

INSTITUTE FOR NANOMATERIALS,
ADVANCED TECHNOLOGIES
AND INNOVATION TUL



Department of Environmental chemistry

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4 Different research groups:

- **Accredited laboratory** – ČSN EN ISO/IEC 17025:2018
- **Environmental Catalysis Group**
 - green synthesis of heterogeneous catalysts
 - photocatalysis and catalytic hydrogenation for the removal of micropollutants
- **Femto-Nano Group**
 - development of complex nanomaterials using laser-mediated strategies
 - laser synthesis of colloids, photoreduction, and superficial modification for biological labeling, suppression of bacterial growth, development of intelligent fluids, and reclamation of water from oily polluted sources
- **Chromatographic Group**

Chromatographic Group

Equipment

1) Liquid chromatography laboratory

- HPLC-DAD
- HPLC-ELSD
- HPLC-MS/MS (QTRAP 3200)
- HPLC-MS/MS (QTOF X500R)

2) Gas chromatography laboratory

- GC-FID
- GC-ECD
- GC-TCD
- 2 x GC-MS/MS (QQQ Thermo)

Focus of the Chromatographic Group

- 1) Research activities
- 2) Analytical service



Main research activities

Phytoscreening

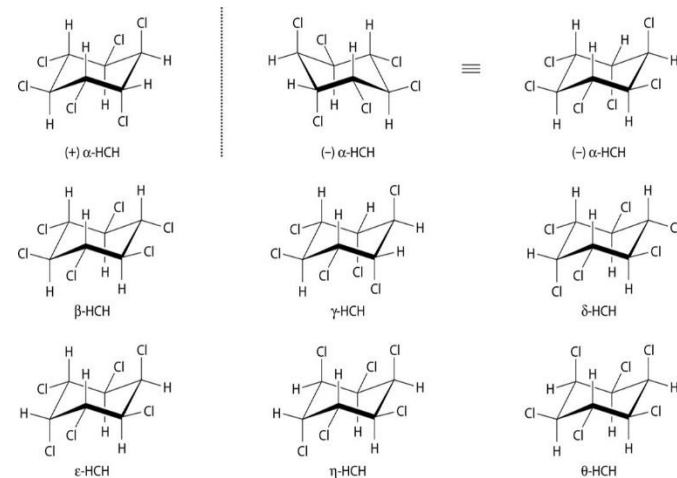
= phytoindications of groundwater pollution

Principle: intake of contaminated groundwater by the root system of vegetation and its transport by the transpiration stream to the above-ground parts as compensation for plant transpiration

Innovative technology based on constructed wetlands for treatment of pesticide contaminated waters – LIFE18

ENV/CZ/000374

- Hexachlorocyclohexanes (HCHs)
- *Alnus glutinosa*
- Species-, genetic-, age-, season-, height-dependence
- SPME x LLE



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1) Species:

root system shape and permeability of root membrane
deal with one ubiquitously growing species
preferably of a broadleaf tree

2) Genetic predisposition:

6 *Alnus glutinosa* genotypes, that were bred for the resistance against the parasitic fungus
Monitoring of HCH removal, uptake and stress adaptation (plant hormones)

3) Age:

higher age = higher evapotranspiration
heartwood – not suitable for phytoscreening



