Green Plants for Wastewater Treatment: *European Approaches and Trends*

Jean-Paul Schwitzguébel

Laboratory for Environmental Biotechnology

Swiss Federal Institute of Technology (EPFL)

CH - 1015 Lausanne, Switzerland

Overview

1. What is a COST Action ?
2. Plants and bacteria: who is doing what ?
3. New applications for constructed wetlands
4. The Epuvalisation system
5. Development of a process to treat wastewater from dye and textile industry

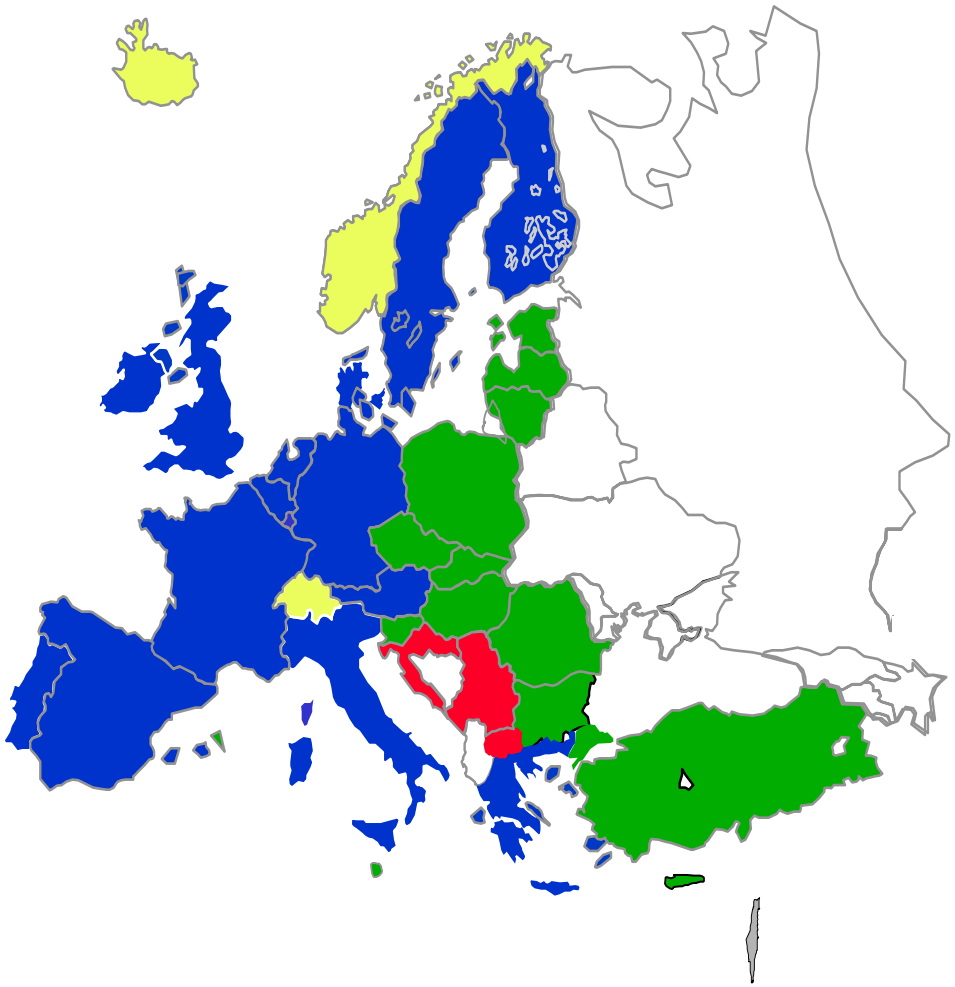
1) What is COST ?

European CO-operation in the field of Scientific and Technical Research

- **A concerted Action is the co-ordination at a European level of national research projects**
- **COST funding covers the co-ordination expenses of each Action:**

  - contribution to Meetings and Workshops
  - support of Short-Term Scientific Missions

COST Countries



I COST Member States

The fifteen EU MemberStates

EFTA Member States

- Iceland
- Norway
- Switzerland*

Candidate Countries

- Bulgaria
- Cyprus
- Czech Republic
- Estonia
- Hungary
- Latvia
- Lithuania
- Malta
- Poland
- Romania
- Slovak Republic
- Slovenia
- Turkey*

Other Countries

- Federal Republic of Yugoslavia*
- Croatia *
- Former Yugoslav Republic of Macedonia (FYROM)*

