CÁTEDRA DEL AGUA
Y LA SOSTENIBILIDAD

Murcia, 15 de diciembre de 2016

III JORNADA
AGUA Y SOSTENIBILIDAD
LA REUTILIZACIÓN DE AGUAS EN ESPAÑA Y EUROPA
PASADO, PRESENTE Y FUTURO

REGENERACIÓN DE AGUAS EN PEQUEÑAS COMUNIDADES. AVANCES EN I+D+i

Dra. Isabel Martín

FUNDACIÓN CENTRO DE LAS NUEVAS TECNOLOGÍAS DEL AGUA

PEQUEÑAS AGLOMERACIONES/ZONAS RURALES/ ZONAS ECONOMICAMENTE DEFICITARIAS

Saneamiento básico y/o tto. inexistentes o inadecuados

Degradación de la calidad del agua: riesgos para salud pública

Escasez agua: seguridad alimentaria

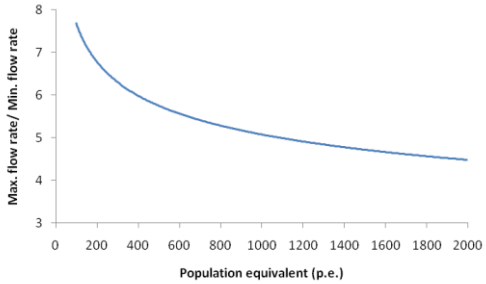
Helmintos int.

Virus, bacterias, protozoos

Dificultad para determinar la causa, numerosos factores

Políticas no definidas/no ejecutadas

- Población dispersa → complejidad gestión de las infraestructuras
- Características del agua residual:
  - Fuertes oscilaciones de caudal y carga→ dimensionamiento y diseño



  - Generación de pequeño caudal con alta carga contaminante.

CONTEXTO DE TRABAJO

En este contexto, debemos buscar opciones tecnológicas que reconcilien los requerimientos de **bajo coste, simplicidad en operatividad, mantenimiento y explotación**, así como aquellas que garanticen la calidad de un **efluente con garantías sanitarias**, dando prioridad a los aspectos relacionados con el **DESARROLLO SOSTENIBLE Y LA ECONOMÍA CIRCULAR.**

CENTRO EXPERIMENTAL I+D+ i (Carrión de los Céspedes, Sevilla)

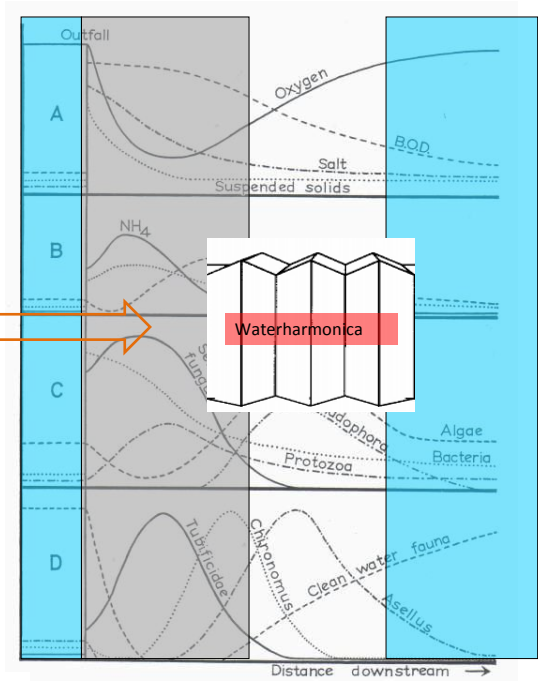
HUMEDALES ARTIFICIALES

HUMEDALES ARTIFICIALES

HUMEDALES ARTIFICIALES: RECUPERACIÓN DE ZONAS HÚMEDAS

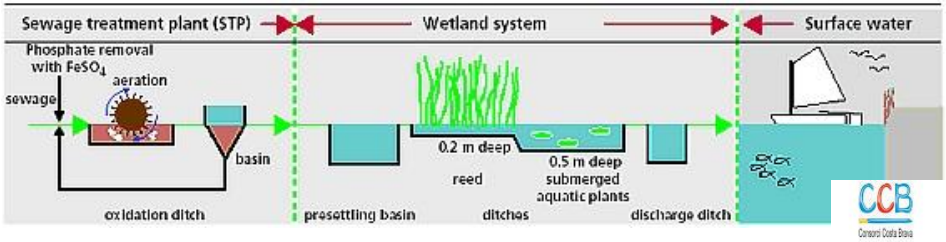
The Waterharmonica:

Bridge between sewage treatment and surface water

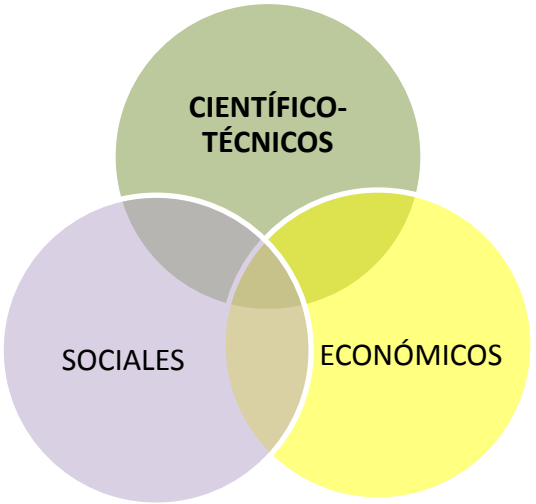


Based on Hynes, 1960 The biology of polluted waters

Tratamiento de afino
(reutilización ambiental)



La recuperación de zonas húmedas requiere la **participación coordinada de un equipo integrado**, que abarque los aspectos:



