Climate protection in the wastewater treatment arena

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Switzerland has around 800 municipal wastewater treatment plants. A recent study by Eawag researchers reveals the burden these plants place on the climate, and explores how emissions of climate-damaging nitrous oxide can be reduced.

Wastewater treatment plants (WTP) place a greater burden on the climate than was previously thought. They generate greenhouse gases at various processing stages and, in total, account for over one per cent of all greenhouse gas emissions in Switzerland. In the case of N_2O (nitrous oxide), which is particularly harmful to the climate and the ozone layer, they account for a massive 20 per cent or so of total emissions. “Wastewater treatment plants are significant N_2O emitters, not only in Switzerland but also worldwide,” according to Wenzel Gruber, a postdoc at Eawag’s Process Engineering Department, who says the global significance of emissions from WTPs has so far been “seriously underestimated”. This is due to the lack of measurement data with sufficient temporal and spatial resolution.

Überlandstrasse 133
CH-8600 Dübendorf
T +41 58 765 55 11
F +41 58 765 50 28
info@eawag.ch
www.eawag.ch

Eawag researchers during the assembly of the off-gas measurement system. (Photo: Andrin Moosmann)

Broad data set thanks to long-term monitoring

Under the umbrella of the N2Oara project at Eawag, researchers conducted 14 long-term observation series on various types of treatment plants in Switzerland. This enabled them to produce a broad data set for WTP emissions, and pave the way for a deeper understanding of emissions drivers. The results of the research project were recently presented. in the journal AQUA & GAS. Emissions of N2O from biological wastewater treatment make up the greatest proportion of greenhouse gas emissions from the treatment process as a whole. Biological treatment centres around the processes of nitrification and denitrification. The findings show that, if these process steps could be optimised, overall greenhouse gas emissions from a WTP could be reduced by up to 75 per cent.

Nitrous oxide emissions from wastewater treatment plants have long been underestimated.”
Wenzel Gruber, Eawag

No impact on the quality of treated wastewater

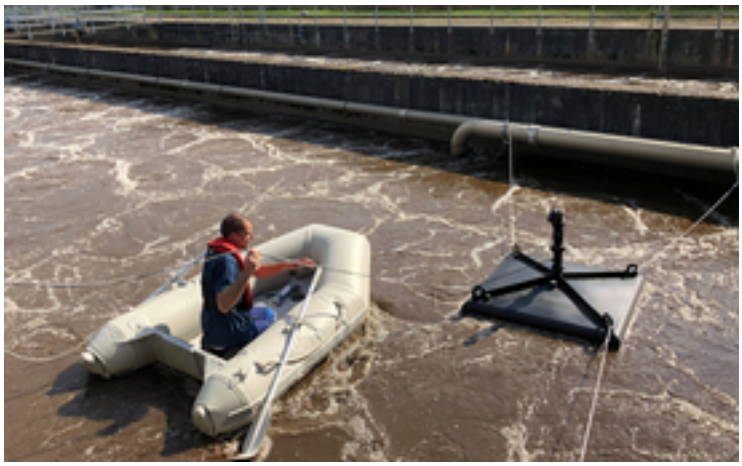
According to the researchers, optimisation could be achieved by boosting nitrogen elimination and preventing the accumulation of nitrite. “As our study shows, it’s possible to achieve a huge reduction in N2O emissions without reducing the quality of the treated water,” explains Gruber. In fact, the measures described here actually improved the effluent quality. However, before robust optimisation measures can be recommended, there is a need for greater insights into the mechanisms involved – and it is with this objective in mind that Eawag has launched two new projects. Eawag has been addressing the production of nitrous oxide in WTPs for a long time: the first dissertation on N2O from WTPs was authored in 1996 and was followed by another doctoral thesis in 2013. Nitrous oxide research was then presented to a wider audience at the Info Day 2018 on Wastewater as a Resource.

Increasing nitrogen elimination by Swiss wastewater treatment plants is also an issue at the political level. In December 2020, the National Council adopted a motion to this effect (20.4261). An amendment to the Water Protection Ordinance with a statutory limit value for nitrite is now in preparation. If this is implemented, a significant reduction in nitrous oxide

emissions from wastewater treatment plants can be expected in the future.

Cover picture: Andrin Moosmann, Eawag

Off-gas measurement hood in operation at the Birs WTP.
(Photo: Andrin Moosmann)



Eawag researcher Wenzel Gruber undertaking some maintenance work on the measurement system at the Moossee Urtenenbach WTP.
(Photo: Andrin Moosmann)

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Contact

Überlandstrasse 133
CH-8600 Dübendorf

T +41 58 765 55 11
F +41 58 765 50 28

info@eawag.ch
www.eawag.ch

eawag aquatic research

Wenzel Gruber

Tel. +41 58 765 6773

wenzel.gruber@eawag.ch

Andri Bryner

Media officer

Tel. +41 58 765 5104

andri.bryner@eawag.ch

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