

Nitrogen removal optimization and control of hybrid vertical/horizontal flow treatment wetland with forced aeration for wastewater reuse in an urban environment.

Nom et prénom du(de la) (post)doctorant(te) : Caroline MIYAZAKI

Contact : caroline.miyazaki@inrae.fr

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Laboratoire de rattachement : Unité de Recherche REVERSAAL, INRAE, Lyon

Direction de thèse/postdoc / co-encadrement : Pascal Molle et Laura Delgado Gonzalez

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Résumé :

Treatment Wetlands (TW) are an attractive technology for wastewater (WW) treatment of small size communities (<5,000 people equivalent, p.e.) due to its robustness and low operation and maintenance costs. When applied in urban area with a decentralized approach, to improve treated WW reuse in urban context, treatment systems have to face different constraints linked to the high land pressure, varying loads conditions, sanitary and environmental risks as well as the necessity to produce different treated WW quality according to reuse application. Intensified TWs appear as an interesting technology to face such context. They can improve performance by adding some processes, for instance oxygen transfer. The studies on forced aeration TW has increasing considerably, in particular to meet the compliance criteria for nitrogen removal. An innovative hybrid treatment wetland with forced aeration, called Rhizosph'air®, promises high efficiency removal in terms of carbon and nitrogen. This system consists of a French vertical TW in the first layer, receiving raw wastewater and alternate two feeding beds, followed by a common saturated horizontal TW in the bottom layer. Furthermore, this system uses intermittent aeration through air blowers across the bottom surface in the saturated zone. Such design could allow the nitrification and denitrification process in a single-stage wetland. Research on a real scale systems demonstrated the great potential for carbon (>90%), ammonium (84%) and total nitrogen (60-90%) removal. Some important conclusion in this study was that some analysis achieved levels of 15 mg TN/L (88% removal), but was difficult to maintain in all inflow conditions. If promising, it requires a specific study to better understand the dynamic of nitrogen compounds and define how to control aeration in varying loads conditions. Therefore, this research aims at optimizing and controlling nitrogen removal using online sensors (pH, O₂, redox potential, NH₄-N and NO₃-N) in a hybrid vertical and horizontal treatment wetland with forced aeration.

Axe(s)/Domaine(s) d'applications(s) du réseau/TRL : filtré planté, reuse urbain, nitrogen