



BioSol Water recycling project

An innovative microalgae based wastewater treatment and reuse system



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INTRODUCTION

Worrying trends show the wider spread of water scarcity which is expected to affect in 2030 nearly half of EU river basins [1]. Water recycling and reuse is considered as the core of an integrated water management approach to save costs, recover materials and demonstrate environmental stewardship.

The BioSol Water Recycling LIFE project (www.life-biosol.eu) deals with this challenge by offering an innovative solution based on algae cultivation in closed and open systems. The project's objective is at least to recover 80% of wastewater for reuse. This project paves the way to a better water resources management in small and medium size communities and isolated dwellings where physico-chemical tertiary treatments are not competitive.



METHODS

BIOSOLWARE Demo 1 has been built up in CENTA R&D Experimental Center (Carrión de los Céspedes, Spain). HelioPure® BSP units, developed by HELIO PUR TECHNOLOGIES (France), have been implemented to treat 13 m³ j⁻¹ of wastewater with a total water volume of 37 m³ and 24 hours of hydraulic retention time (8h in continuous mode and 16h in batch mode).

This system consists in 16 transparent treatment tubes (125 mm diameter, 65 m length each, 128 m²), 4 feeding and collecting tanks connected to 2 Coldep® Vacuum Air-Lifts (VAL) columns used for water circulation, O₂ stripping and CO₂ dissolution (1400/700 mm downward/upward column diameters, 6.2 m height).



Figure 1 – Recycling concept (BSP/VAL) in DEMO1 site

Anaerobically pre-treated wastewater from Imhoff tank is used to feed the BSP/VAL unit. After treatment, water is piped to a separation unit using Coldep® VAL column (630/315 mm downward/upward column diameters, 4 m high). The separation performances have been evaluated using JAR test experiments (coagulant: Al Cl₃ and flocculant: Polyacrylamide). Coagulating and flocculating agents are used to obtain clarified water. Water analysis have been performed to assess the system performances.

RESULTS & DISCUSSION

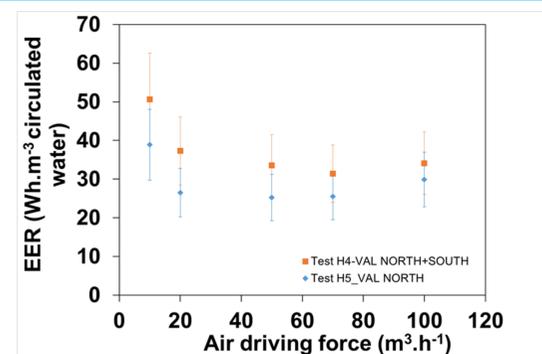


Figure 4 – Electrical Energy Consumption (EER) in case of 2 and 1 VAL column

→ The BSP system can operate using one VAL column keeping the same hydraulic and energetic performances.

2. Treatment and separation results

Trials performed in continuous mode (58 m³ brought along 7 days, water temperature=32±4°C) demonstrate organic matter degradation ability of BSP unit (Table 1). Coagulating/flocculating processes have provided additional performances on disinfection. These parameters lie in the European treatment regulation concentration thresholds (91/271/EC directive), B (French) or 2.2 (Spanish) reuse classes (Decree 2 August 2010, Royal decree 1620/2007).

Table 1– Treatment and separation performances

		Treatment performances			Treatment regulation			Reuse regulation
		Tank Imhoff	BSP-VAL	JAR TEST	Removal%	France	France (B)	
TSS	g/m ³	150	32	14	91	35 (90%)	35	35
COD	g/m ³	242	174	87	64	125 (75%)	125	
DBO5	g/m ³	110	45	9	92	25 (70-90%)		
TN	g/m ³	43,8	15,6	13	71	10-15 (70%)		
TP	g/m ³	4,91	1,55	0,59	88	1-2 (80%)		
E	UFC/100 ml	72*10 ⁵	64*10 ⁴	135	5 LOG		10000	1000

RESULTS & DISCUSSIONS

1. Hydraulic trials



Figure 2 – U turn connection used to replace one VAL column

BSP-VAL system operated initially with 2 VAL columns. We have removed one of these two columns performed hydraulic trials to study:

- Pipes flow rate and velocities (Figure 3).
- Power consumption (Figure 4).

The results obtained show that the variation between hydraulic (in term of water velocity and flow rate) and energetic conditions are not significant in the two cases (with Two or one column)

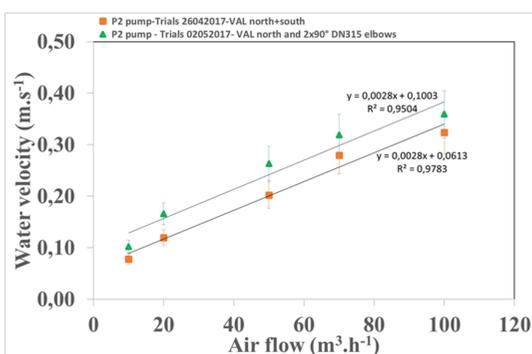


Figure 3 – Water velocity distribution with air flow variation in case of 2 and 1 VAL column

CONCLUSIONS

- The treatment trials performed on BioSol Water Recycling project have shown degradation performances regarding targeted parameters for wastewater treatment and reuse. The combination of BSP-VAL and separation tests help to meet the European wastewater treatment and reuse regulations.
- The study of the whole system (treatment and separation) performances including water biomass and reuse, in continuous and automatized mode, is in progress. We expect rising the total treated wastewater volume up to 30 m³ j⁻¹. Continuous trials on separation are expected to improve JAR Test results.

[1] European Commission (2012). Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions a Blueprint to Safeguard Europe's Water Resources (com/2012/0673).

BIOSOL WATER RECYCLING consortium would like to thank the European commission for supporting the project through Life financial instrument.

