14th International HCH and Pesticides Forum

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SERPOL

PROTOCOLS OFFER TO THE CLIENTS FOR WETLAND+® REPLICATION

LIFE POP WAT

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Life

TECHNICAL UNIVERSITY OF LIBEREC www.tul.cz

PHOTON WATER

Jaworzno źródło energii

AARHUS UNIVERSITY

GIG

SERPOL SERFIM GROUPE

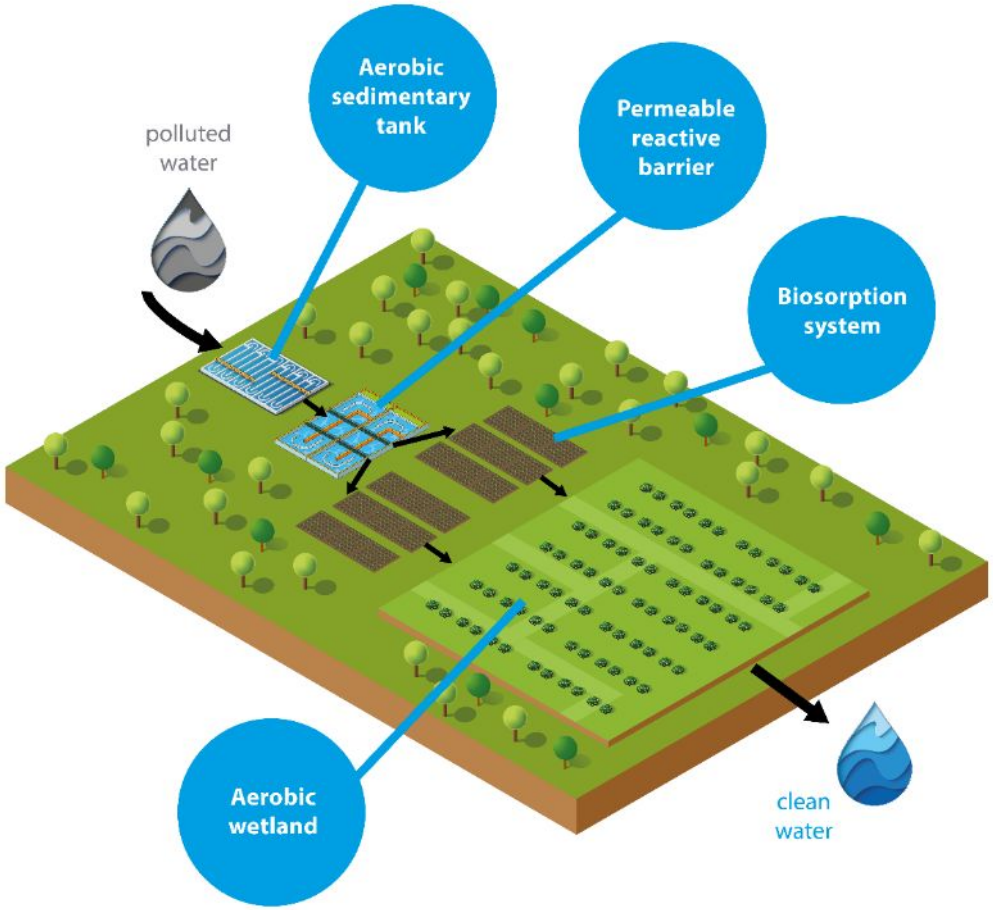
DIAMO

Ministerstvo životního prostředí

- Wetland+® is :
  - an innovative adaptable wetland treatment system for lindane and pesticides removal in waters (GW, resurgences, leachates, effluent)

  - a natural-based solution to limit widespread of pesticides in water (pathway management)

