

Experimental results on constructed wetland pilot system

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Abstract Research into a constructed wetland for wastewater treatment using M.H.E.A. (Hierarchical Mosaic of Artificial Ecosystems) pilot system was carried out over a vegetative period in 8 different flow and vegetable composition series. The system consisted of a free water pond as a first step working as primary treatment followed by a zone with *Typha* sp. and surface flow and finally a woody zone with a subsurface flow and planted with ligneous species (*Salix* sp., *Populus* sp., *Fraxinus* sp. and *Alnus* sp.).

Removal efficiency in the study reflects an optimal result: 80–99% total suspended matter removal, 82–98% organic matter removal, 70–98% nutrients removal and up to 99.9% faecal bacterial disinfecting. Effluent characteristics were in accordance with European Union legislation criteria for wastewater treatment systems.

Keywords Constructed wetlands; experimental sewage treatment; pilot system; removal efficiency; wastewater

Introduction

Wastewater treatment plant viability is a pressing problem, especially for small communities in regions characterised as “sensible” for eutrophication. It is therefore necessary to develop new low installation and operation cost technologies; these must efficiently remove organic and nutrient loads, allowing for water reuse and biomass utilisation in order to reduce operating investments. In most cases, the economic costs should cover the proposed objectives, such as the inclusion of tertiary treatment for sensitive designated zones, is economically unapproachable for small villages in rural areas. In Spain wastewater is reused for irrigation in many areas.

The European Union Directive 91/271/EEC (ECOD, 1991a) established a series of requirements for wastewater treatment plant effluents and removal efficiency, which must be applied before the end of December 2005 for populations between 2,000 to 15,000 equivalent inhabitants. Nutrients must therefore be removed in rural areas in the north-west of Spain where wastewater is very diluted (BOD_5 between 20 and 50 mg/l in 70% of the villages), but with moderate to high concentration of Nitrogen (N) and Phosphorus (P) due to use of fertilisers (González and Cabo, 1998).

The province of León localities with less than 10,000 inhabitants come to about 97%, and those with less than 2,000 inhabitants represent 82.5% of the total population of the province. Most of these small localities are located in disperse zones or in mountain and riverside zones, many of them being catalogued as eutrophication sensitive and consequently will require tertiary treatment (nutrients elimination). In another case, these localities are on the Spanish meseta, but very tied to agricultural or cattle-raising activities and they are equally conditioned to treat their wastewater to tertiary level according to European legislation EU 91/676 (ECOD, 1991b).

It has been widely demonstrated in Spain that conventional (activated sludge) treatment systems applied to small rural municipalities have many operational and management problems, which is at present greatly inactive or abandoned. As an alternative to the conventional treatment systems, low-cost and natural systems are increasingly applied in