II Co-operating State

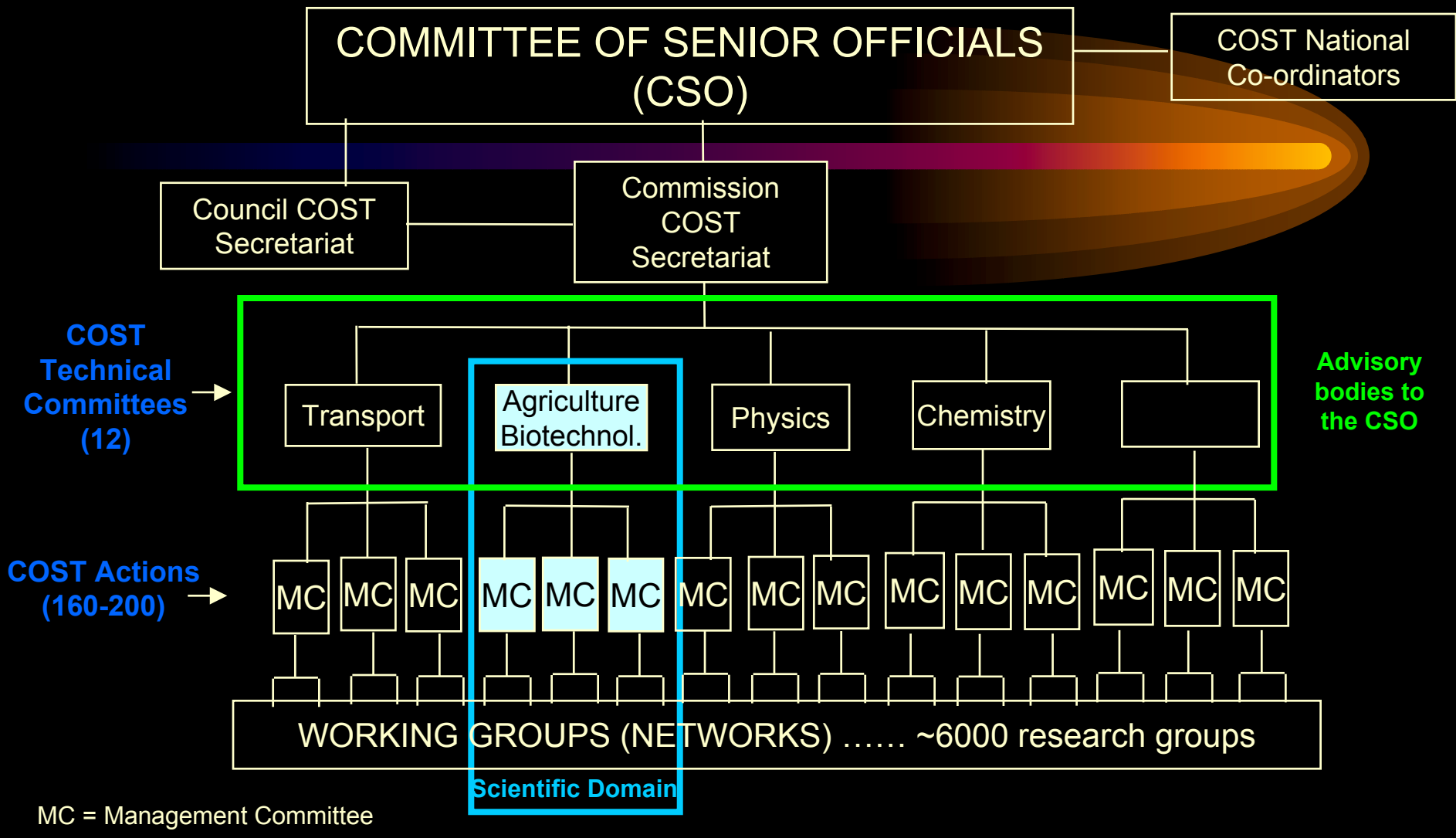
- Israel

* Not Associated to FP

COST Characteristics

- Concerted Actions / Networking
- Co-ordination
- Pan-European
- "Non-competitive" (pre-normative; environmental and cross-border problems; public utility)
- Financed nationally
- Bottom-up / Flexibility
- "A la carte" participation
- "Integration"
- Complementarity
- Exploratory
- Commission involvement

