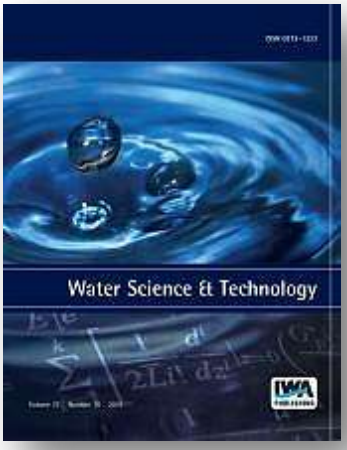
NOS PUBLICATIONS SCIENTIFIQUES

***Effect of aging on phosphorus speciation in surface deposit of a vertical flow constructed wetland*.**
Environmental Science & Technology.
Kim B., Gautier M., Rivard C., Sanglar C., Michel P., Gourdon R., 2015.

Abstract
This study was conducted to determine phosphorus (P) species captured in a vertical-flow constructed wetland (VFCW) system combining a trickling filter followed by FeCl3 injection for phosphate coagulation. Suspended solids (SS) thus formed accumulated over time at the VFCW surface and transformed into a sludge deposit layer which was shown to concentrate most of the P captured in the system. In order to investigate the effect of aging on P species, representative SS and sludge samples were taken from a wastewater treatment plant that had been in operation for 8 years, and analyzed using P fractionation, solution 31P NMR spectroscopy and P and Fe K-edge XANES spectroscopy. A partial mineralization of organic matter was shown by comparing organic carbon contents of SS and sludge materials. Chemical fractionations combined with P and Fe K-edge XANES spectroscopy showed that P was predominantly bound to iron within both samples in the form of ferric phosphate rather than sorbed onto ferric oxyhydroxide. Calcium-bound P was more significantly observed in sludge than in SS, suggesting that aging induced the recombination of part of organic and iron-bound P species into calcium-bound forms, as a possible consequence of the partial mineralization of organic matter.

Performance evaluation of partially saturated vertical-flow constructed wetland with trickling filter and chemical precipitation for domestic and winery wastewater treatment.
Ecological Engineering 71, 41–47.
Kim B., Gautier M., Prost-Boucle S., Molle P., Michel P., Gourdon R., 2014.

Abstract
The use of Vertical Flow Constructed Wetlands (VFCW) is growing rapidly in Europe for domestic wastewater treatment in small communities. In order to improve denitrification and dephosphatation as compared to classical VFCW, the Azoé-NP® process has been developed. The process line consists of: a biological aerobic trickling filter as a primary treatment stage, ferric chloride (FeCl3) addition for phosphorus (P) treatment and two stages of partially saturated VFCW. A municipal wastewater treatment plant using Azoé-NP® process has been monitored during eight years through 44campaigns of 24h time-proportional inlet-outlet sampling followed by analyses of TSS, BOD5, COD, TKN, NO3-N and TP concentrations. The results revealed good performances of the overall treatment. To better characterize the performance of each treatment step, five additional 24h monitoring campaigns were performed with samples taken from four different points along the treatment line. Results showed a good performance in dissolved carbon removal and nitrification by the trickling filter. The main part of the treatment was found to be done by filtration throughout the first filtration stage. Nitrate removal was achieved principally at the second filtration stage. Phosphorus migration through the first stage and its slight retention at the second stage was observed.



Physical–chemical characterization of sludge and granular materials from a vertical flow constructed wetland for municipal wastewater treatment.

Water Science and Technology 68, 2257–2263.

Kim B., Gautier M., Michel P., Gourdon R., 2013.

Abstract

The use of vertical flow constructed wetlands (VFCWs) is well developed in France and other countries for the treatment of wastewaters from small communities. The patented Azoé® process has been developed by a French company, SCIRPE, in order to improve denitrification and phosphorus removal as compared to classical VFCWs. It includes a biological trickling filter pretreatment followed by two stages of partially flooded VFCW. The performances of partially flooded VFCW are well demonstrated for the removal of organic matter and nitrogen. The system is now being considered for phosphorus removal as well. In this article, sludge and granular materials sampled from the filters of a municipal plant where the Azoé® system has been operated for 8 years were analyzed in order to provide data that may contribute to a better understanding of the dynamics of phosphorus retention. Elemental analyses showed that phosphorus was predominantly captured in the sludge layer accumulated at the surface of the first stage. The progressive mineralization of the sludge over time was also clearly highlighted. The phosphate phases were mainly associated with iron and calcium. The transport of phosphorus via the migration of fine particles through the porous medium in the first stage was also observed.