HUMEDALES ARTIFICIALES: CONTAMINANTES ORGÁNICOS, TTO. AGUAS DE TORMENTA

G Model
ECOENG-3119; No. of Pages 9
ARTICLE IN PRESS

Ecological Engineering xxx (2014) xxx–xxx

Contents lists available at ScienceDirect

Ecological Engineering

journal homepage: www.elsevier.com/locate/ecoleng

Emerging organic contaminant removal in a full-scale hybrid constructed wetland system for wastewater treatment and reuse

Cristina Ávila[a], Josep M. Bayona[b], Isabel Martín[c], Juan José Salas[c], Joan García[a,*]

[a] GEMMA – Group of Environmental Engineering and Microbiology, Department of Hydraulic, Maritime and Environmental Engineering, Universitat Politècnica de Catalunya-BarcelonaTech, c/ Jordi Girona, 1-3, Building D1, E-08034 Barcelona, Spain
[b] Department of Environmental Chemistry, IDAEA-CSIC, c/ Jordi Girona, 18-26, E-08034 Barcelona, Spain
[c] Foundation Centre for New Water Technologies (CENTA), Autovía Sevilla-Huelva (A-49), km. 28, Carrión de los Céspedes, E-41820 Seville, Spain

ARTICLE INFO

Article history:
Received 12 February 2014
Received in revised form 23 June 2014
Accepted 2 July 2014
Available online xxx

Keywords:
Endocrine disruptor
Ibuprofen
Pathogen removal
Pharmaceuticals
Treatment wetland

ABSTRACT

A full-scale hybrid constructed wetland (CW) system based on three stages of differer
rations showed to be a very robust ecotechnology for domestic wastewater treatmer
communities. It consisted of a 317-m² vertical subsurface flow (VF), a 229-m² horizo
(HF), and a 240-m² free water surface (FWS) CWs operating in series. VF and HF we
with *Phragmites australis* and the FWS contained a mixture of plant species. An excelle
performance was exhibited on the elimination of conventional water quality paramet
removal efficiency for TSS, BOD_5 and NH_4–N; $n = 8$), and its final effluent proved to c
Spanish regulations for various reuse applications. The removal of studied emerging c
included various pharmaceuticals, personal care products and endocrine disruptors
(above 80% for all compounds), being compound dependent ($n = 8$). The high rates
to high temperatures as well as the differing existing physico-chemical conditions o
CW configurations, which would allow for the combination and synergy of various ab
mechanisms to occur (e.g. biodegradation, sorption, volatilization, hydrolysis, photo
aerobic metabolic pathways and solids retention are enhanced in the VF bed, other r
such as anaerobic biodegradation and sorption would predominate in the HF bed. At
tion through direct sunlight exposure, and less importantly, sorption onto organic r
an active part in organic contaminant removal in the FWS wetland.

Ecological Engineering 50 (2013) 13–20

Contents lists available at SciVerse ScienceDirect

Ecological Engineering

journal homepage: www.elsevier.com/locate/ecoleng

Integrated treatment of combined sewer wastewater and stormwater in a hybrid constructed wetland system in southern Spain and its further reuse

Cristina Ávila[a], Juan José Salas[b], Isabel Martín[b], Carlos Aragón[b], Joan García[a,*]

[a] GEMMA-Group of Environmental Engineering and Microbiology, Department of Hydraulic, Maritime and Environmental Engineering, Universitat Politècnica de Catalunya-BarcelonaTech, c/ Jordi Girona, 1-3, Building D1, E-08034, Barcelona, Spain
[b] Foundation Centre for New Water Technologies (CENTA), Autovía Sevilla-Huelva (A-49), km. 28. 41820 Carrión de los Céspedes, Seville, Spain

ARTICLE INFO

Article history:
Received 7 February 2012
Received in revised form 5 July 2012
Accepted 10 August 2012
Available online 10 September 2012

Keywords:
Combined sewer
Constructed wetlands
First-flush
Reed beds
Stormwater
Treatment wetlands
Urban wastewater
Water reuse

ABSTRACT

An integrated pilot-scale treatment system consisting of a vertical subsurface flow (317 m²), a horizontal subsurface flow (229 m²) and a free water surface (240 m²) constructed wetlands operating in series for the treatment of a combined sewer effluent was put into operation and monitored over a period of about 1.5 years. The goal of the treatment system was to provide effluents suitable for various water reuse applications. Moreover, the influence of pulses of high flow resulting from several rain events over the treatment performance of the system was evaluated. An intensive sampling campaign was also carried out following an intense storm (45 mm in one-hour span) to have a further insight into the characteristics of the inflowing water at the early part of it or so-called 'first-flush'. Results under dry weather conditions showed a good performance on the removal of BOD_5, COD and TSS taking place already in the vertical flow wetland (94, 85 and 90%, respectively). A high removal of total nitrogen occurred also in the vertical flow wetland (66%) suggesting both nitrification and denitrification to take place, presumably due to the existence of both aerobic and anoxic microenvironments within the bed. Removal of *Escherichia coli* along the treatment system was of almost 5 log units. To this respect, the horizontal flow and free water surface wetlands proved to be crucial treatment units to achieve a water quality suitable for further reuse (e.g. recharge of aquifers by percolation through the ground, silviculture and irrigation of green areas non accessible to the public). Although the occurrence of the storm event caused a prompt raise of COD and TSS within the first 30 min of rainfall (868 and 764 mg L^{-1}, respectively), it was soon followed by a dilution effect. In general the storm events did not jeopardize the correct functioning of the system, proving its robustness for the treatment of a combined sewer effluent.

1. Introduction

Nowadays, it is estimated that the load of wastewater receiving inappropriate treatment in Spain (mostly small communities with less than 2000 people equivalent (PE)) corresponds to 3–4 million

Although no specific criteria or prescribed technologies for communities with less than 2000 PE have been specified, the plan aims at boosting the establishment and use of low-cost solutions to provide wastewater treatment to small communities.