COST Structures



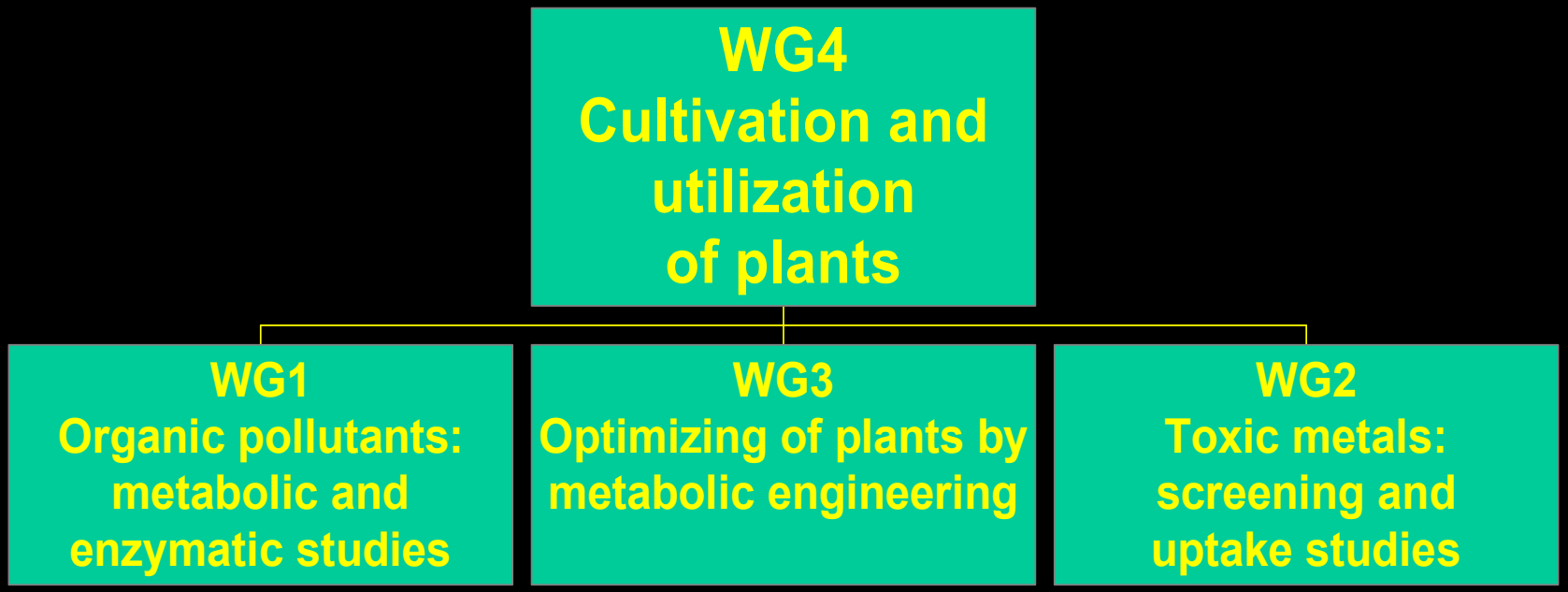
COST Action 837

Plant biotechnology for the removal of organic pollutants and toxic metals from wastewaters and contaminated sites

