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The efficiency of different electron donor sources in biological denitrification processes

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Groundwater nitrate pollution has increased globally mainly due to agricultural activities, impairing drinking water quality and potentially causing human health and environmental problems. Biological denitrification, the principal NO_3^- removal process in groundwater, can be enhanced by providing external organic carbon to overcome the natural limitation of electron donors.

The study of the efficiency and capacity of different cheap and easy-to-find electron donors (circular economy) in degrading nitrates in groundwaters is of utmost importance for the design of field applications able to enhance denitrification in severe contaminated areas such as the Campo de Cartagena aquifer discharging to the Mar Menor in the southeast Iberian Peninsula (Spain). This study is carried out in laboratory experiments (batch and column experiments) where different electron donors sources (mainly from food industry) are tested. N compounds concentrations and N and O isotopes are measured over time. The use of robust geochemical and/or reactive transport models able to reproduce these experimental results helps in the upscaling of these systems to field scale and in the design of pilot sites These models consider nitrate and nitrite reduction associated to organic matter oxidation coupled with evolution of the isotopic composition and have resulted successful in the assessing the potential of wine wastes residues to remove NO_3^- in a constructed wetland [1].

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References

[1] Abu, A., Carrey, R., Navarro-Ciurana, D., Soler, A., Otero, N., Causapé, J. & Domènech, C. (2023, in prep.). The potential of industrial wine residue to induce biological denitrification in laboratory batch and column experiments using chemical, isotopic and numerical modeling tools.

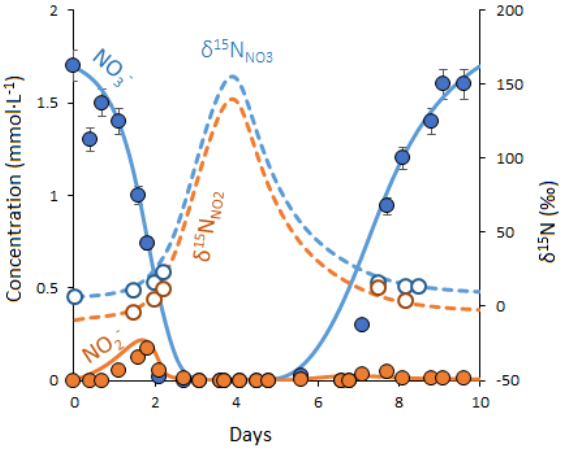

Figure 1. Experimental (circles) and model results (lines) in a denitrifcation column experiment with wine waste [1]