Reactive zones description



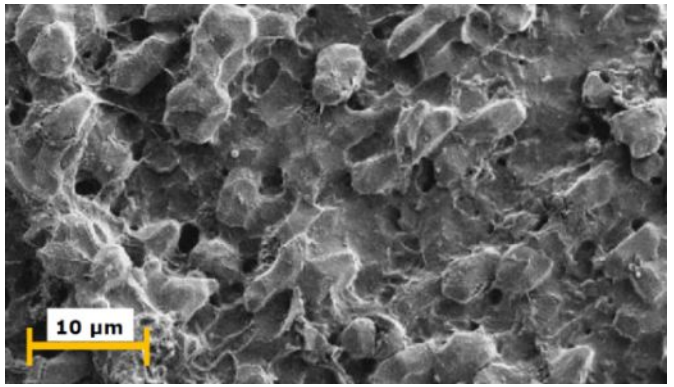
- **Sedimentary tank**: eliminate suspended particles

- **Anaerobic/reductive compartiment:**
  - Permeable Reactive Barrier (ZVI): create strong reducing conditions to break C-Cl bonds
  - Biosorption system: increase lindane residence time to reductive biodegradation processes

- **Aerobic wetland**: aerobic biodegradation of residual oxidable by-products (Benzene, Phenols, BOD)

Factors for lindane and micropollutants degradation within Wetland+®

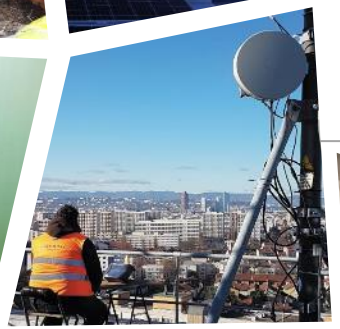
- The main degradation mechanism is metabolisation of pollutants (biodegradation) thanks to bacteria located onto biofilms and within the roots of macrophytes
- REDOX potential variation for dechlorination (anaerobic/reductive conditions) and oxydable by-products degradation (aerobic/oxydative conditions)
- Optimized residence time thanks to enhanced sorption thanks to organic mater addition (wood chips, peat,…)
- ZVI permeable ractive barrier allows enhanced reductive condition to optimize and accelerate treatment and so reduce global time residence in the wetland.



Bacteria developped at the plants roots interface (Chong et al., 2009)

The SERFIM Group

10 branches



Energy

- Transport networks
- Distribution networks
- City planning
- Building fittings

Water

- Drinking water supply
- Rainwater sewerage and management
- Pumping
- Special works

Structures

- Any structures: Tunnels, bridges, accessible drains, channelling, etc.
- Underwater works
- Remote-operated and diver inspections
- Sleeving rehabilitation

Road

Environmental remediation

- Work site environmental remediation
- Treating effluents
- Decontamination and asbestos removal
- Global management of landfills

Recycling

- Global waste management
- Preparation of recycled raw materials
- City and private cleaning
- Building demolitions
- Sale of quarrying materials and recycled materials

RES

- Production of renewable energy
- Development and construction of solar power plants for our clients
- Research and consultation for innovative solutions

ICT

- Fibre optics and telecoms
- Connected regions and Internet of Things (IoT)
- Digital communications and Smart City innovations
- Safety devices
- Road traffic management

Industry

- industry
- Working at higher altitudes

40+ fields of intervention

SERFIM Environmental Remediation

14 Sites

SERPOL

VENISSIEUX (HQ)

DOLE

MERIGNAC

GEISPOLSHEIM

MAUGUIO

VILLEBON-SUR-YVETTE

NANTES

MARCQ-EN-BAROEUL

GEOAMBIENT

BARCELONA (HQ)

