Microbial communities inhabiting a constructed wetland applied to tourism wastewater treatment

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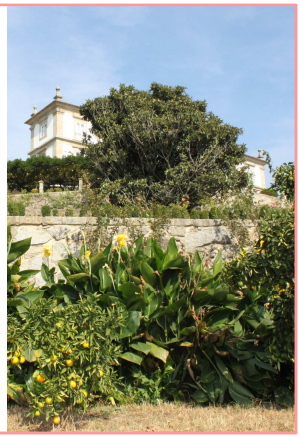
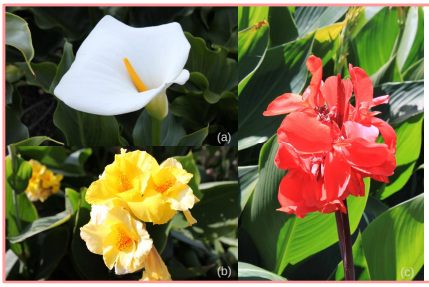
Overview

Constructed wetlands (CWs) are man-made wastewater treatment systems that intent to mimic the conditions, mainly in terms of physicochemical and biological processes, of natural wetlands. They represent a low-technology treatment, enabling wastewater recycling and reuse. CWs structural components include, in general, a support media, macrophytes, water, microbes and fauna population. Two important groups of these microbial organisms are bacteria and fungi, including mycorrhiza, primarily because of their role in the assimilation, transformation, and recycling of chemical constituents present in wastewaters. Besides microorganisms, the plants are essential to the water treatment performance since they provide the structure that fosters removal processes.

The aim of this study was to assess microbial community shifts over a full year operation on a CW treating wastewater coming from a Portuguese rural tourism unit (Paço de Calheiros, Ponte de Lima), with a organic load (Chemical Oxygen Demand) between 20-700 mg/L.



Experimental Background

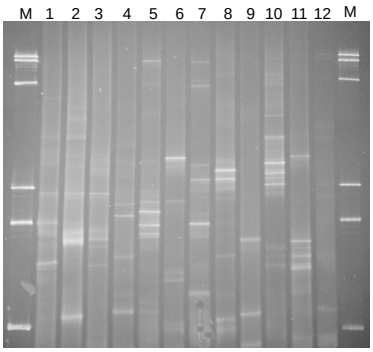


The CW substrate that supports the plants is expanded clay (Leca®M). Plant roots ((a) *Zantedeschia aethiopica*, b) *Canna flaccida*, c) *Canna indica*) were sampled from the inlet and outlet of the CW and fungal community profiles determined using PCR-DGGE.

Species diversity were analyzed and used to estimate microbial diversity and composition variation over a period of time.

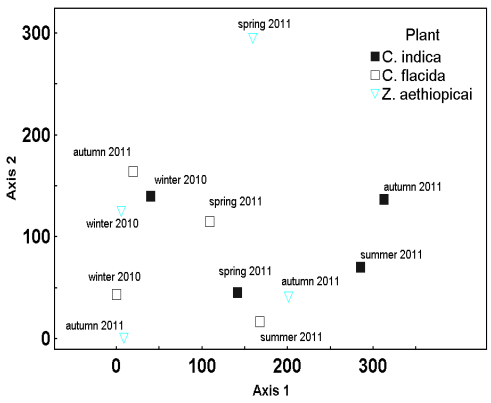
Results Assessment

➢DGGE



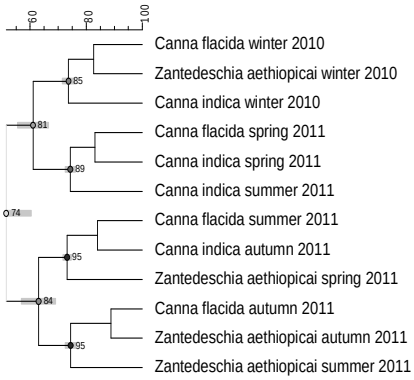
DGGE band profile of 18S rDNA. Legend: M-Marker; 1- *Canna indica* Winter 2010; 2- *Canna flaccida* Winter 2010; 3- *Zantedeschia aethiopica* Winter 2010; 4- *Canna indica* Spring 2011; 5- *Canna flaccida Spring* 2011; 6- *Zantedeschia aethiopicai Spring* 2011; 7- *Canna indica* Summer 2011; 8- *Canna flaccida* Summer 2011; 9- *Zantedeschia aethiopicai* Summer 2011; 10- *Canna indica* Autumn 2011; 11- *Canna flaccida* Autumn 2011; 12- *Zantedeschia aethiopicai* Autumn 2011.

➢Ordination



Detrended Correspondence Analysis (DCA) ordination analysis of plant roots during CW operation. Axis 1 and 2 explain 42.6% of the cumulative variance shown by DCA

➢Cluster analysis



Cluster analysis of DGGE patterns of plant roots sampled at different time seasons. Similarity coefficient was calculated using Pearson correlation, UPGMA clustering and branch quality analysed by Cophenetic correlation.

Final Remarks

Tourism facilities are often characterized by great variations in wastewater quantity and quality over the year, affecting negatively the performance of conventional treatment systems. Results show that the microbial community associated to root plants shifts during the operation period. *C. indica* and *C. flaccida* have close related microbial symbionts, when compared to *Z. aethiopica*. How this is affecting CW behavior is unclear. The use of CWs under this scenario still needs research and knowledge on microbial dynamics can be of great importance to the understanding of such systems. Considering the fundamental purpose of public health and environmental protection, vegetated systems arise as an interesting and suitable option for use in integrated wastewater management systems.

Acknowledgments

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