



Treat wastewater in an environmentally sustainable way with worms

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Topics: Wastewater | Pollutants | Society | Climate Change & Energy

This research project explores vermifiltration as an alternative method for wastewater treatment. The aim is to fill knowledge gaps about greenhouse gas emissions, scaling-up, long-term operation, micropollutant abatement and treated wastewater reuse options.

Vermifiltration is a non-sewered sanitation technology that uses a symbiotic relationship between *Eisenia Fetida* earthworms and microorganisms to treat wastewater. The earthworms not only break down organic matter, which is then more easily available to the microorganisms, but they also aerate the vermifilter via their burrowing activity and this stimulates bacterial productivity. This technique has various advantages: it is low-cost and robust, requires minimal to no energy use and can be built with local, easily available materials (compost, biochar, gravels, sand, etc.). Additionally, treated wastewater can be used to close water and resource loops.



Vermifilter setup at the housing cooperative Equilibre in Geneva (Photo: Eawag, Kayla Coppens).

Vermifiltration has been implemented on a full-scale in various countries, including China, Germany, France, India, Rwanda, the USA and Switzerland. One example in Switzerland is the vermifiltration installation at the housing cooperative, Equilibre, in Geneva, which treats wastewater from 100 habitants. Despite growing implementation, an optimised design model for building and operating vermifiltration has not yet been scientifically defined. Additionally, as the majority of the scientific research remains at a laboratory scale, the effects of both scaling-up and long-term use on the treatment efficiency of vermifiltration is lacking. The lack of scientific knowledge is a barrier that impedes vermifiltration from being used more widely in Switzerland and globally.

Developing scientific standards

The vermifiltration research project at the University of Geneva is co-supervised by Dr. Linda Strande, Group Leader of the Management of Excreta, Wastewater and Sludge research group of the Department of Water, Sanitation and Solid Waste for Development (Sandec) at the aquatic research institute Eawag. It began in February 2022 and the first step was a study that evaluated the treatment performance of a full-scale vermifilter at the housing cooperative Equilibre in Geneva. Study results show that the effluent quality remains stable even with varying hourly hydraulic loading rates and with seasonal temperature changes. In addition, it was observed that the vermifilter buffers outdoor temperatures, which may explain how it can function well despite the colder climate observed in winter.

The next steps in the ongoing research include analysing greenhouse gas emissions, micropollutant treatment, nitrogen and phosphorus fates and the use of the effluent for irrigation. The results of this study aim to better understand the overall treatment mechanisms that are taking place during vermifiltration. These results are necessary in creating an optimised design model, as well as for ensuring treatment efficiency of future installations. Vermifiltration could be a boon for municipalities because it offers a low-cost, sustainable wastewater treatment system.

Research project featured in Sandec News

An article about this project is one of many articles in the 2023 Sandec News, the annual magazine of the Sandec Department. Sandec News highlights the department's current research, as well as information on publications in the sector and digital learning initiatives. The magazine is [available online](#).

Cover picture: Rooftop garden of the housing cooperative Equilibre in Geneva, irrigated with treated wastewater (Photo: Eawag, Kayla Coppens).

Original publication

Coppens, K., 'Vermifiltration: Optimising and Scaling-up for Domestic Wastewater Treatment' Sandec News, 24 (2023), 18-19

Documents

Singh, R., et al., 'Vermifiltration as a sustainable natural treatment technology for the treatment and reuse of wastewater: A review', *Journal of Environmental Management*, 247 (2019), 140-151. <https://doi.org/10.1016/j.jenvman.2019.06.075>

Samal, K., et al., 'Treatment of wastewater by vermifiltration integrated with macrophyte filter: A review.', *Journal of Environmental Chemical Engineering*, 5/3 (2017), 2274-2289. <https://doi.org/10.1016/j.jece.2017.04.026>

Chowdhury, S.D., et al., 'Sustainability assessment of vermifiltration technology for treating domestic sewage: A review.', *Journal of Water Process Engineering*, 50 (2022). <https://doi.org/10.1016/j.jwpe.2022.103266>

Council Directive 91/271/EEC of 21 May, 1991 Concerning Urban Waste Water Treatment (The Council of the European Communities, 1991). <http://data.europa.eu/eli/dir/1991/271/oj>

Exigences fixées aux stations d'épuration aérobies de faible capacité. (VSA, 2006).

Funding / Cooperations

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<https://www.eawag.ch/en/info/portal/news/news-archive/archive-detail/treat-wastewater-in-an-environmentally-sustainable-way-with-worms>