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Editorial

Nitrification & Denitrification: A Key Player in Waste Water Treatment

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Nitrification and denitrification play a key role in regulating the concentration of inorganic N_2O production, a powerful greenhouse effect that also contributes to the depletion of stratospheric ozone. Changes in nitrification and denitrification in response to CO_2 growth, temperature rise and deposition of atmospheric and climatic changes. In addition, N loss of ecosystems, nitrification and denitrification affect the existence of the N ecosystem for decades to hundreds of years. Because the availability of N in ecosystems can reduce abduction C, changes in nitrification and denitrification could alter the storage of Earth C and atmospheric CO_2 concentrations. Nitrification and denitrification may be influenced by CO_2, temperature and N through a wide variety of complex, interactive mechanisms. Some of the effects are direct, but many of them are indirect. For example, nitrification is aerobic and denitrification is anaerobic, so that indirect effects of environmental change on O_2 concentrations in the soil play a key role in controlling these processes. Increased CO_2 and temperature have a strong influence on soil water content and soil biological activity in many field experiments, as a result of which a strong control of the concentrations of O_2 in the soil is exercised. Nitrification is generally promoted by increasing the availability of NH_{4+}, the initial substrate for nitrification. It is preferred at moderate pH and in well aerated soils, but decreases as the soil becomes very dry. The temperature response of nitrification is approximately bell-shaped with an optimum between 20°C and 35°C. The decrease at higher temperatures may partly be due to an increased biological O_2 consumption. Denitrification is generally promoted by high availability of labile C as a source of energy and of NO_3 as an electron acceptor. It is preferred in poorly aerated soils, with a pH close to neutrality. The reaction of denitrification to temperature is comparable to that of nitrification, but can have a higher temperature maximum. Nitrification and denitrification can produce N_2O. During denitrification, NO_3 is reduced to NO_2 and then to NO, N_2O or N_2, the latter is the smallest form. The increase in soil toxicity, labile availability, availability of NO_3, pH and temperature, are changing gaseous emissions to the smallest forms. During nitrification, some NO, N_2O and N_2 can be released through two routes, the best of which is documented of what nitrifier is denitrification. N_2O effluent associated with nitrification is generally a small fraction of the total nitrification flow N, but it can often make a great contribution N_2O. There are preliminary indications that the fraction of the N_2O emissions associated with nitrification decreases with the increase in temperature. The production of N_2O is, therefore, a complex process that is not easy to relate to total denitrification or nitrification flows, although some recently developed approaches can provide interesting information about the metabolic origin of N_2O. Nitrification, denitrification and N_2O effluence are controlled by complex and environmental factors that are interconnected and are likely to be modified by high CO_2, extra N and warming. Although the limited number of high temperature experiments presented here emphasizes the need for the hottest on-site studies, some models emerge from high CO_2 and N studies. The CO_2 increase generally has little effect or effect Negative in nitrification, while N increases the nitrification. Increased CO_2 in general can reduce denitrification, possibly by reducing NO_3 availability of earth, while the response of denitrification to the addition of N is very variable. Often there is little reaction from the N_2O streams on high CO_2 in the field, which can be explained by the balance between the positive and negative effects of high CO_2 in the environmental and biological processes that determine N_2O emissions. The stimulation of N_2O field emissions by N-substrate has been clearly demonstrated, although the response range is large and shows no correlation with the sum of the added N. It is becoming increasingly clear that, in order to get a better understanding of the complexity of environmental controls on nitrification and denitrification, it is necessary to control these processes using different methods along with their main motives.

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