180 scientists and 120 institutes
from 24 COST countries

http://lbewww.epfl.ch/COST837

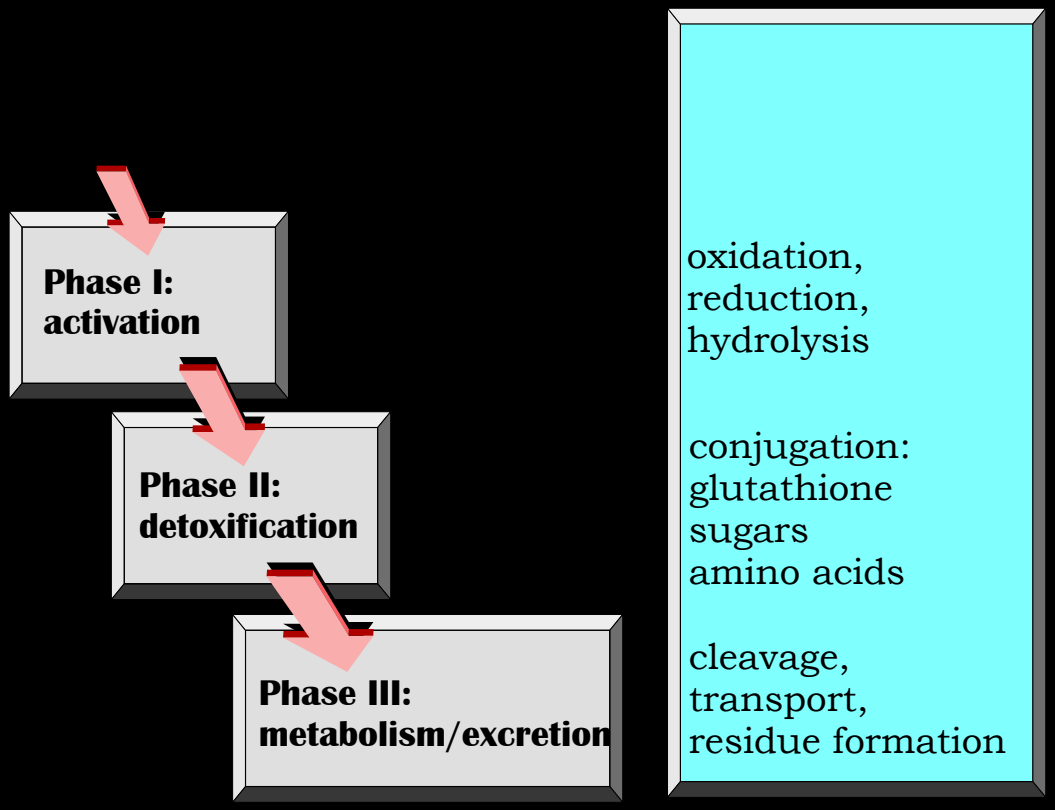
Working Groups



2) Plants and bacteria: who is doing what ?

Peter Schroeder and Diana Daubner
Institute of Soil Ecology, GSF
Neuherberg (Germany)