Contents lists available at ScienceDirect
Ecotoxicology and Environmental Safety

journal homepage: www.elsevier.com/locate/ecoenv



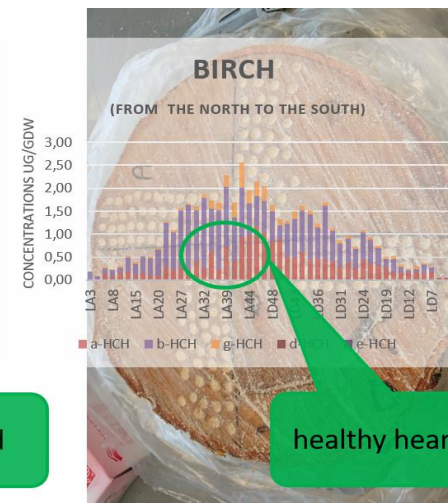
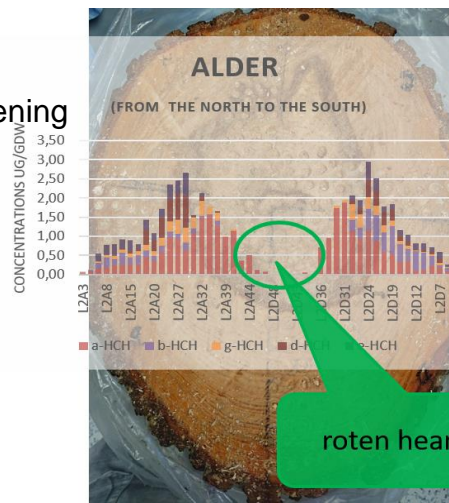
Influence of delta-hexachlorocyclohexane (δ -HCH) to *Phytophthora ×alni* resistant *Alnus glutinosa* genotypes – Evaluation of physiological parameters and remediation potential

Stanislava Kosková^{a,b}, Petra Stochlová^c, Kateřina Novotná^c, Aday Amirbekov^{a,b}, Pavel Hrabák^{a,c}

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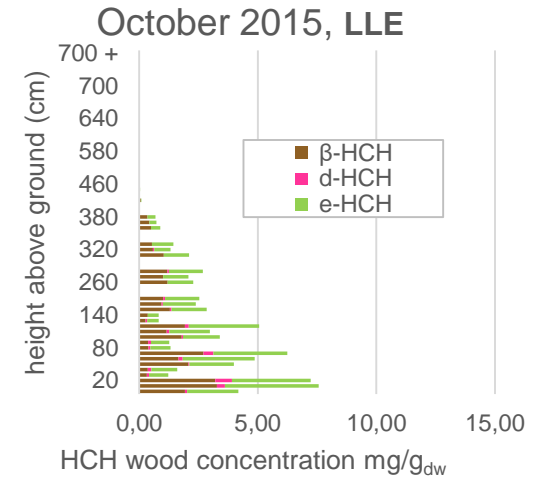
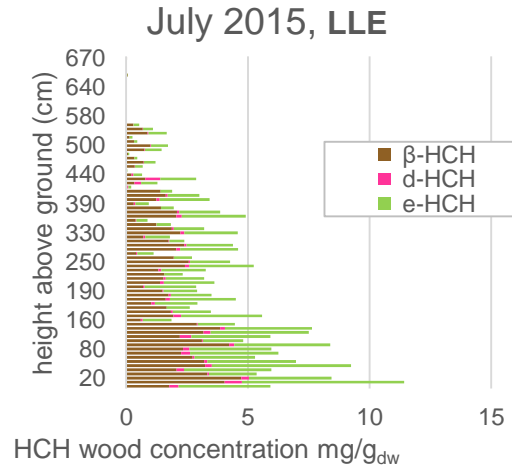


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4) Season and height dependence:

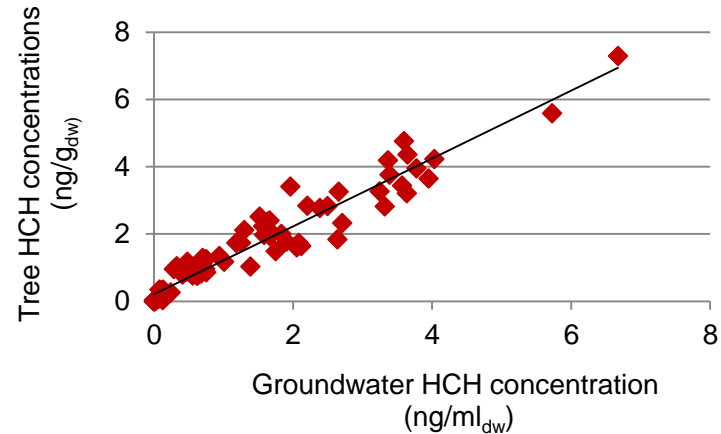
seasonality was found to influence Σ HCH concentrations

