

Innovative Rain Gardens for Sustainable and Effective Treatment of Urban Runoff Polluted with Microplastics, Organic Pollutants, and Metals

Urbanization has contributed to a degradation in the quality of surface water, where inadequate stormwater management and pollution control have played an important role. Stormwater management in urban areas has moved from quantity control and combined sewers to current strategies for quantity and quality source control, with an emphasis on the multiple benefits provided by the blue-green infrastructure.

Though most stormwater discharges are still transported untreated to receiving waters, various technologies have been developed and used to treat stormwater locally. However, research supporting the new development of innovative and more effective technologies and management strategies are urgently needed to meet the demands on sustainable development of urban environments.

A cocktail of emerging environmental pollutants such as microplastics, toxic metals, and organic pollutants are released into urban environments and emissions are particularly high in highly trafficked areas. The largest proportion of pollution is transported from roads by runoff and further by stormwater to receiving watercourses. So far, research has focused on clarifying the consequences and fate of the cocktail of pollutants in the environment; however, technological solutions that solve the problem are lacking.

In this project, rain gardens are developed to treat urban stormwater with an innovative focus on the recycling of metals. Simultaneous studies are performed on the degradation of microplastics and organic pollutants in pilot filter beds with ash, bio-charcoal, peat, and plants in mycorrhiza symbiosis with fungi. The retention, degradation, or recycling of pollutants from road runoff will be studied in detail.

This project will be the first study of a cocktail of pollutants in pilot-scale rain gardens using fungi and innovative sorption materials such as municipal solid waste incineration ash, peat, and biochar in the soil-bed.

The relevance and value of this project are to support the implementation of rain gardens for the development of green and sustainable urban infrastructure. If polluted stormwater is treated as close to the emission sources as possible, then the nearby watercourses will contain fewer plastic particles and toxic compounds.

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