To this regard, constructed wetlands constitute the most com-

HUMEDALES ARTIFICIALES: APLICACIÓN DE TÉCNICAS ELECTROQUÍMICAS MICROBIANAS

Escala laboratorio

Escala piloto

HUMEDALES ARTIFICIALES: APLICACIÓN DE TÉCNICAS ELECTROQUÍMICAS MICROBIANAS

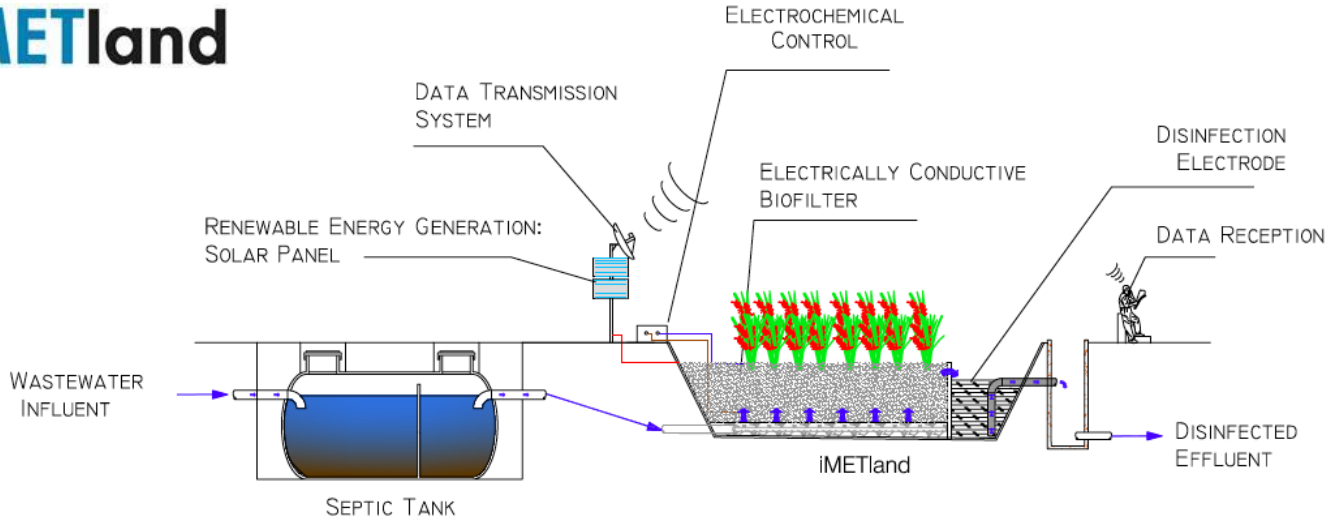
iMETland

THE FRAMEWORK PROGRAMME FOR RESEARCH AND INNOVATION
HORIZON 2020

iMETland: A new generation of Microbial Electrochemical Wetland for effective decentralized wastewater treatment. (www.imetland.eu)

(a-c ing) AQUA-CONSULT INGENIEROS
AARHUS UNIVERSITY
Aston University Birmingham
centa FUNDACIÓN CENTRO DE LAS NUEVAS TECNOLOGÍAS DEL AGUA
institute IMdea water
IMTA INSTITUTO MEXICANO DE TECNOLOGÍA DEL AGUA
CONICET
UNIVERSIDAD NACIONAL de MAR DEL PLATA
I N T E M A
Kilian Water
PIROECO
pwc
youris.com EUROPEAN RESEARCH MEDIA CENTER

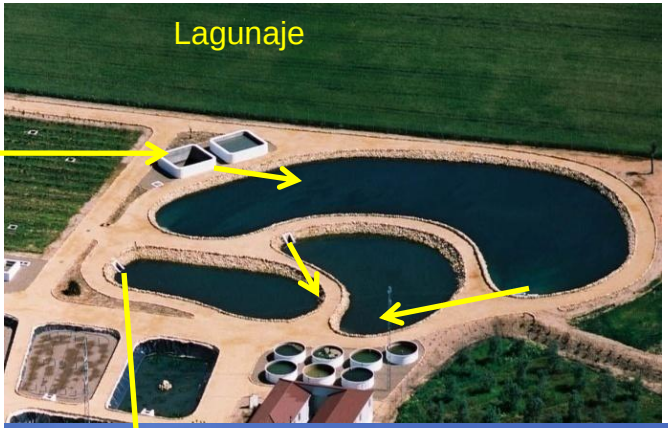
HUMEDALES ARTIFICIALES: APLICACIÓN DE TÉCNICAS ELECTROQUÍMICAS MICROBIANAS



- Aumento del rendimiento de los biofiltros mediante la combinación de bacterias electroactivas + material conductor
- Electrodesinfección mediante generación *in situ* de cloro activo.
- Generación de agua residual tratada, apta para uso en agricultura
- Costes energéticos, cero (energía solar)
- Control remoto mediante el uso de TICs:
- Validación de las unidades iMETland en cuatro ubicaciones: España, Dinamarca, Argentina y México.

