**Quantification of micropollutant removal mechanisms in vertical-flow constructed wetlands: outcome of the ‘emisûre’ project**

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**Abstract.**

The aim of the current research is to quantify mechanisms in vertical-flow constructed wetlands contributing on the removal of micropollutants from wastewater effluents. This intent raised from the impressive results of constructed wetlands in lab scale (lysimeters) treating synthetic wastewater and constructed wetlands treating wastewater effluents from two wastewater treatment plants (with 4 300 PE and 20 000 PE respectively, located in Luxembourg (Interreg Project, EmiSûre). The developed approach consists on consequent steps aiming to target each individual mechanism via minimizing the impact of the others:

1. To determine **the adsorption potential of selected substrates**, an adsorption test on packed bed columns is being carried out. Adsorption on packed-bed columns is a commonly used technology for treatment of wastewater effluents, therefore data coming from a lab scale could be useful for possible further upscaling. Moreover, the results will offer a comparison with the results of the lysimeters to understand the impact of the water matrix. Adsorption kinetics tests are carried out for completed description of the adsorption process. The results from the first measurement campaigns showed a high adsorption efficiency for the column with sand mixed with activated biochar 15 % (more than 70 % removal in case of 20 out of 27 compounds), at columns with sand and sand and zeolite 15 % is detected desorption of some compounds. This behavior is observed during batch kinetic experiments as well.
2. To evaluate **the potential of selected macrophytes to uptake micropollutants**, phytoremediation experiments in hydroponic conditions were carried out. For evaluation and consequent comparison of plants’ potential for micropollutants’ uptake, fresh plants which did not treat any wastewater and plants taken from an established constructed wetland used previously for treatment of wastewater effluent are investigated. Among all studied plants, *Lythrum salicaria* seems to be most promising, having potential to remove 25 out of 27 compounds with more than 20 %.
3. For the assessment of **bioremediation**, experiments with emergent macrophytes from an established constructed wetland with presence of rhizosphere in semi-hydroponic conditions are carried out. Results of the bioremediation experiment will, besides the information about the bioremediation potential itself, allow to compare the micropollutants’ removal potential of the macrophytes in combination with symbiotic relations of the rhizosphere with the potential of the macrophytes themselves during the phytoremediation experiment. A substantial focus on rhizosphere is given, as that is an active reaction zone where the physicochemical and biological processes take place and are prompted by the synergy of plants, microorganisms, soil and pollutants. Moreover, the presence of symbiotically acting fungi (arbuscular mycorrhiza (AM)) in the roots of studied macrophytes was confirmed. It was found, that highest affinity for colonization by AM has *Iris pseudacorus*, followed by *Phragmites australis* and *Lythrum salicaria.* For determination of the present bacteria, targeted approach of amplicon sequencing will be performed.

BIO of Presenter (50-word maximum):

Hana Brunhoferova is in her third year of PhD at the University of Luxembourg. The main topic of her PhD research is quantification of the removal mechanisms in constructed wetlands. Among her other research interests belongs application of nature-based solutions in the urban environment.