WETPOL

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Aromatic plants for water treatment in green roofs technology

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Introduction

Contamination of water supplies have greatly increased in the last decades due to massive use of contaminants directly discharged into water bodies. In addition to this, water scarcity due to climate changes is occurring in several parts of the globe. Mediterranean countries are among those with high risk of water stress. It is thus urgent to find efficient ways for sustainable water treatment and management and alternative sources of water supply, such as rainwater harvesting in buildings and water treatment for later reuse.

Green roofs (a multilayer construction comprising vegetation on roof top of buildings) have appeared as an alternative technology in urban centres to aid in water treatment and reuse.

Green roofs and constructed wetlands technologies can be compared concerning the use of vegetation to enhance water quality and as tools for water management. Also, in both systems, the water flows through a specific substrate or support where selected plants are established, two key components that influence the hydraulic system capacity.

The major goal of the present research project, was to establish an extensive pilot green roof to assess:

(1)Growth of different aromatic species in different support materials

(2)Runoff water quality after flowing through green roof substrates for later storage and reuse.

Experimental Design

Pilot extensive 20 m² Green Roof

Substrate mixtures and aromatic species

Granulated cork + organic matter + crashed egg shell	Expanded clay + organic matter + crashed egg shell
Granulated cork + organic matter	Expanded clay + organic matter


Lavandula dentata


Satureja montana


Thymus pseudolanuginosus


Thymus caespititius

Results and Discussion

✓ Plant establishment, development and growth has been followed

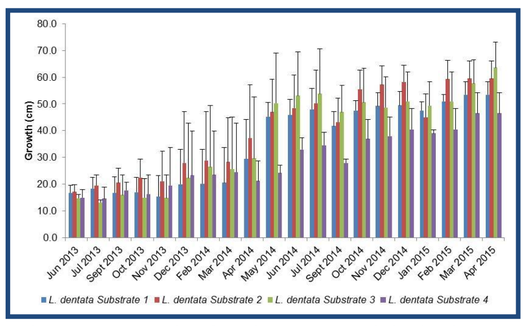

Figure 1: Example of *L. dentata* growth in the four tested experimental substrates

✓ The aromatic species (irrigated during the establishment period) revealed adaptation to different substrates, which showed to be suitable for the support of the aromatic species tested in these green roofs structures.

✓ Selection of aromatic species was based on plant tolerance to the climate of the region as they might be more adapted to climate changes. Also, their low maintenance requirement, resistance to drought conditions and consequently low water needs, were key characteristics that were considered for their use in green roofs.

✓ The selection of different plant species is important in this type of construction in order to select vegetation combinations that promote and enhances water quality.

✓ Water runoff samples were collected from the green roof for analysis of water quality physico-chemical parameters (based on Standard Methods)

	Average ± SD
Turbidity (NTU)	10.93 ± 5.18
pH	7.71 ± 0.20
Conductivity (µS/cm)	337 ± 111
NH_4^+ (mg N/L)	0.09 ± 0.03
NO_3^- (mg N/L)	6.91 ± 2.40
PO_4^{3-} (mg P/L)	1.76 ± 0.61

✓ The water that flows from the green roof system might be re-used for non-potable purposes such as irrigation, flushing toilets and/or pavements cleaning concerning physico-chemical parameters.

✓ Water re-use is of extreme importance, since we are facing adverse dry events and there is a high demand of potable water for non-potable use. As such, green roofs show to be a suitable technology for urban water treatment, allowing rainwater re-use.

Conclusions

The combination of green roofs with rainwater harvesting systems seems a promising solution that can contribute greatly to a very appropriate response to the impacts of climate change and water scarcity.
However, the design of these combined solutions has a great dependence on particularities of local or regional climate, as well as plant species and substrates used.
The present research will contribute to further the knowledge to the development of green roof technology and also to disseminate green roofs as an alternative technology to water quality enhancement for later reuse in buildings.

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