FILTROS VERDES

ARU



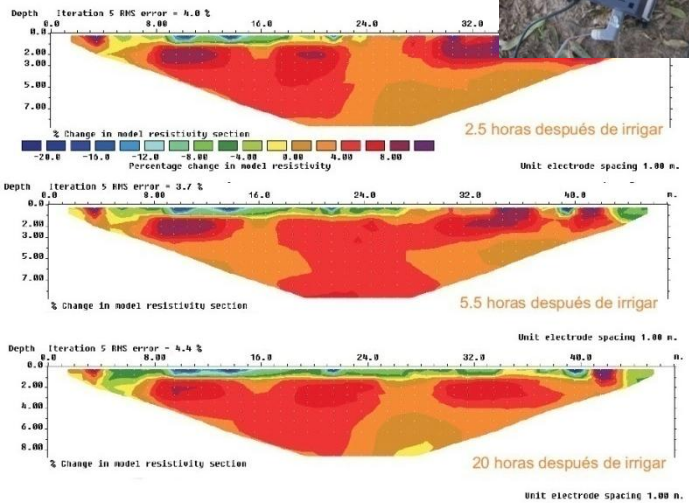
FITRO VERDE EXTENSIVO

superficie: 2.000 m²
Caudal 10 m³/d
TRH: 10-12 d

Riego

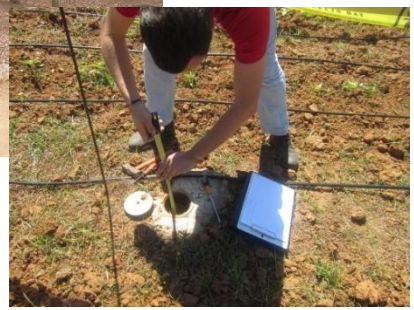
***E. Camaldulensis* (324), (3 x 1)** **P. Euroamericana (80), (5 x 2.5)**

EXTENSIVOS: Silvicultura para producción de biomasa- energía, eliminación contaminantes para recarga de acuíferos



Tomografía de resistencia eléctrica (ERT): flujo del agua

INTENSIVOS: producción de biomasa- energía



Ecological Engineering 73 (2014) 560–568

Contents lists available at ScienceDirect

Ecological Engineering

journal homepage: www.elsevier.com/locate/ecoleng

Treating municipal wastewater through a vegetation filter with a short-rotation poplar species

Angel de Miguel [a,*], Raffaella Meffe [a], María Leal [a], Víctor González-Naranjo [a], Virtudes Martínez-Hernández [a], Javier Lillo [a,c], Isabel Martín [d], Juan J. Salas [d], Irene de Bustamante [a,b]

[a] Imdea Water, cPunto Net nº4 Edificio Zye 2ª Planta, 28805, Alcalá de Henares, Madrid, Spain
[b] University of Alcalá de Henares, Departamento de Geología, 28871 Alcalá de Henares, Madrid, Spain
[c] University of Rey Juan Carlos, ESCET, Departamento de Biología y Geología, C/Tulipán s/n, 28933 Madrid, Spain
[d] New Water Technologies Center (CENTA), Autovía Sevilla-Huelva (A-49) Km. 28, 41820Carrión de los Céspedes, Sevilla, Spain

ARTICLE INFO

Article history
Received 20 May 2014
Received in revised form 27 August 2014
Accepted 17 September 2014
Available online xxx

Keywords:
Vegetation filters
Wastewater reuse
Vadose zone
Pollutant removal
Short rotation coppice

ABSTRACT

The performance of a vegetation filter using a short-rotation coppice of poplars was evaluated over a 3-year period in terms of pollutant removal capacity. The vegetation filter was designed for scattered and small populations with no storage facilities and a wastewater application constrained by the own production of effluent. Wastewater effluent was pre-treated in an Imhoff tank and applied to the vegetation filter. The chemical compositions of drainage water and groundwater were regularly monitored. Surface soil samples at the beginning and the end of the study were also collected. The monitored chemical species in drainage water and groundwater were DOC, COD, N_T, NO_3–N, NH_4–N, P_T, PO_4–P, and other major ions. Electrical conductivity, organic matter content (%), NO_3–N, available P, cation exchange capacity and major cations were analyzed for soil. The vegetation filter presented efficient removal of wastewater-originated pollutants. DOC and COD removal reached values of 85%. A correlated increase in soil organic matter content was detected (from 1.0% to almost 2.0%). A similar removal capacity was observed for P+ which is interpreted as due to plant uptake mechanisms and PO_4^{3-} precipitation in the presence of soil Ca^{2+}. Around 73% of N_T was removed. However, due to the high applied N_T load, the average N_T concentration in drainage water was about 41.9 mg/L, higher than the admissible concentration limit. When considering Nr mass, about 10% of the cumulative applied Nr leached through the vadose zone. Groundwater quality was not affected by the vegetation filter operation.

1. Introduction

Nature-based wastewater purification systems have been reported as a feasible solution for small municipalities and scattered populations with limited access to sewage networks (Ortega et al., 2011). They came about as an alternative to conventional treatment systems given their advantages in term of robustness, low management and maintenance costs, and environmental benefits, primarily related with low sludge production. Specifically, these systems imply reduced operational, energy and chemical requirements if compared to conventional methods (Dimitriou and Aronsson, 2011).

Vegetation filters (VFs), a specific type of nature-based wastewater purification systems, involve the application of pre-treated and/or treated wastewater to a vegetated soil surface. Such a system relies on soil attenuation capacity and plant uptake to remove potential wastewater contaminants (i.e., nutrients). The use of fast-growing tree species with a high evapotranspiration rate, and the fact that their root systems show excellent tolerance to anaerobic conditions, enable the application of considerable amounts of wastewater (Herschbach et al., 2005; Persson and Lindroth, 1994). In Northern European climates, the most widely used tree species are willows (Salix spp.) whereas poplars (*Populus* spp.) or eucalyptus (*Eucalyptus* spp.) are mostly used in Southern climates (Dimitriou and Rosenqvist, 2011). Commonly, a VF is characterised by the low density of planted trees (300–500 plants/ha) and long cutting periods (12–17 years) (de Bustamante, 1990; Magesan and Wang, 2003; Sanz et al., 2014).

