Removal of pharmaceuticals in constructed wetlands

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Motivation

Pollution by pharmaceuticals presents a challenge which is not satisfactorily solved by conventional wastewater treatment technologies. Some effective, advanced treatment technologies take high construction and maintenance costs, high energy consumption, and require qualified permanent staff for their operation. Constructed wetlands (CWs) can be managed as water quality improving systems representing an alternative or additional low-cost wastewater treatment. We aim to investigate the removal mechanism in CWs, to understand the pathways that are responsible for the removal, and to further optimize the removal efficiency.

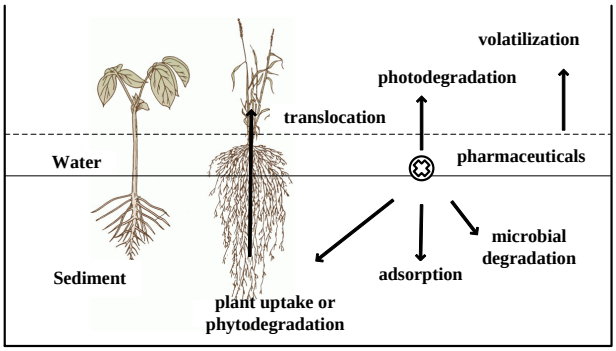
Technological challenge

CWs have been often viewed as a “black box”. Complex physical, chemical, and biological processes may occur simultaneously in CWs, including volatilization, photo degradation, microbial biodegradation, phytoremediation, as well as adsorption. To date, studies on pharmaceutical removal in CWs mainly focus on removal performance, and optimization by selecting plant communities, the sediment or the operational parameters. Only a few studies reported removal mechanism, and often not in a comprehensive way that contains all involved factors including light, microbes, plants, and sediments.

Under field conditions, the performance of CWs is far from its potential to remove pharmaceuticals.

Various wastewater compositions, and environmental conditions will influence pharmaceutical removal performance. Therefore, laboratory experiments are useful as the first step in identifying various aspects that influence the removal efficiency in a CW, and designing CW setups to improve removal efficiency in a fast and cost effective manner.

The overall objective of this work is to determine the contribution of individual pathways (through photodegradation, biodegradation, phytoremediation, and adsorption) in removing pharmaceuticals in CWs, and to enhance the two most significant pathways including photodegradation and biodegradation in CW application. In summary, the “black box” of the CW will be unfolded and processes in this box will be utilized in a better way, leading to a better understanding and performance of a CW.



PhAC removal mechanisms in CWs

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