MADRID

SEVILLE

TERENVIE

HEYZIN

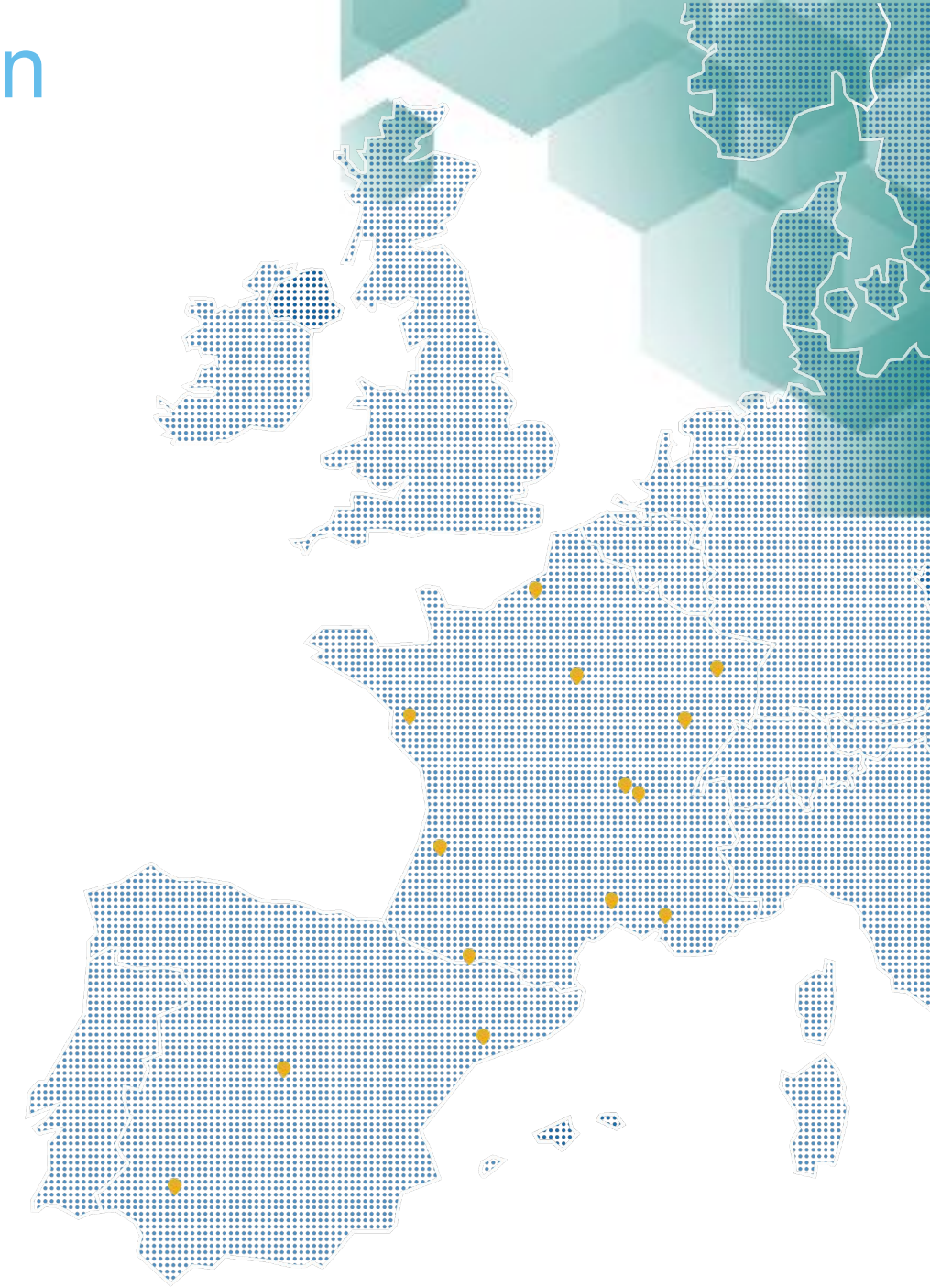
ECOFHAIR

VENISSIEUX (HQ)

TOULON (Branch)

ENVIRONIUM

LE BOURGOU (Branch)



SERPOL

Since 1983, as a company, **Serpol** has clearly demonstrated its commitment to both the environment and its clients.
Pioneers in work site environmental remediation in France, we offer our services through our national operations.
Our work and developments are driven by our continuous quest to innovate, governed by our strong CSR approach.

