Use of 13-C NMR for Organic Matter Characterization in Forest Ecosystem Studies. (S07-johnson122958-Oral)

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Abstract:

Soil organic matter (SOM) is an energy source for soil biota, a nutrient reservoir for plants, a regulator of soil and solution acidity, and an important factor in soil texture. For all these reasons, interest in the characterization of the structural chemistry of SOM has grown rapidly in recent years. Carbon-13 nuclear magnetic resonance spectroscopy (13C-NMR) holds great promise as a non-destructive means of studying the nature of carbon bonding in SOM. Known limitations to CP/MAS (cross polarization/magic angle spinning) 13C-NMR - the most commonly used technique - include difficulties in quantitation and interference by paramagnetics such as Fe and Mn. We have used CP/MAS 13C-NMR to study organic matter dynamics in forest-watershed ecosystems at the Hubbard Brook Experimental Forest, in New Hampshire. In studies using whole-soils, extracted SOM, and humic substances isolated from soils, soil solutions and stream waters, we have found that 13C-NMR is especially useful for characterization of organic matter chemistry, and comparisons of organic matter derived from different sources. Pre-treatment using 2% HF can reduce the effects of paramagnetics. Uncertainties regarding quantitation limit the usefulness of CP/MAS 13C-NMR in detecting change over time, or change due to treatment effects, unless the magnitude of those changes is large. For this reason, the method is ideally suited for the study of the most dynamic pools of organic matter.

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