Interreg Sudoe

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TARGET

TerritoriAl stRateGy for watEr scarciTy


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Electrochemical oxidation and nature-based solutions for emerging contaminants in urban water

From monitoring to treatment: evidence and lessons from the TARGET demonstrative action (NOVA FCT)

MAIN OBJECTIVES

- Improve NbS performance for contaminants of emerging concern (CECs), extending the range to pesticides
- Identify the CECs most relevant for the SUDOE area
- Couple an electrochemical pre-treatment (EO) with NbS
- Obtain information on degradation products and ecotoxicity

KEY RESULTS & LESSONS

- Pesticides are also an urban problem: 59 of 141 detected in three Lisbon WWTPs over one year
- Conventional treatment removes ~25 %; treated effluent > 100 ng/L every month
- At lab scale, EO degraded 79 % of pesticides /pharmaceutical compounds on average
- No changes in ecotoxicity were observed after EO
- Metabolites detected alongside parent compounds: transformation products matter
- Stakeholder workshop with Barreiro municipality on water reuse (22 Oct 2026)

LESSONS FOR REPLICATION

- Select target CECs from local monitoring, not generic lists
- Tune EO to the matrix: chloride shapes oxidation and by-products
- Use EO as a polishing step, letting NbS do the rest

TAKE-HOME MESSAGE

What the Wastewater Treatment Plant does not remove reaches rivers, soils and reuse. Electrochemical oxidation offers a targeted, reagent-free polishing step.

01 DEMONSTRATIVE ACTION: APPROACH

SUDOE-relevant CECs	Analytical methods	EO process	EO + NbS	Barreiro	Replicability
monitoring + EU review	SPE + GC-MS/MS, HPLC	pre-retention basin	lab-scale treatment train	EO-only scale-up, stakeholders	lessons & specifications

02 WHICH CECs? ONE YEAR OF MONITORING

141 pesticides screened

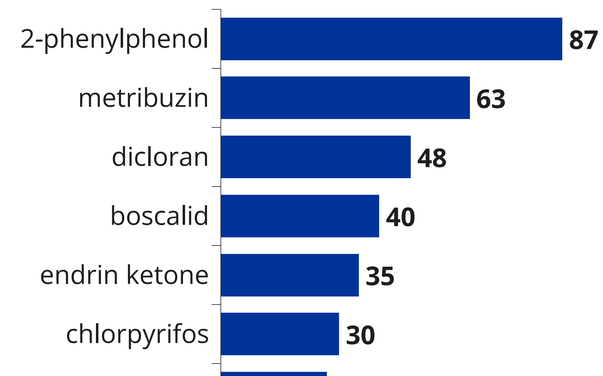
59 detected

46 quantified

Real treated effluent, 3 WWTPs, 12 months: all seasons covered; summer peak (70.9 ng/L in Sep)

Soils too: boscalid in 36 % of EU soils and in every wastewater sample

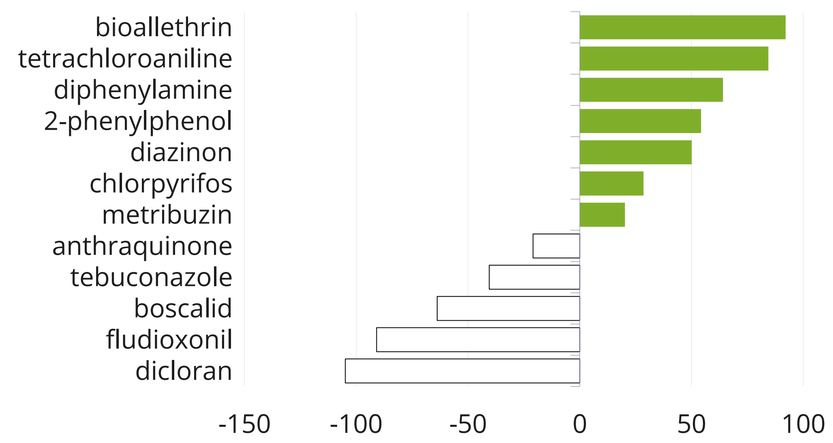
Highest mean concentrations (ng/L)*



** bioallethrin excluded (634.8 ng/L, 3/12 months)*

03 CONVENTIONAL TREATMENT IS NOT ENOUGH

Removal in the WWTP (%)



~25 %
overall annual removal

> 100 ng/L
in treated effluent, every month

04 ELECTROCHEMICAL OXIDATION (EO)

MMO	79 %	140/154	=	Watch-outs
circular mesh, 250 mA	mean pesticide removal	pesticides > 40 % removal	no change in ecotoxicity	Organochlorines resist Cl-driven by-products

05 EO + NbS: LAB-SCALE TREATMENT TRAIN

T−1	T0	T1	T2	T3
Unspiked blank	Abiotic control	EO only	Plants only	**EO + Plants**

Hydroponic *Spartina maritima* microcosms: lab-scale model of a vegetated saltmarsh NbS (phytoremediation)
Native Coina salt marsh plants · real Barreiro effluent · 7 days · pesticides, pH, EC, COD, microbiology, toxicity

REFERENCES

Carvalho R. et al. (2025) Open Res Eur 5:257 · Carvalho R. (2025), Cristina T. (2025) MSc theses, NOVA FCT · Selected results; full results in the final TARGET deliverables

EPIDOR EPTB Dordogne · Le Grand Périgueux Communauté d'Agglomération · Agencia de Medio Ambiente y Agua de Andalucía Junta de Andalucía · NOVA Faculdade de Ciências e Tecnologia · République Française Liberté Égalité Fraternité · Cerema Climat & Territoires de demain · Ajuntament Granollers · Barreiro Câmara Municipal · Universidad Complutense Madrid · Universitat Politècnica de Catalunya BarcelonaTech · ecofilae