* Corresponding author. Tel.: +34 918305962.
E-mail address: angel.demiguel@imdea.org (Ad. Miguel).

http://dx.doi.org/10.1016/j.ecoleng.2014.09.059
0925-8574/

Recarga de acuíferos

Palygorskita

Carbón activo

Zeolita

Cultivo de *Jatropha curcas* (producción biodisesel)

Ecological Engineering 50 (2013) 44–51

Contents lists available at SciVerse ScienceDirect

Ecological Engineering

journal homepage: www.elsevier.com/locate/ecoleng

Short-term effects of reclaimed water irrigation: *Jatropha curcas* L. cultivation

A. de Miguel[a,*], V. Martínez-Hernández[a], M. Leal[a], V. González-Naranjo[b], I. de Bustamante[b,a], J. Lillo[c,a], I. Martín[d], J.J. Salas[d], M.P. Palacios-Díaz[e]

[a] IMdea Water Institute, C/Punto Net, nº4, Edificio ZYE, 2ª Planta, 28805, Alcalá de Henares, Madrid, Spain
[b] University of Alcalá de Henares, Departamento de Geología, 28871 Alcalá de Henares, Madrid, Spain
[c] University of Rey Juan Carlos, ESCET, Departamento de Biología y Geología, C/Tulipán s/n, 28933 Madrid, Spain
[d] New Water Technologies Center (CENTA), Autovía Sevilla-Huelva (A-49), Km. 28, 41820 Carrión de los Céspedes, Sevilla, Spain
[e] University of las Palmas de Gran Canaria, Departamento de Patología Animal, Producción Animal y Ciencia y Tecnología de los Alimentos, C/Juan de Quesada, nº 30, 35001 Las Palmas de Gran Canaria, Spain

ARTICLE INFO

Article history:
Received 2 January 2012
Received in revised form 18 June 2012
Accepted 22 June 2012
Available online 21 July 2012

Keywords:
Irrigation
Jatropha curcas L.
Wastewater reuse
Bio-diesel
Bio-fuels
Climate change

ABSTRACT

In a growing concern of water and energy availability decrease, the sustainable growth of *Jatropha curcas* L. may be a feasible and complementary alternative within the local non-conventional energies field. This study emphasizes the idea of using reclaimed water agriculture implemented as a complementary local energy option. The main goal of this work focuses on monitoring the environmental affections and feasibility of treated water reuse for *J. curcas* L. irrigation. Two parcels were irrigated with two different water qualities: well groundwater (WG) and reclaimed water (RW). Differences were found in terms of nitrate, ammonia, sulphate, chloride, dissolved organic carbon (DOC), chemical oxygen demand (COD) and metals concentrations between the two irrigation water qualities. However, after one year of study, no significant differences in the leaves composition were measured with the exception of Fe (WG = 85.17 and RW = 102.63 mg/kg) and Mn (WG = 83.98 and RW = 43.51 mg/kg). The statistical analysis shows no significant differences in height, collar diameter and crown diameter (WG = 142.4, 5.7 and 157.1 cm; RW = 143.5, 5.4 and 154.7 cm, respectively). So far the aquifer water quality was only slightly affected in terms of total nitrogen (N_T) after irrigation when rainfall took place. DOC and COD in groundwater were always below 5 and 15 mg/L, respectively. As a conclusion, wastewater reuse for irrigation does not provide a negative effect in *J. curcas* L. feasibility, becoming an alternative option in the renewable energy field. An environmental monitoring is necessary to guarantee a sustainable management.

1. Introduction

The non-regular spatial and temporal rainfall distribution in most of the Mediterranean countries, generates a high cost in getting water of good quality available at the required place and time (Angelakis et al., 1999). Irrigated agriculture is the main water using groundwater as the main source of water. But this has generated groundwater overexploitation during the last decades, which in turn has limited the availability of this source of water.

To cope with water scarcity coupled with a growing water demand, the reuse of wastewater effluents derived from wastewater treatment plants (WWTP) is considered as a technically and

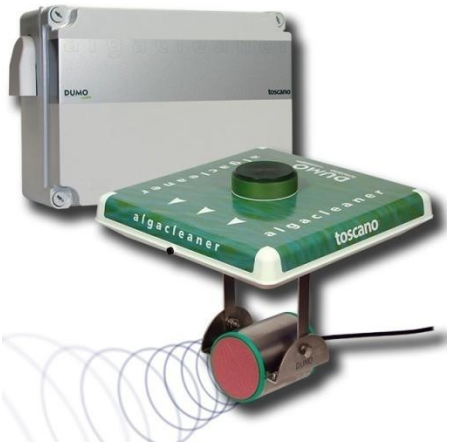
Cultivo de girasol (*Helianthus annuus)*, producción de biodiesel





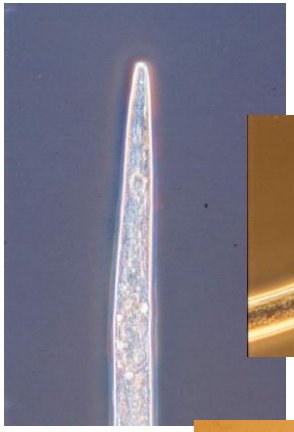


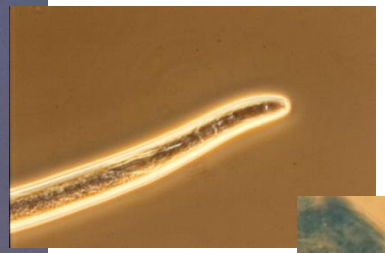
Tratamiento ultrasónico para eliminación de algas en balsa de riego

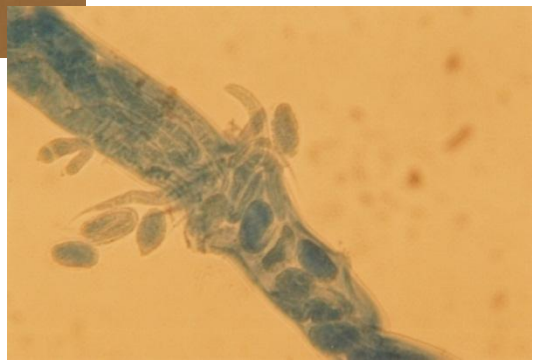


Nematodes as a factor for consideration in the wastewater treatment and water reuse process.

