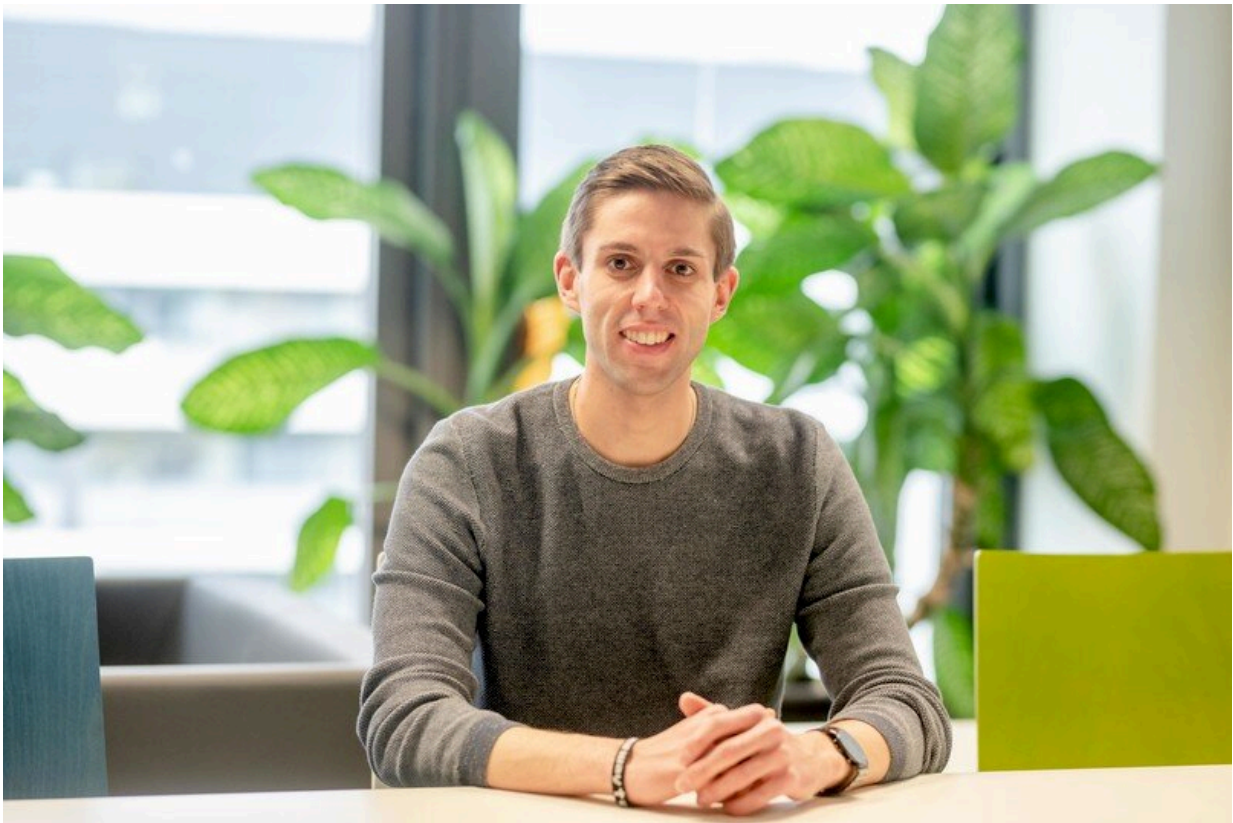


# How nitrate concentrations can be reduced in groundwater

December 1 2021

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Felix Ortmeyer has recreated groundwater systems in the laboratory. Credit: RUB, Marquard

High nitrate levels in groundwater are often caused by nitrogen fertilizers used in agriculture. Germany and other EU member states

have already been taken to the European Court of Justice for non-compliance with the EU's Nitrate Directive. "This means intervention is urgently needed to protect the groundwater," explains Felix Ortmeyer, who works at the Department of Applied Geology/Hydrogeology at RUB. One way to improve nitrate degradation is to add carbon-containing substances to the groundwater.

In his study, Ortmeyer analyzed the effect of various additives. To this end, he recreated the [groundwater](#) system on a laboratory scale, where water containing nitrates flowed through sediment-filled columns containing natural microorganisms. At room temperature and at the groundwater temperature of 10 degrees Celsius, which is typical in Germany, Ortmeyer added four substances and observed what happened: ethanol, acetate, [ascorbic acid](#) and glucose served as carbon suppliers. In addition to nitrate degradation, microbiological processes were also examined in cooperation with the RUB's Department of Evolution of Plants and Fungi. It was observed that temperature and the addition of organic carbon affected the composition of the microbial community.

## Temperature affects the choice of substance

"Previous studies had shown that the nitrate degradation works better with higher temperatures," explains Felix Ortmeyer. "But this is not true with ethanol: it is precisely at colder temperatures, which are typical for our groundwater, that degradation occurred best with ethanol." At [room temperature](#), glucose performed best.

"Groundwater temperature is thus an important factor in the selection of the substance that supplies the carbon for nitrate degradation," concludes Ortmeyer. "This finding is particularly considerable, because [climate change](#) is also expected to increase groundwater temperature."

**More information:** F. Ortmeyer et al, Comparison of Denitrification

Induced by Various Organic Substances—Reaction Rates, Microbiology, and Temperature Effect, *Water Resources Research* (2021). [DOI: 10.1029/2021WR029793](https://doi.org/10.1029/2021WR029793)

Provided by Ruhr-Universitaet-Bochum

Citation: How nitrate concentrations can be reduced in groundwater (2021, December 1)  
retrieved 10 April 2024 from <https://phys.org/news/2021-12-nitrate-groundwater.html>

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