4 business lines

- **Soil and groundwater remediation**
- **Effluent treatment** (urban, industrial, landfills leachate, ...)
- **Decontamination and asbestos removal**
- **Global management of domestic landfills**

200
employees

8
sites in France

€32 M
in turnover

Our certifications

ISO 9001 | MASE | QUALIBAT | ENR B & ENR C | ECOVADIS (gold)

GEOAMBIENT

The trades

- Soil and groundwater remediation
- Brownfield restauration
- Geology, hydro-geology

GEOAMBIENT

20
employees

2 M €
turnover in 2022

SERPOL

1 Laboratory and pilots

From lab tests to trials!

Lab tests and trials enable us to respond to requests arising from our clients' challenges, feedback from our sites, or our collaborative R&D projects, which drive us to test and develop other approaches that will continuously improve our land and aqueous effluent treatment procedures (underground water or industrial effluents)

4
employees

100 m²
Lab
and trial unit

€70k
in turnover/year

Lab tests and trials enable various treatment to be simulated:

- **Physicochemical:** Soil washing, coagulation/flocculation, absorption, etc.
- **Chemical:** Soil stabilisation, oxidation and chemical reduction, etc.
- **Biological:** Bio-stimulation, reed-based filters rhizodegradation, aerobic and anaerobic respirometry, etc.
- **Membrane filtration:** Micro, nano, ultra-filtration and reverse osmosis

What can we do for you??

1) <u>DESK STUDY:</u>

- NDA signature
- Free and confidential first study for green light feasibility declared by LIFEPOWAT expert (feedbacks/literature)
- Context, contaminants, physico-chemical parameters, impacted effluent flowrate, surface topography, surface available for treatment implementation, outflow thresholds
- If it concerns GW problematic: conceptual model
- In any cases, missing data would be identified to then propose how to get them

2) <u>LAB TEST (10-20 keuros)</u>

- Objective to validate feasibility and design the different compartiment(s) needed for the treatment
- Validation of abattement or transformation kinetics / residence time needed in each compartiments
- first estimate of CAPEX and OPEX

What can we do for you??

Effluent initial characterisation

- Dissolved and suspended solid fraction of contaminants (HCH,….), Fe and Mn
- Granulometric analysis
- Physico-chemical parameters (pH, Eh, DO conductivity)