C. Santos, I. Martín and E.M. Trujillo. 2013. Desalination and water treatment 1-6







FILTROS INTERMITENTES DE ARENA

Regeneración de aguas residuales con filtro intermitente de arena previamente depuradas mediante lagunaje y humedales artificiales

Manuel Enrique López Sapúlveda investigador del Departamento de Tecnologías del Medio Ambiente en la Universidad de Cádiz (UCA)
Juan José Salas Rodríguez coordinador de área del Centro de las Nuevas Tecnologías del Agua (CENTA)
José María Quiroga Alonso catedrático del Área de Tecnologías del Medio Ambiente en la Universidad de Cádiz (UCA)

Los filtros intermitentes de arena han sido utilizados para regenerar, y posteriormente reutilizar, efluentes provenientes de lagunas de maduración (WSP) y de diferentes tipos de humedales artificiales. El estudio de regeneración se divide en dos fases. En la primera se utilizó como alimentación para la regeneración el agua depurada procedente de un sistema de lagunaje. La regeneración se realizó mediante cuatro filtros intermitentes de arena (FIA) a escala de laboratorio. Para la segunda fase de regeneración se usó un filtro a escala piloto y agua depurada procedente del lagunaje y de los humedales artificiales. Los resultados obtenidos mostraron rendimientos en la eliminación de la turbidez y de los sólidos en suspensión mayores del 95%, mientras que para los *E. coli* se superó el 99% del rendimiento en algunos casos, lo que posibilita su uso en muchas de las aplicaciones recogidas en el RRD de reutilización.

Palabras clave
Regeneración, reutilización, pequeñas comunidades, filtros intermitentes de arena, lagunaje, humedales artificiales.

Reclaim of wastewater with intermittent sand filters previously treated by pond system and artificial wetlands

Intermittent sand filters have been used to reclaim and subsequently reuse effluents from maturation ponds (WSP) and different types of artificial wetlands. Regeneration study was divided into two phases. The first treated water for reclaim was from a pond system, was performed using four intermittent sand filters (ISF) laboratory scale. For the second phase was used at pilot scale ISF and reclaim water from the lagoons and constructed wetlands. Performance removing turbidity and suspend solids was higher than 95% and in some cases exceeded 99% in E. coli, making it suitable for use in many of the applications in Spanish normative of reuse.

Keywords
Reclaim, reuse, small communities, intermittent sand filters (ISF), pond system, artificial wetlands.

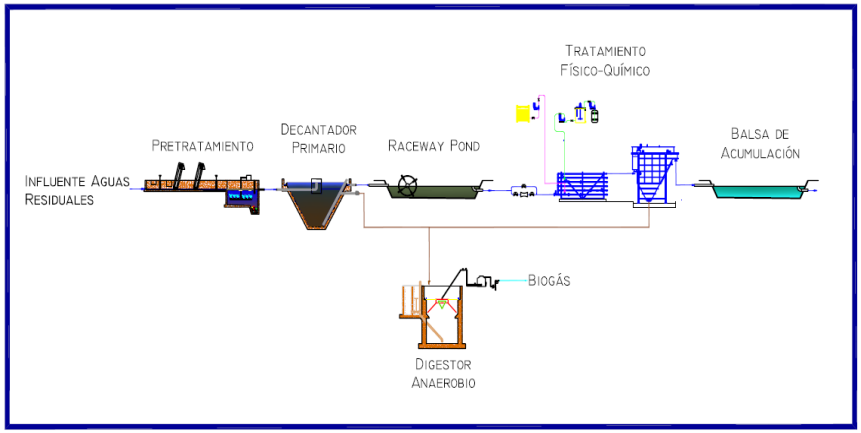
Biorreactores tipo Raceways

Unión Europea

JUNTA DE ANDALUCIA

Andalucía se mueve con Europa

Mejoras en los sistemas de depuración por lagunaje para incrementar la calidad de sus efluentes, promover la reutilización de las aguas residuales tratadas y la generación de energía.

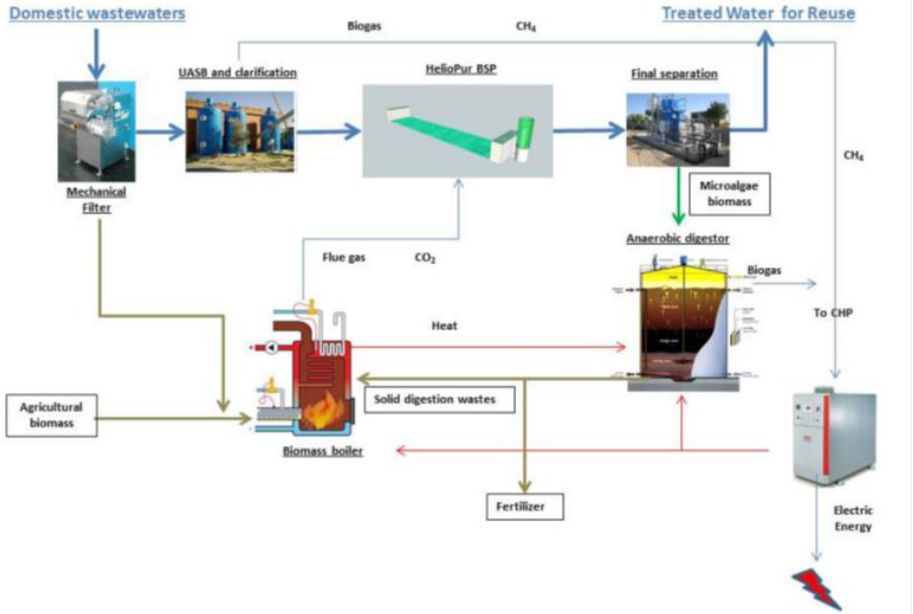


Biosol Water Tecycling (BioSolWare)

Demonstration wastewater treatment system dedicated to freshwater reuse and recycling

LIFE13 ENV/FR/000711

www.life-biosol.eu



Uso de tecnología biológica (fotosíntesis algal) y solar (photo-oxiación):

- Reutilización del agua en riego agrícola
- Recuperación y valoración de gases efecto invernadero y residuos orgánicos.

