

RESULTS OF MSABP PILOT PROCESS IN NEW WATER TECHNOLOGY CENTER (CENTA)

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Abstract

MSABP technology has been piloted in the facilities of PECC for a period of 19 months through a program of experimentation with new technologies. This pilot was conducted in two phases. The results of the first validation process raises a number of conclusions that have been the basis for conducting a second round of analysis. This document aims to summarize the results of both processes as well as general conclusions about the technology and its benefits.

Introduction

On April 23, 2008, the Andalusian Water Agency of the Ministry of Environment of the Junta de Andalucía, granted a subsidy to the Centre for New Water Technologies (CENTA) to finance the maintenance and management actions with Experimental Technologies in Carrión de los Céspedes. Thanks to that decision is developing the "PROTOTYPE ASSESSMENT TEST PILOT SYSTEMS SEWAGE TREATMENT: TECHNOLOGICAL INNOVATION IN THE FIELD." This report presents the monitoring made to the MSABP technology in the period from November 27, 2007 and April 15, 2011.

Description of the MSABP Unit Compact 3m³

The system of sewage treatment MSABP is a biological treatment unit based on a spatial hydrobionts organisms and food chains. A food chain organisms provides spatially segregated conditions in which microbes are consumed by primary microorganisms while the latter are consumed by filter-top eaters from different trophic levels. The operation of MSABP is characterized therefore by a separation of the biological functioning, as populations grow in separate compartments, and continuity of the hydraulic operation. The pilot plant established in the PECC has 12 stages. The unit does not have any recirculation line or excessive sludge blowdown nor sludge treatment line and does not require any sludge disposal action.

The biological treatment system consists exclusively of the following components:

- Aeration system.
- Textil substrate for fixing microorganisms.

The water flow between compartments is zig-zag, with each independently ventilated. The biomass is attached to the textile substrate.

Flow: 3 m³/day

Reactor volume: 3 m³

Size: 2 x 1 x 1.5 m

Construction materials: AISI 304

Includes aeration blower

Feed pump 380 / 6 kW.

For ease of transport and assembly, the plant is located within a container 20''(6 x 2.5 x 2.5 m)

The pilot system is not designed for nutrient removal, being limited by the water column.

First Test Period Results

Periodo	Fechas		Caudal
1^{er} (incluye puesta en marcha)	05/11/2007 a 03/02/2008		3 m ³ /d
2^o	04/02/2008 a 06/04/2008		2 m ³ /d
3^{er}	07/04/2008 a 29/06/2008		1,5 m ³ /d
4^o	30/06/2008 a 03/08/2008		2 m ³ /d
5^o	04/08/2008 a 09/11/2008		1,7 m ³ /d
6^o	10/11/2008 a 18/01/2009		1,2 m ³ /d
7^o	19/01/2009 a 30/06/2009		0,8 m ³ /d

Periodo	Influente (mg/l)	Efluente (mg/l)	Rendimiento (%)	Periodo	Influente (mg/l)	Efluente (mg/l)	Rendimiento (%)
1 ^{er}	1.022 ± 128	108 ± 58	89	1 ^{er}	458 ± 39	19 ± 17	96
2 ^o	814 ± 312	108 ± 54	86	2 ^o	426 ± 106	20 ± 28	96
3 ^{er}	526 ± 212	115 ± 55	70	3 ^{er}	300 ± 130	10 ± 5	96
4 ^o	735 ± 230	87 ± 66	87	4 ^o	426 ± 69	9 ± 5	98
5 ^o	660 ± 96	165 ± 123	75	5 ^o	425 ± 87	55 ± 148	89
6 ^o	668 ± 254	171 ± 112	76	6 ^o	387 ± 129	57 ± 82	85
7 ^o	554 ± 162	41 ± 27	93	7 ^o	325 ± 96	10 ± 3	97
TOTAL	696 ± 250	113 ± 85	84	TOTAL	387 ± 111	25 ± 71	94

DQO Reduction Ratio				DBO ₅ Reduction Ratio			
Periodo	Influente (mg/l)	Efluente (mg/l)	Rendimiento (%)	Periodo	Influente (mg/l)	Efluente (mg/l)	Rendimiento (%)
1 ^{er}	273 ± 60	71 ± 56	74	1 ^{er}	12,3 ± 1,1	11,4 ± 0,8	7
2 ^o	250 ± 106	67 ± 43	72	2 ^o	12,4 ± 1,1	12,1 ± 2,7	2
3 ^{er}	232 ± 87	110 ± 65	40	3 ^{er}	8,7 ± 2,2	9,2 ± 0,8	0
4 ^o	290 ± 54	33 ± 16	87	4 ^o	10,5 ± 0,8	10,7 ± 2,5	0
5 ^o	217 ± 86	150 ± 54	24	5 ^o	9,9 ± 1,5	11,8 ± 2,0	0
6 ^o	183 ± 44	107 ± 51	43	6 ^o	8,9 ± 0,7	9,7 ± 2,6	0
7 ^o	239 ± 103	17 ± 5	91	7 ^o	7,6 ± 1,6	7,0 ± 2,2	2
TOTAL	239 ± 85	86 ± 71	64	TOTAL	10,0 ± 2,2	10,3 ± 2,5	0