Fraction decantable

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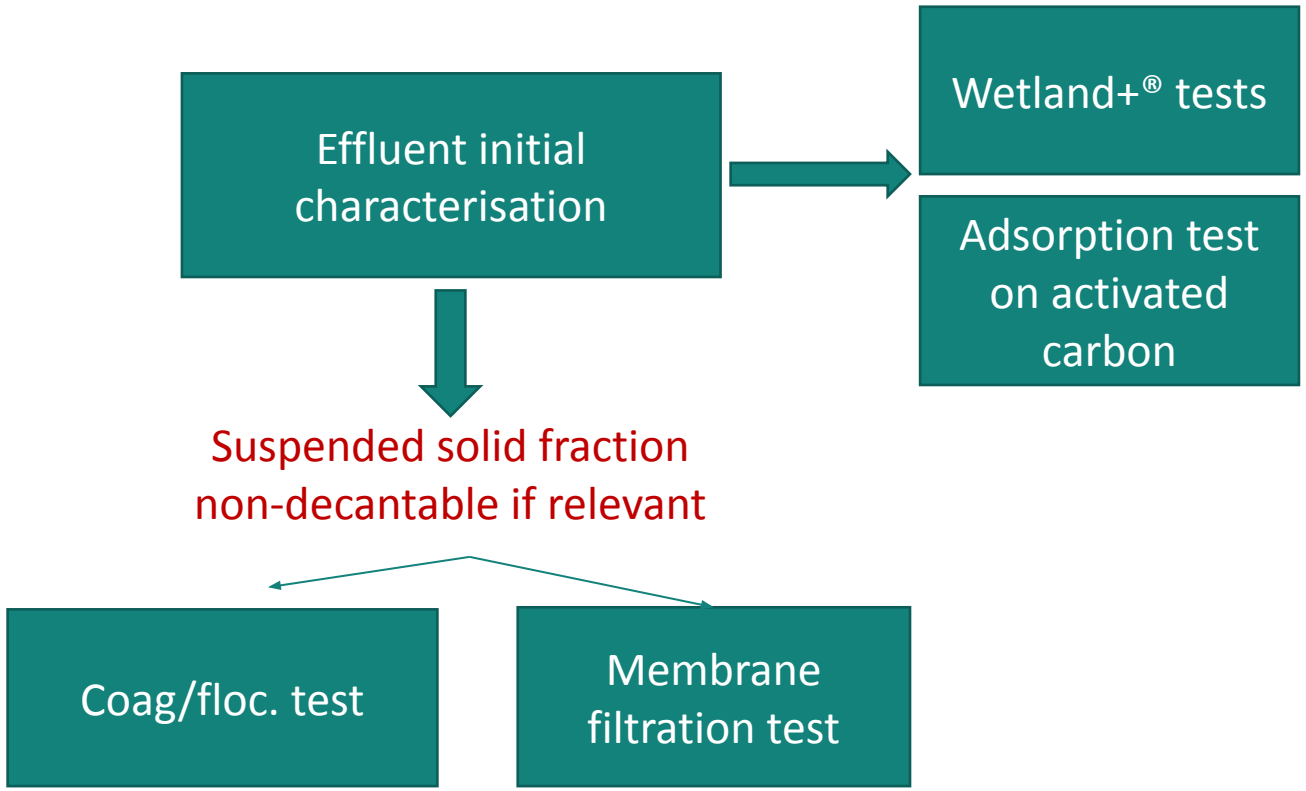
Natural sedimentation test

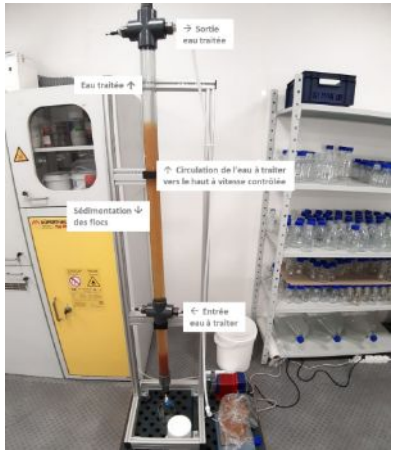
- Estimate of mood quantity naturally decantable
- Design of the sedimentary tank if relevant
- Cost estimate of contaminated mood to be evacuated

What can we do for you??



What can we do for you??

Coag/floc. test



- Different coagulant reactives
- Floculant test if necessary
- Dynamic sedimentation test for the selected best reactive(s)

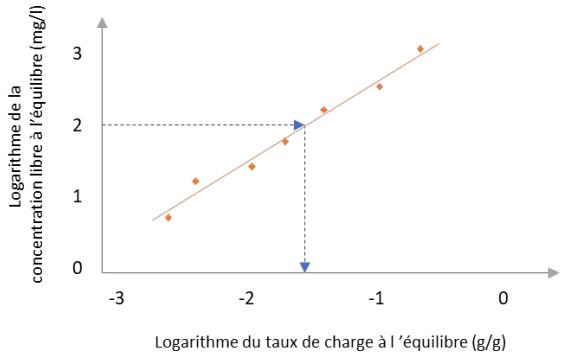
=> Residual HCH dissolved fraction, mood quantity, reactive(s) concentration(s)

Membrane filtration test

- Different types of UF membrane tested

=> Permeate analysis (HCH and by-products)

