

LIFE13 ENV/ES/000800 (TL-BIOFER)

Nutrients and regenerated water recycling in WWTPS through twin-layer microalgae culture for biofertilizers production Gómez, J.M.; González, I.; Pareja, J.; Carrera, D.; Dios, M.; Podola, B. www.life-tlbiofer.eu



European Sustainable Phosphorus Conference



Circular approaches to phosphorus: from research to deployment



INTRODUCTION-OBJECTIVES

The LIFE+ TL-BIOFER project aims to address the N and P removal from wastewater



produced by small- and medium-size urban agglomerations. The Project plans the demonstration of a prototype Twin-Layer or TL system, an advanced nutrient removal technology based on microalgae immobilised culture photobioreactor. The project also plans to develop, produce and test bio-fertilisers derived from the microalgae and evaluate and reuse the effluent of the wastewater treatment system. The trials will be conducted in microplots for two different crops in northern Italy and four different crops in Spain.



EXPECTED RESULTS

TWIN LAYER (TL) prototype for treatment of 12 m³/day wastewater from the secondary treatment along the two years of planned operation to produce a quality final effluent compliant with for discharge in sensitive zones (estuaries, coasts, etc);

Table.- N and P removal rates from WWTPs

20094420023323713139991345	Nitrification/ Denitrification	P-Precipitation	Membrane bioreactors	Constructed wetlands	High-Rate Algal Ponds	Twin-Layer Technology
Efficency Total N	High 70-80%	High (P) 0%	High < 90%	Low 30%	Low 100% (NH4 ⁺);	High 60-90%
Total P Duration of test	80% 24 hours	95% Few hours	< 90% Few hours	5% Few days	83 % (NO ₂ ⁻) 98% 2 weeks	100% 1-2 days
Operation Complexity	High Multiple step process	Low Chemical procedure	High Sensitive material	Low Simple construction	Moderate Large ponds	Moderate Complex setup
Floor space requirements	High Each step requires a pond, sludge landfill	Moderate Tanks with low ground space	Moderate Depening on design and requirements	High 10 m ² per person	High Double the size of a treatment plant	The second s
Complexity	High Complex controlling, monitoring, special trained	Low Easy to operate and control	High Material, highly trained personnel	Low Few personnel, easy to control	Moderate Constant monitoring, few personnel	Moderate Constant monitoring (via sensors), few personnel
Odor generation	High	Low	Moderate/High	None	Low	Low
Landscape	Low	Moderate	Moderate	High	Low	Moderate
integration Heavy metal	No	No	Yes	Possible	Possible/Dependi	Voc
reduction	NO	NO	TES	POSSIBLE	ng on species	Tes
122 J 122 J 124 J	Yes (70-90%)	Yes	Yes	Yes (60%)	No	Under Investigation/ possible
Cost						
and Anna and a second second	High	Moderate	High	Moderate	Moderate	High
Operation	High	Moderate	High	Low	Low	Low
Energy input Major consumption	High Aeration,Pumpin	Low Water transport	High Pumping,	Low Pumping	High Pumping,	Low Pumping
	Moderate Heavy metals for P percipitation	High Ironchloride, Aluminium sulfate	Yes For cleaning purposes	None	None	None
Biosolid production	High amounts of waste sludge	None	None	Moderate, Plant biomass	Moderat, algal biomass and sludge	High, Algal biomass
and the second	Yes	Yes	No	No	Yes	Yes
from biomass		a	- 11 - F - 1			- 1 1
Technical problems	Requires chemical input, exact balancing of bacteria needed, Fluctuations in high waste productionthe treatment	Requires high energy and chemical input, only Phosphate removal, generation of metal waste	Fouling of the mebrane, blocking of membrane	Generation of biomass is slow, low efficency of nutient removal, unfeasable for areas with dense population	High energy for harvesting, low efficeny of biomass growth, contamination with other species	Technology on pilot scale stage

EXPECTED RESULTS

. Development of a concept for transformation of TL harvested microalgae into formulated marketable biofertilisers.

. Three new products formulated and produced at pre-commercial stage:

. Total treated wastewater 7.300 m³;

Uptake 90-100% of nutrients (N and P) from wastewater. Previous analysis show N content 38.33 mg/l, and P content of 5.07 mg/l in wastewater.



- 300 l suspensión / foliar;
- 100 kg for powder;
- 50 kg for micro-granulated.





ACTIONS

A) Preliminar local strain selection and nutrient uptake capacity tests
B) TWIN LAYER prototype operation for N and P removal during 24 months
C) Biofertilizers from microalgae development, production and agronomical tests
D) Communication and dissemination
E) Project management and monitoring of the progress





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