HAL
open science

What is the fate of trace metals and phosphorus in CW receiving treated wastewater? Contributions of free water, plants and soil

S. Papias, Marina Coquery, Catherine Boutin, L. Dherret, M. Masson, C. Crétollier, J.M. Choubert

To cite this version:

S. Papias, Marina Coquery, Catherine Boutin, L. Dherret, M. Masson, et al.. What is the fate of trace metals and phosphorus in CW receiving treated wastewater? Contributions of free water, plants and soil. 8th international symposium on Wetland Pollutant Dynamics and Control (WETPOL), Jun 2019, Aarhus, Denmark. pp.1. hal-02609278

HAL Id: hal-02609278

https://hal.inrae.fr/hal-02609278v1

Submitted on 16 May 2020

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

WHAT IS THE FATE OF TRACE METALS AND PHOSPHORUS IN CW RECEIVING TREATED WASTEWATER? CONTRIBUTIONS OF FREE WATER, PLANTS AND SOIL

***Sandrine Papias*[1]*, Marina Coquery*[2]*, Catherine Boutin*[1]*, Lysiane Dherret*[2]*, Matthieu Masson*[2]*, Clément Crétollier*[1] *and Jean-Marc Choubert*[1]**

[1] Irstea, UR REVERSAAL, Lyon-Villeurbanne, France
[2] Irstea, UR RiverLy, Lyon-Villeurbanne, France

Constructed Wetlands receiving Treated Wastewater (CWtw) are systems downstream of Wastewater Treatment Plants (WWTPs) before the receiving water bodies. They have recently become attractive in France under the perception that they improve water quality of the WWTP effluent (e.g. removal of excess suspended solids, or sorption of some dissolved pollutants). Depending on the historical background of the site close to the WWTP, trace metals are often present in the soil. The aim of this study is to determine the fate of the main trace metals (As, Ba, Cd, Co, Cr, Cu, Fe, Mn, Ni, Pb, Zn) and phosphorus (P) in the different compartments of CWtw: free water, soil and deposits (when relevant) and plants at two different sites.

The first site (MAG) is a Surface Flow (SF) CW (10 000 m²) consisting of 2 watertight ponds in series. They receive an average of 1500 m^3/d of TW from a WWTP that had occasional dysfunctions (sludge loss). The second site (BTT) consists of a SF CW (150 m²) built on semi-permeable (infiltration) clay soil contaminated with metals that come from construction waste and former viticulture. It receives an average of 250 m^3/d of TW. Both sites have *Phragmites australis*.

For both sites, the daily water balance was determined using inlet and outlet flowmeters associated with a weather monitoring. Free water samples were collected at the inlet and outlet: 4 2-day flow proportional composite samples. The BTT site had silicon carbide porous suction cups (0.3 m deep in the soil) to collect 4 composite samples of pore water. The plants and soil (BTT) sampling was performed at both sites by using quadrats (0.5 x 0.5 x 0.2 m). At MAG site, only deposits were sampled as there is no infiltration. Total phosphorus (TP) and metals were analyzed in plants, deposits (MAG) and soil (BTT).

A mass balance for each metal and P is estimated thanks to daily hydraulic loads, infiltration flux (BTT), metals and P concentrations in free and pore water, in the plants and in the soil (BTT). The concentration of most metals does not change in the free water along both CWtw. In the soil (BTT), there is a substantial adsorption of P (80%) and As (75%) confirmed with lower concentrations in the pore water. In contrast, Cd and Pb are found in higher concentrations in pore water compared to the inlet (12 to 200 times higher for Cd). Moreover, the concentrations of metals in *Phragmites* roots on the contaminated soil (BTT) are much higher than in MAG, respectively 8, 14 to 45 and 17 times higher for As, Cd and Pb. On MAG, most metals and P come from the occasional dysfunctions of the WWTP and are mainly stored in the deposits of the first pond. Finally, an evaluation of the mass balance for metals and P within the different compartments of both CWtw will be discussed.

<u>BIO (50-word maximum)</u>: Sandrine Papias is a process and environmental engineer. After she graduated, she has worked on the 4 past years at Irstea (France) on a project which aims at studying and assessing constructed wetlands receiving treated wastewater.

<u>Contact Information</u>: Sandrine Papias, Irstea, UR REVERSAAL, 5 rue de la doua, CS 20244, 69625 Villeurbanne Cedex, France, Email: sandrine.papias@irstea.fr