



Suppression of N₂O and NO from denitrification by biochar: the role of pH

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Denitrification reduces NO₃⁻ to N₂ and returns excess nitrogen to the atmosphere. NO and N₂O are gaseous intermediates of denitrification which, once escaped to the atmosphere, have adverse effects on chemistry and radiative forcing in the atmosphere. We studied the effect of biochar on denitrification and its gaseous intermediates in two acidic soils and tried to distinguish between the alkalizing effect of biochars on soil pH, and other, unknown effects of biochar on denitrification. Anoxic soil slurries were incubated with untreated biochars or biochars from which part of the alkalinity had been removed by water- and acid leaching. Soils amended with NaOH and uncharred cacao shell were used as controls. Biochar addition stimulated overall denitrification depending on biochar and soil type. This stimulation was not strictly coupled to pH increase, suggesting that biochar fueled respiration processes by contributing microbially available C. High resolution gas kinetics of NO, N₂O and N₂ showed that biochar amended soils induced denitrification enzymes earlier and with higher activity, resulting in less NO and N₂O accumulation relative to N₂ production. The extent to which biochar suppressed NO and N₂O was dose-dependent and clearly related to the effective pH increase during incubation. Acid leaching of BC reduced or eliminated its ability to suppress N₂O and NO net production. Comparison of BC with NaOH-amended soils showed that the reduction of N₂O and NO net production was mainly an effect of increase in soil pH. Even though other factors supporting N₂O reductase activity could not be excluded, our results indicate that soil pH increase might be an important driver behind the often-reported suppression of N₂O emissions after biochar addition.