

A Simple Alkaline Hydrolysis Method for Estimating Nitrogen Mineralization Potential of Soils

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Abstract

A simple, precise and rapid alkaline hydrolysis method for determining nitrogen (N) availability index of soils is described. It involves direct steam distillation of 1 g field-moist soil and 1 M KOH, NaOH, LiOH or phosphate-borate buffer (pH 11.8) and the amount of NH₄⁺-N released trapped in boric acid and its concentration determined successively every 5 min for a total of 40 min. The cumulative N hydrolyzed was fitted to a hyperbolic equation to determine the maximum hydrolyzable N (N_{max}) and the time required to hydrolyze one-half of N_{max} (K_t) by linear regression of the transformed data. First-order equation was also used to estimate the potentially hydrolyzable N (N_o), hydrolysis rate constant (k) and the time required to hydrolyze one-half of N_o ($t_{1/2}$). Results showed that, for each soil and reagent, N_{max} and N_o values were similar, but differed significantly among soils, suggesting differences in the chemical nature or reactivity of organic N in the soils. In general, N_{max} and N_o values ranged from 401 to 1667 mg kg⁻¹ soil and accounted for 12-56% of total organic N in the soils. The Kt values ranged between 15 and 30 min. Among the reagents tested, KOH and NaOH showed the best promise for estimating the total hydrolyzable organic N pool in the soils. The N_{max} and N_o values were significantly correlated with the amounts of N mineralized in two weeks under aerobic and anaerobic conditions at 30 °C, N released by 2 M KCl extraction at 80°C for 20 h, and the initial NH₄⁺-N present in the soils. We concluded that direct steam distillation of soils with 1M KOH or NaOH offer a quick and precise mean for estimating the potentially mineralizable organic N pool and availability index in soils.