SST Reduction Ratio				PT Reduction Ratio			
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Periodo	N-NH ₄		Rendimiento (%)	N-NO ₃		Rendimiento (%)
	Influente (mg/l)	Efluente (mg/l)		Influente (mg/l)	Efluente (mg/l)	
1 ^{er}	57,7 ± 5,5	0,5 ± 0,7	99	0,67 ± 0,46	51,3 ± 15,6	–
2 ^o	46,1 ± 6,5	3,3 ± 8,0	99	0,9 ± 0,6	42,7 ± 6,7	–
3 ^{er}	34,7 ± 14,8	0,7 ± 0,5	98	6,5 ± 12,2	31,1 ± 11,7	–
4 ^o	46,6 ± 6,4	1,0 ± 0,0	98	1,0 ± 0,0	54,9 ± 3,3	–
5 ^o	43,6 ± 11,5	9,3 ± 19,7	81	1,0 ± 0,0	36,8 ± 18,3	–
6 ^o	52,4 ± 9,1	7,1 ± 11,2	84	3,2 ± 4,7	46,4 ± 36,5	–
7 ^o	42,7 ± 9,0	1,2 ± 0,4	97	2,2 ± 2,2	43,6 ± 11,3	–
TOTAL	44,9 ± 12,0	3,6 ± 10,5	92	2,4 ± 5,8	41,9 ± 17,0	–

Amonio & NO₃ Reduction Ratio

Operation and Maintenance of Pilot unit MSABP

- **LABOR:** The rate of technical staff visits Integra Environmental Solutions Ltd. was **1 visit every 1-2 weeks, mainly during the early stages of the test**, dropping to 1 visit per month in the last phases. During these periods the unit has continued to function normally with no more requiring extra maneuvers than the specified in the daily maintenance of the facilities (**routine inspections**).
- **POWER CONSUMPTION:** It has been at an average of 29 kWh / d, no significant variations observed. **This consumption is exclusively associated with the ventilation system (blower), in the absence of other relevant electromechanical equipment in the biological treatment unit.** In the case of this pilot system, **the blower is oversized, so that these consumption data are not directly transferable to the standard operation of the unit.**
- **SLUDGES:** During the study period, **has not proceeded to the removal of sludge from the treatment unit at any time, nor were required to perform tasks sludge recirculation** for the operation of the system.
- **INCIDENTS:** **minor incidents have been detected in operation with almost immediate correction.** The most noteworthy are fouling of tubes and pumps, but **none attributable to the biological system itself.**
- **ADDITIVES:** During Assessment Test **has not proceeded to the dosing of chemical reagents or biological accelerators (biocatalysts).**

Conclusions

- The system has an **acceptable efficiency in removing organic matter (COD)** with average values of this parameter according to Royal Decree Law 11/95.
- The system features a **high efficiency in removing biodegradable organic matter (BOD5)** under all operating conditions studied.
- The system fails, **in most cases, the limit for suspended solids, either in absolute or performance.** However, it was found that **the solids in the effluent of the system have a high mineral component.**
- The **system does not conform to the reference standard in the elimination of total nitrogen and total phosphorus, but has a high rate of nitrification** (conversion of ammonia nitrogen to nitrate). It should be stressed that the prototype installed in the PECC is not designed for nutrient removal.
- MSABP unit **has operated without sludge recirculation line and purge during the study period.**
- Also, the maintenance staff by CENTA has **included the routine inspection of the facilities to check their status.** Additionally, technicians from Integra Solutions SL have made **occasional visits (1 visit every 15 days or so).**
- Finally, note that **the aeration system is the only relevant electromechanical element** in the whole process in terms of energy consumption is concerned, **and the system works properly without biological or chemical additions.**

Recommendations to the Prime Process Analytical

Based on these results, it is recommended to improve solid waste disposal system, by including in the processing unit of some kind of retention of these particles (such clarifying or filtering). The results of this second process will be announced days before the conclusion of Smallwat'11, where he officially made public. Everything presented here is therefore endorsed by the official report of CENTA.