

## Providing new life to waste: recycling industrial materials in wetland construction to clean leachates

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### ABSTRACT

The quality of many surface and ground water sources is negatively impacted by nutrient contamination arising from agriculture. Constructed wetlands are becoming more and more popular as a wastewater treatment option for small municipalities, and have also been proposed as an alternative for horticultural sector.

In the frame of the Eco-Innovation project ECO/12/332862/CLEANLEACH, a proposal for cleaning the drained nutrient solution from nursery sector has been studied. The implemented approach consisted of a treatment plant based on the combination of slow soil-sand filtering in situ and constructed wetlands that is applicable to outdoor container nurseries.

Life Cycle thinking has been applied in the design of the product in order to assure a more sustainable Nursery business. Different environmental aspects (water and wastewater treatment, waste reduction and use of recycled materials including those from food industry and from building industry) have been quantified through Life Cycle Analysis (LCA), which has allowed to choose the most appropriate alternative.

As a result, we have produced a low-cost technology product regarding construction and maintenance; it is driven by gravity without energy waste by using the different levels of benches in nurseries and it is controlled real-time and continuously by assembling sensor technologies feed by solar energy. It also includes natural suppressive effects against pathogens and it neither uses chemicals (pesticides, chlorine) nor methods with high energy cost (UV, osmosis, heat) for disinfection. Industrial ceramic wastes are reused as a substrate in the wetland and effluent waste from the beer industry is used as an alternative carbon source to increase the ratio C:N-NO<sub>3</sub><sup>-</sup>, while the generated wetland plant biomass is used in composting. Moreover, in-situ measurements of gaseous emission rates (CO<sub>2</sub>, NH<sub>3</sub>, N<sub>2</sub>O, CH<sub>4</sub>) have been performed in order to verify estimations.

As main outcomes of the project we highlight the following:

- The holistic perspective that has contributed to the environmental and economic improvement of the system.
- The project as an example of the transformation of an experimental system into a commercial product.
- The usefulness of quantification environmental impact through LCA tool, but also the limitations of the tool regarding aspects related to functional units, databases, emission modelling and site specific characterization impacts.

KEYNOTES: Nursery, constructed wetland, LCA, wastewater, water recirculation



**Mainstreaming Life Cycle Management for sustainable value creation**