

Kaur, S. and Gillespie, A. 2023. **Revolutionizing the Soil Nitrogen Mineralization Measurement Using Pyrolysis Coupled with FTIR**. Presentation at Soil Science of America Conference, St Louis, USA Nov 2023.

Abstract - Soil nitrogen (N) is a key component of plant nutrition but our ability to predict organic N mineralization potential remains incomplete. Several methods are commonly used to characterize and measure mineralizable N; however, they are generally lacking because of required lab resources and poor predictive power. Pyrolysis is an emerging technology used to characterize soil organic matter and thermal stability of soils. However, the idea of using Pyrolysis technology to characterize soil N and measuring soil N release is novel. We adopted a novel online pyrolysis coupled with FTIR (Fourier-transform infrared spectroscopy) technology to investigate soil N. The soil samples were pyrolyzed from 25 to 850 °C with heating rates of 10, 15, and 25 K min⁻¹. The temperature at which 50% of the material underwent pyrolysis, referred to as T50, was determined to quantify the thermal stability. The focus was to look at mass loss characteristics, identify volatile matter released, T50 and the correlation of TG-FTIR data with a 12-week lab mineralization study. We found that the heating rate significantly affected the relationship (R²) between T50 and mineralized N at Week-12. The mineralization study demonstrated a strong correlation (R²= -0.92), at heating rate of 10 K min⁻¹. However, as the heating rate increased 15 K min⁻¹ and 25 K min⁻¹, the correlation weakened, suggesting poor relationship between T50 with 25 K min⁻¹(R² = -0.48) and 15 K min⁻¹ (R² = -0.52) . In conclusion, this study elucidates the intricate interplay between heating rates, thermal degradation kinetics, and nitrogen mineralization. The negative correlation observed at the optimal heating rate of 10 K min⁻¹ underscores the potential of the material to release N during over time. This research offers a valuable foundation for optimizing Pyrolysis application in context of soil nitrogen.