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Measuring potential denitrification enzyme activity rates using the membrane inlet mass spectrometer

The denitrification enzyme activity (DEA) assay, provides a quantitative assessment of the multi enzyme, biological process of reactive nitrogen removal via the reduction of $N0_3$ to N_2. Measured in soil, usually under non limiting carbon and nitrate concentrations, this short term, laboratory assay (≤ 6h) provides quantitative information on the potential denitrification enzyme activity existing in the soil at time of sampling. DEA is related to size of the denitrifying enzyme pool and yields an index of the denitrifier population in soils that is reflective of long term *in situ* denitrification rates. DEA is commonly measured by the production of nitrous oxide that accumulates due to acetylene inhibition of the enzyme nitrous oxide reductase; rate is expressed as ng N_20-N/g dry soil/h. Other approaches have been used to quantify this process. It is a challenging activity to measure. Without using an acetylene block the small amount of the major end product N_2 is difficult to measure in the high background of N_2 that exists in the atmosphere. Using the membrane inlet mass spectrometer (MIMS) background problems are reduced by sampling the DEA solution and measuring an increase in the N2/Ar ratio with time. Presented is our approach for measuring rates of DEA in surface soil samples using the MIMS. Reaction vessel design, sampling regimes, rate calculations, appropriate controls and data quality objectives are examined and discussed.