Adsorption test on activated carbon

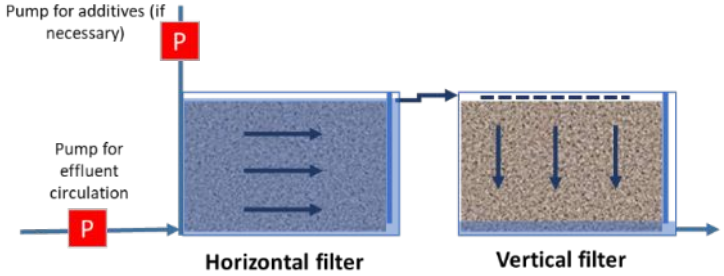


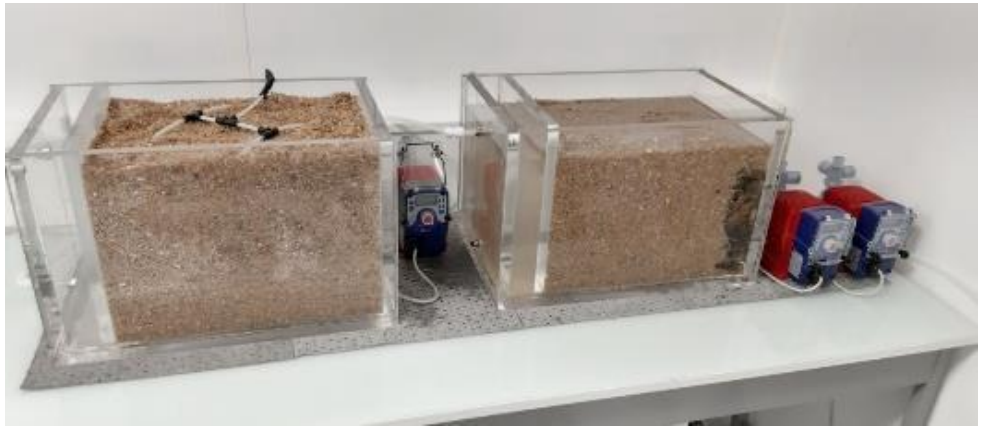
- Batch test with selected GAC

=> Freundlich isotherms to estimate charge capacity of GAC

What can we do for you??

Wetland+® tests





- HCH and by-products monitored at each stage
- No reeds/plants for lab test => results can be underestimated
- Urban sludges to sow and initiate biomass growth
- Wood chips for biosorption in horizontal filter => Mass balance is done to evaluate what is sorbed from what is biologically degraded
- Lab pilot has been already validated

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Wetland+® tests
BPR ZVI

- Dynamic column test with adapted flowrate filled with a mix ZVI and gravel/sand

- HCH and by-products monitored + physico-chemical parameters

=> Objective to estimate residence time to reach HCH transformation in comparison with anaerobic biological filter (biosorption)

3) **PILOT TEST (50-80 keuros) (if necessary)**

- Objective to confirm LAB tests
- Precise sizing scale 1 and CAPEX/OPEX

Vertical and Horizontal Filter with remote monitoring and control for 0,5 m3/h pilot tests

4) **SCALE 1 WETLAND+® (300-500 keuros)**

- 20 m^3/h and 5 000 m^2 maximum (SERPOL operational feedbacks)
- CAPEX directly linked to basin surface (excavation and fillings volume)
- OPEX should be low due to the rusticity of this passive treatment

Pictures of wetlands installed by SERPOL for urban wastewater and landfills leachate (more than 150)

Advantages

- Increase biodiversity
- Low costs and maintenance
- Robust and adaptable
- Flow variation tolerance
- Low energy consuption
- Perfect landscape integration
- Good public acceptance
- Can be sized to accept other types of effluents (urban, industrial, rainwater)

Please come to our LIFEPOPWAT stand to discuss about your project !!!

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THANK YOU FOR YOUR ATTENTION

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Next presentation this afternoon (15h15, Block 6): Innovative HCH in-situ remediation using polymer gel as a reagent carrier – Results at field scale

SERPOL GEOAMBIENT