

LANDFILL LEACHATE MULTISTAGE TREATMENT – A CASE STUDY

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Introduction

Old and intermediate Landfill leachates: highly polluted aqueous systems. Non-biodegradable substrates, high concentrations of ammonia –nitrogen and nitrogen containing organic substances.

Salubris SA is operating a leachate treatment plant for the landfill Balteni based on sequencing batch reactors (SBRs) and some chemical treatment facilities

Design data restricted to:
COD <2650 mg O₂/L,
BOD/COD ratio between 0.25 and 0.66,
ammonia NH₄⁺ < 800 mg/L,
without a specified TKN.

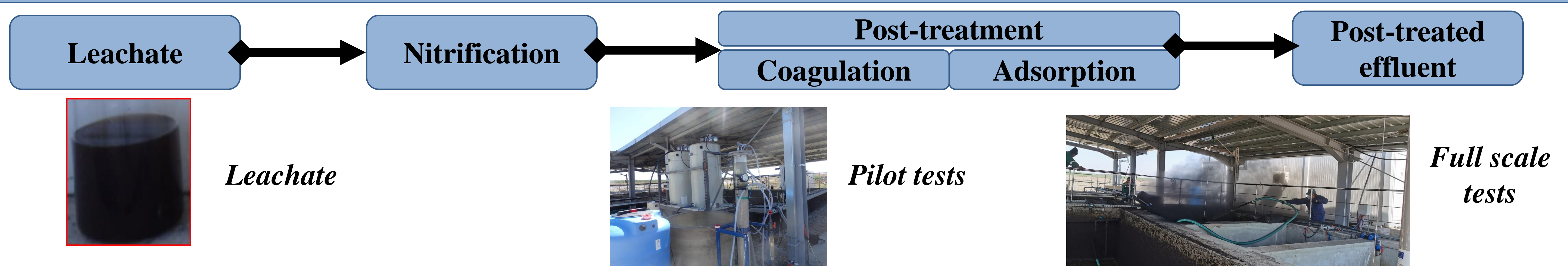
The real leachate parameters were
COD-Cr = 2900-5000 mg O₂/L
BOD/COD < 0.15
TKN=1000-2500 mg N/L,
NH₄⁺ = 1000-1500 mg/L)

The quality of the treated leachate became an issue. Intervention needed for ammonia, TKN, COD, Total-P, extractibles, color

Materials and methods

Treatment tests achieving advanced ammonia, TKN, COD and color removal on laboratory, pilot and industrial scale were done coupling biological oxidation, coagulation and adsorption on activated carbon.

Biological treatment and a post-treatment of the nitrified biological effluent, using only the existing facilities (dosing capabilities and a contact basin with mixer) was tested on full-scale, batch 40 m³.



Results and Conclusions

Activated sludge process using two SBRs. The process was modified for alternating, multiple, aerobic and anoxic phases with filling, adapted gradually to the best performance in relation with ammonia oxidation to nitrate but also without nitrite accumulation

Exchange rate 5%
Specific ammonia load
0.07 kg TKN/(m³·day)
4 kg VSS / m³

Effluent ammonia - typically 10-20 mg/L (or below, down to 2 mg/L in summer, deteriorates in winter 30 and 70mg/L)
TKN 100-150 mg/L
Nitrite, 2-5 mg NO₂⁻/L, stable operation.

COD and color – low performance (10-20%)