one sampling height must be observed



HCH tree phytoscreening

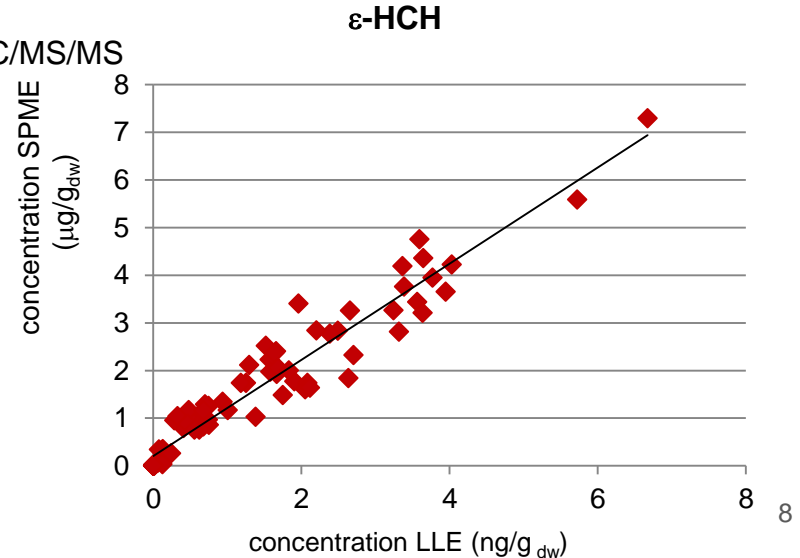
- useful tool to indicate groundwater HCH contamination
- only indicative
- should be further confirmed by robust hydrogeological survey



Analytical procedure for HCH determination

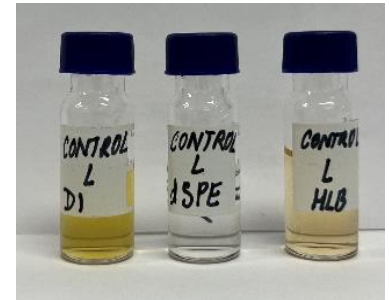
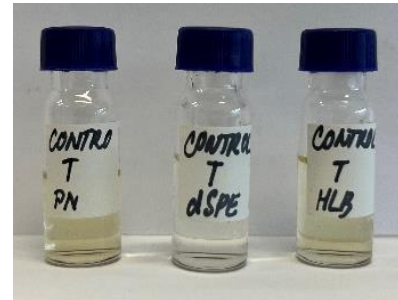
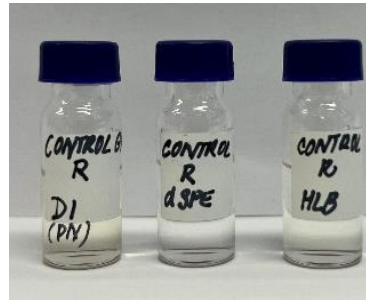
- GC/MS/MS
- Sample pretreatment:

Conventional LLE	x	New developed SPME method
acetone:hexane extraction		solvent free sorption on the fiber
drying of extracts		solvent free
liquid injection into GC/MS/MS		thermal desorption into GC/MS/MS
matrix effects		more selective



Multiscreening for a determination of micropollutants in black poplar samples using liquid chromatography to tandem mass spectrometry

- pesticides (16 parent compounds and their relevant metabolites)
- material – plant biomass (roots, trunks, leaves)
- sample pretreatment – HLB SPE/ Dspe (QuEChERS) with Chlorofilter (recovery and matrix effects)
- LC/MS/MS – Sciex QTOF X500
- Target and non-target analysis



Analytical service

for internal research groups, external scientists and industrial customers

Determination of micropollutants in environmental matrices – routine monitoring

GPC of polymers and nanofibers

Nanostructure sorbents for sample pretreatment

and analytical services to address synthetic, biotechnology and microbiology topics

More information could be found <https://cxi.tul.cz/en/>

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Thank you for your attention!



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