REUTILIZACIÓN EN DIVERSOS USOS:INDIA

SARASWATI (VII FP): ***Supporting consolidation, replication and up-scaling of sustainable wastewater treatment and reuse technologies for India***


NATIONAL INSTITUTE OF INDUSTRIAL ENGINEERING
VIHAR LAKE, MUMBAI 400087
SARASWATI DST - EU STAKEHOLDER WORKSHOP
Saraswati
Date - 06.05.2015

GUIDELINES FOR TECHNOLOGY APPLICATIONS

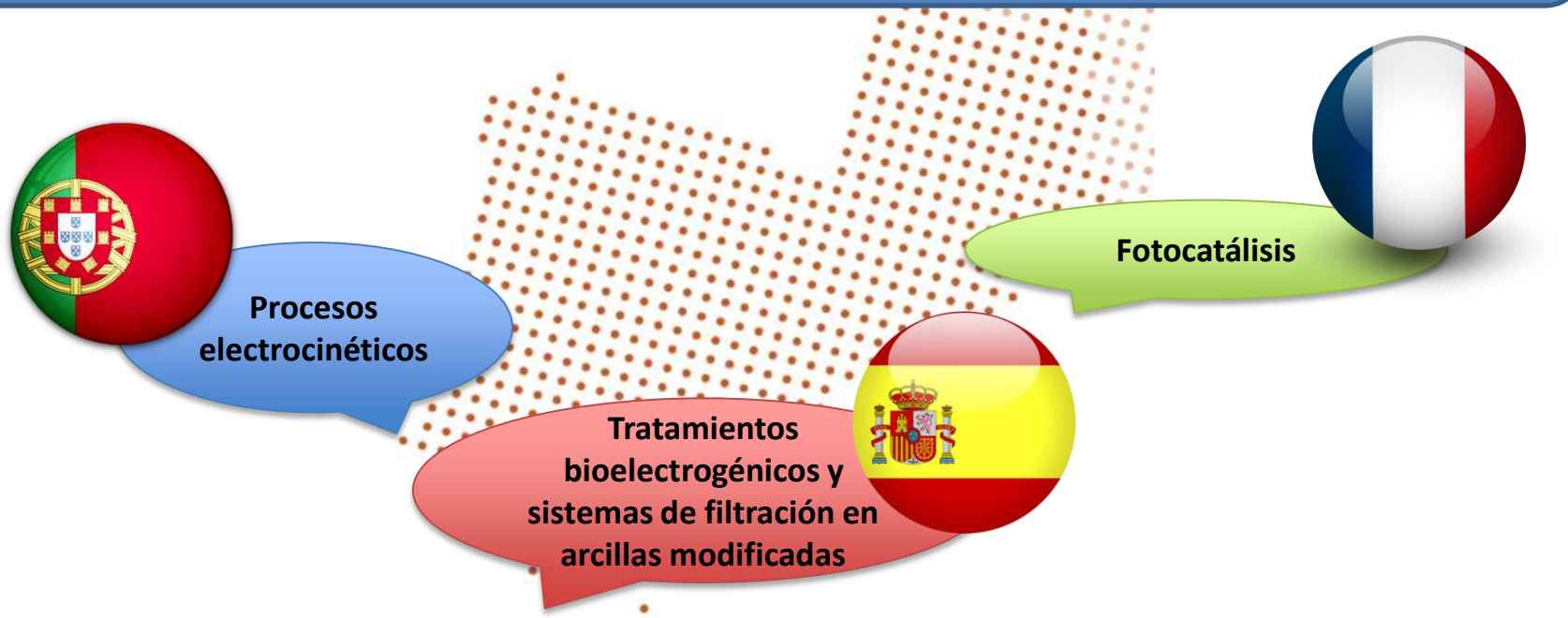
TECHNICAL GUIDELINES FOR TECHNOLOGY DESIGN

RECOMMENDATIONS FOR WATER REUSE

- Diseño e implantación de tecnologías validadas EU e innovadoras en el contexto de India
- Evaluación de impactos: salud y medioambiente
- Aspectos sociales
- Reutilización en pequeñas comunidades (agricultura, conservación de lagunas-prácticas religiosas).

TECNOLOGÍAS ESENCIALES FACILITADORAS

El objetivo principal del proyecto es la **validación y puesta en el mercado de cuatro tecnologías esenciales facilitadoras (KET)** diseñadas para la **eliminación de contaminantes emergentes de aguas depuradas** para, de esta forma, minimizar (o anular) los riesgos derivados de su vertido al medio o reutilización.

