION

Chapters 85 (Bremner, 1965), 96 (Stevenson, 1965b), and 97 (Stevenson, 1965a) of previous ASA monograph Methods of Soil Analysis (Black et al., 1965) has been combined and updated. The reader is referred to the above-mentioned chapters for detailed background information, including a historical account of the development of methods for determining organic forms of N in soils. Detailed reviews of organic N compounds in soil have been provided by Kowalenko (1978) and Parsons and Tinsley (1975).

Most studies on the forms of organic N in soils are based on the use of hot mineral acids (or bases) to liberate nitrogenous constituents from clay minerals and organic colloids. In a typical procedure, the soil is heated with 3 or 6M HCl, after which the N is separated into several discrete fractions. The N remaining in the soil residue is usually referred to as acid-insoluble N; that recovered by distillation with MgO is ammonia-N (NH₃-N). The N brought down in the MgO precipitate after distillation of NH₃ is called humin-N. This fraction is seldom determined and is often grouped with other unaccounted for N as the unidentified or unknown fraction.

The main identifiable organic N compounds in soil hydrolysates are the amino acids and amino sugars. Soils contain trace quantities of nucleic acids and other nitrogenous biochemicals but specialized techniques are required for their separation and identification. Only one third to one half of the organic N in soils can be accounted for in known compounds.

The procedure for hydrolyzing the soil has not been standardized, and many variations in hydrolytic conditions have been employed. The variables include (i) type and concentration of acid, (ii) time and temperature of hydrolysis, (iii) ratio of acid to soil, and (iv) pretreatment (Kowalenko, 1978). In general, hydrolysis is done under reflux with 6M HCl for 6 to 24 hours.

A large amount of the N in soil, usually about 25 to 35%, is recovered as acid-insoluble N. At one time it was thought that this fraction was an artifact resulting from the condensation of amino acids with reducing sugars during hydrolysis, but it is now believed that some of this N occurs as a structural component of humic substances. Cheng et al. (1975) found that...