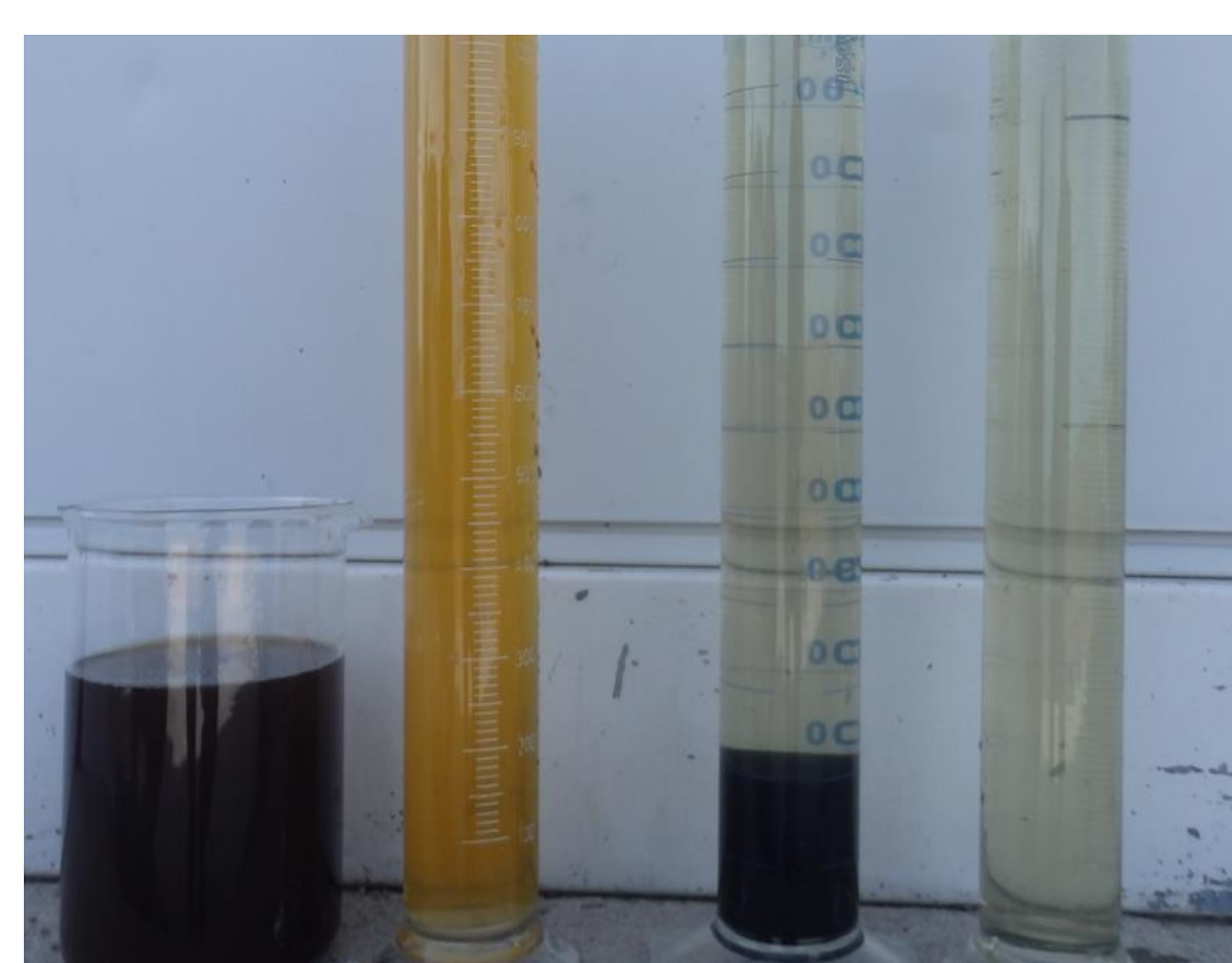
Difficulties: evolution for mid term for alkalinity deficiency < > lack of endogenous denitrification < > BOD/COD < 10%. Foaming.
Leachate pre-treatment – no improvements for the downstream biological oxidation of COD.

Post-treatment of the Biological effluent: quick to implement, flexible solution using only the existing treatment facilities.

The process: coagulation using poly-hydroxyaluminum chloride sulfate (Kempac-14, Kemcristal Fundulea) and adsorption on powdered activated carbon (PAC, Flochem Floerger).

Parameter	Unit	Leachate	Biological effluent	Post-treat	Variation
COD	mg O ₂ /L	3608	2948	616	-79%
TKN	mg N/L	1060	126	39.5	-77%
Total P	mg P/L	14.5	23.9	<0.1	-99%
pH		7.98	5.56	6.59	-

λ	Unit	Leachate	Biological effluent	Post-treat	Variation
254 nm	cm ⁻¹	24.5	20.2	2.20	-89%
436 nm	cm ⁻¹	2.25	1.65	0.060	-96%
525 nm	cm ⁻¹	0.850	0.625	0.020	-97%
620 nm	cm ⁻¹	0.500	0.325	0.015	-95%



Post-treatment of the biological effluent full scale, one contact phase process:
79% removal of COD and >95% reduction of color (from glossy black to yellow).
TKN resisting biological oxidation lowered by 77%, down to 40 mg N/L.
Note: By coagulation only: COD= 1100-1500 mgO₂/L, TKN 50-70 mg/L, Total P < 1 mg/L

Cost estimation: 3.5 Euro/m³ (coagulation step) and 14.1 Euro/m³ for the complete process. Activated carbon - the major cost item. Coagulation is now used as the main polishing step. For Adsorption investments for the proper dosing are needed.

Acknowledgments

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