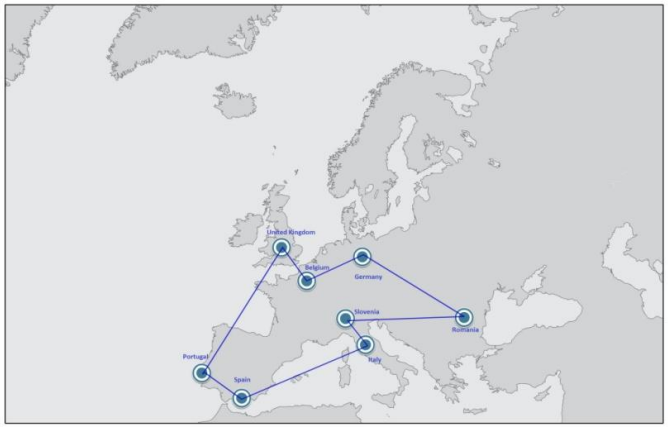


RECUPERACIÓN Y RECICLAJE DE NUTRIENTES-ECONOMÍA CIRCULAR

Call - Industry 2020 in the Circular Economy, **H2020-IND-CE-2016/17**
TOPIC: **CIRC-02-2016-2017: Water in the context of the circular economy**
Demonstrating the potential of efficient nutrient recovery from water (2016)

REcovery and REcycling of nutrients TURNing wasteWATER into added-value products for a circular economy in agriculture (Water2REturn)

Water2REturn propone una solución integrada para las aguas residulaes procedentes de mataderos, incluyendo la recuperación de nutrientes para su uso en agricultura y los aspectos relevantes a nivel legal, social y de mercado, entre otros.



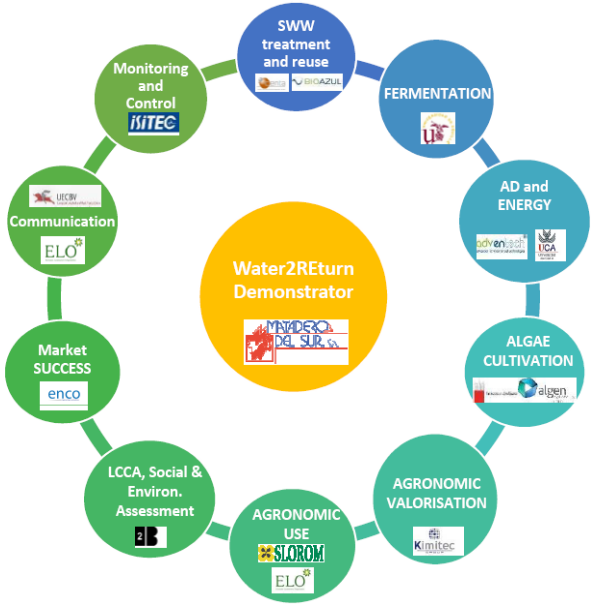
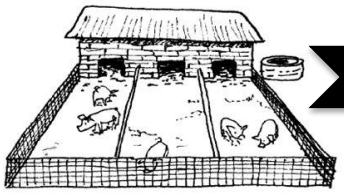
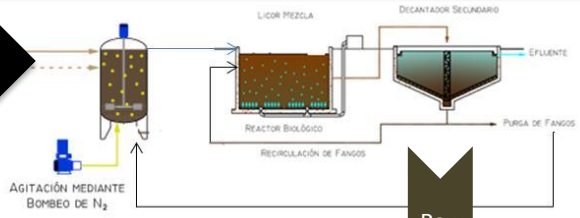


Diagrama de flujo del proyecto Water2Return



High polluted water stream

1. Wastewater treatment (Anaerobic + nitrificaction)



NO_3–enriched stream

2. Module for NO_3 and other soluble nutrients' recovery

Reclaimed water

Raw sludge

3. Fermentative process for sludge valorisation

Organic NO_3 concentrate

Energy

4. Multiplied Biogas production and methane valorisation

Hydrolyzed sludge

Soil biostimultants

Digestate

5. Algae cultivation for CO_2 and nutrients fixation

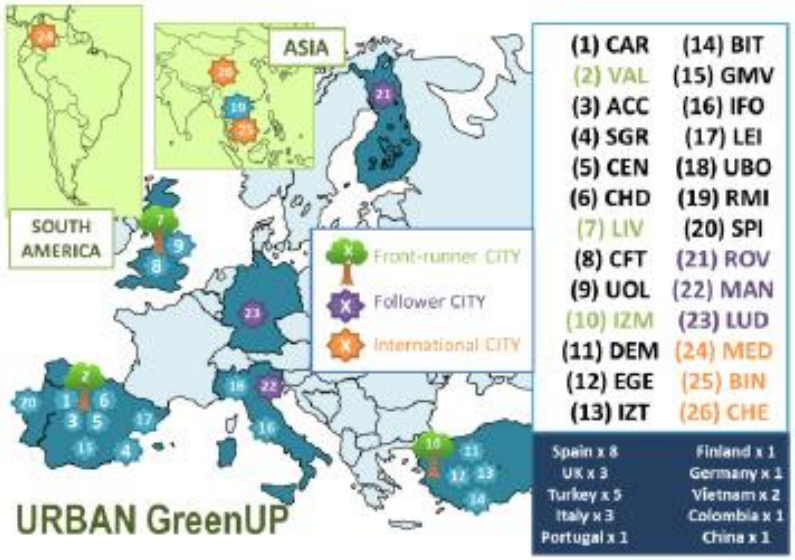
CO_2

Algae biomass

Fertilizers formulation

THE FRAMEWORK PROGRAMME FOR RESEARCH AND INNOVATION
HORIZON 2020

Call – Smart and sustanaible cities, **H2020-SCC-2016-2017**
TOPIC: **SCC-02-2016-2017**
Demonstrating innovative nature-based solutions in cities



Public Bodies	SMEs	Large Enterprises	RTOs	University	TOTAL
11	5	2	5	3	26

New Strategy for Re-Naturing Cities through Nature-Based Solutions (URBAN GreenUP)

Urban GreenUP tiene como objetivo desarrollar una metodología a adaptada a (1) el desarrollo conjunto de los Planes de renaturalización urbana enfocados a la mitigación y adapatación al cambio climático y la gestión eficiente del agua, y (2) contribuir a la implementación de soluciones basadas en la naturaleza.

centa
FUNDACIÓN CENTRO DE LAS NUEVAS TECNOLOGÍAS DEL AGUA

imartin@centa.es