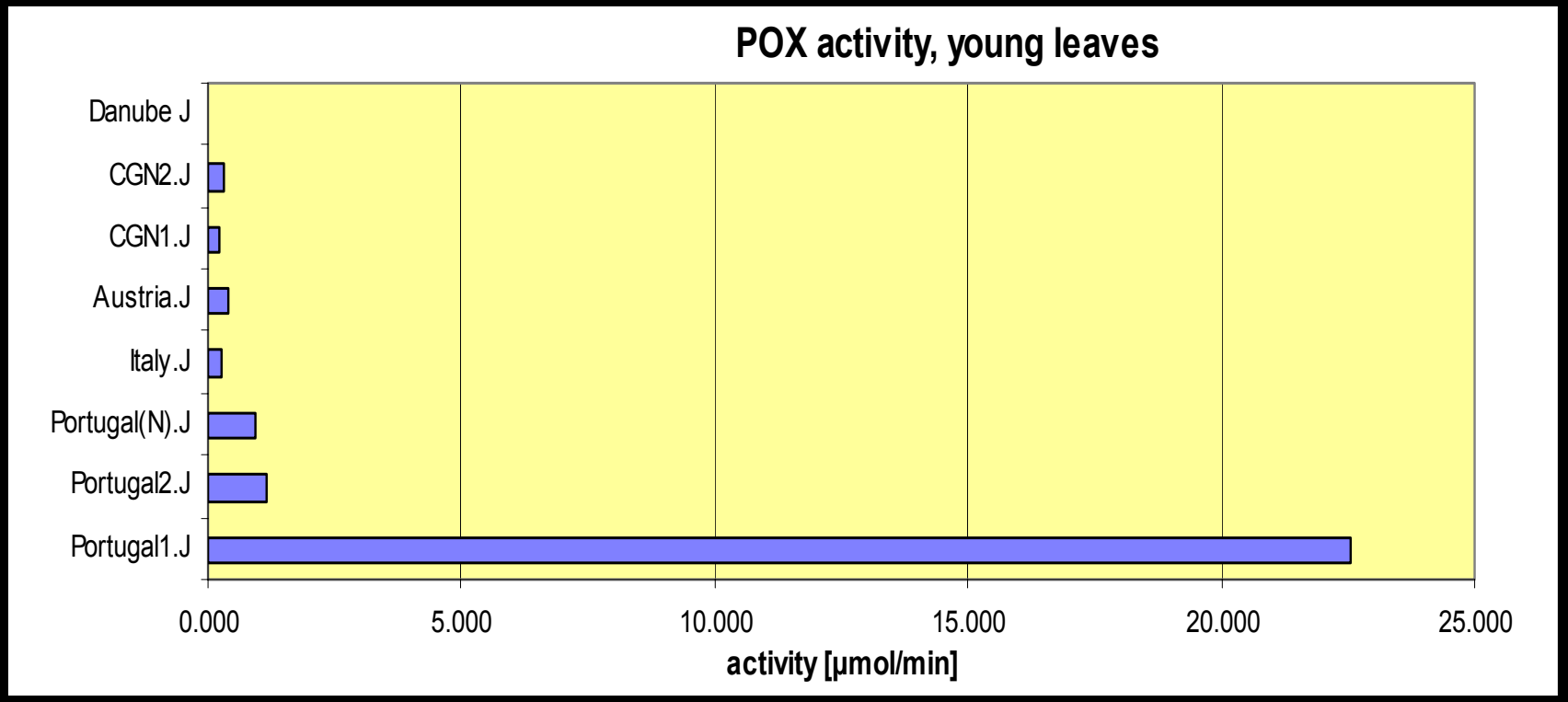
The „green liver“ concept



Phragmites in phytoremediation

- Best known species in sewage treatment
- High biomass production
- Better success than without plants...
- Black box syndrome: seems to work...

Presence of detoxification enzymes: Peroxidase



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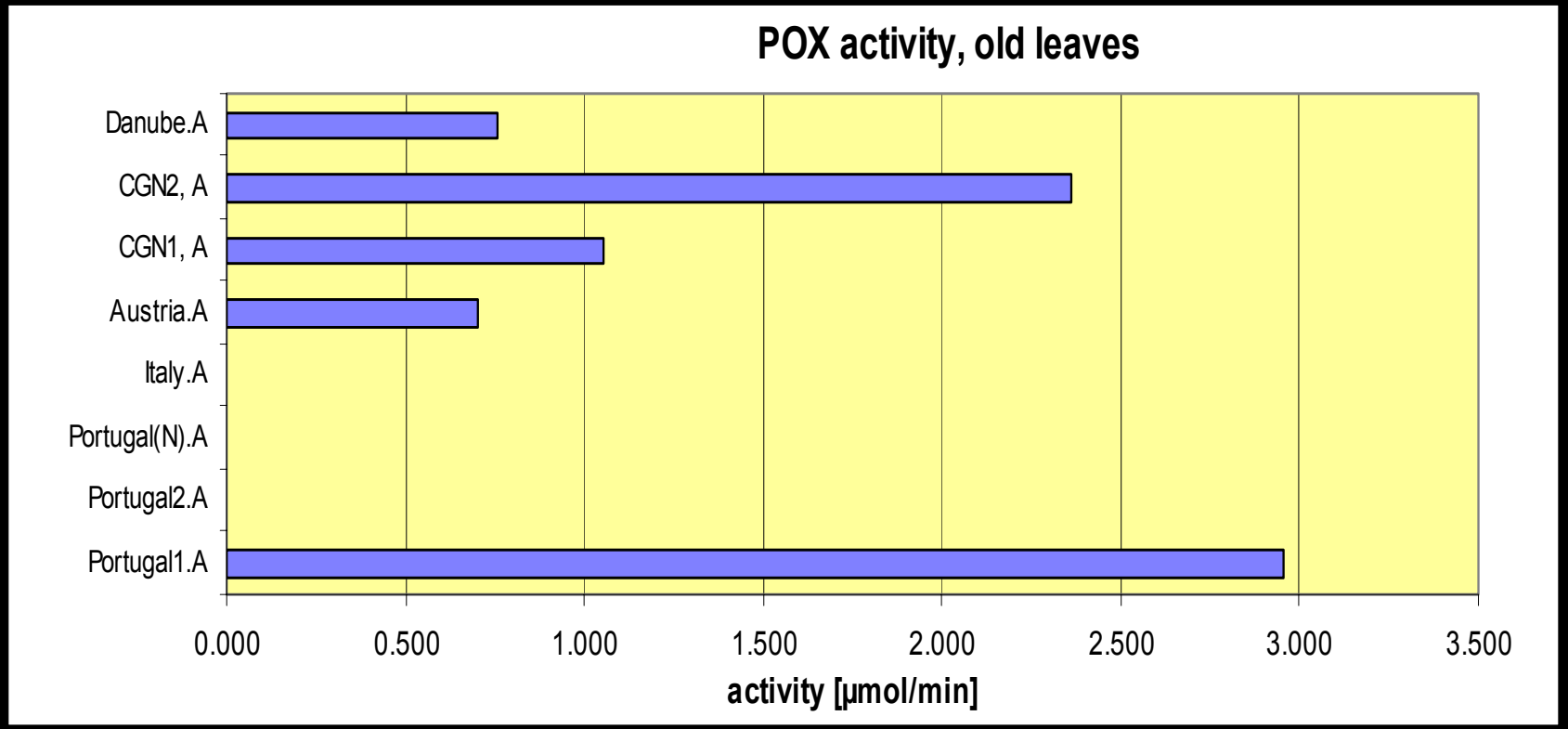

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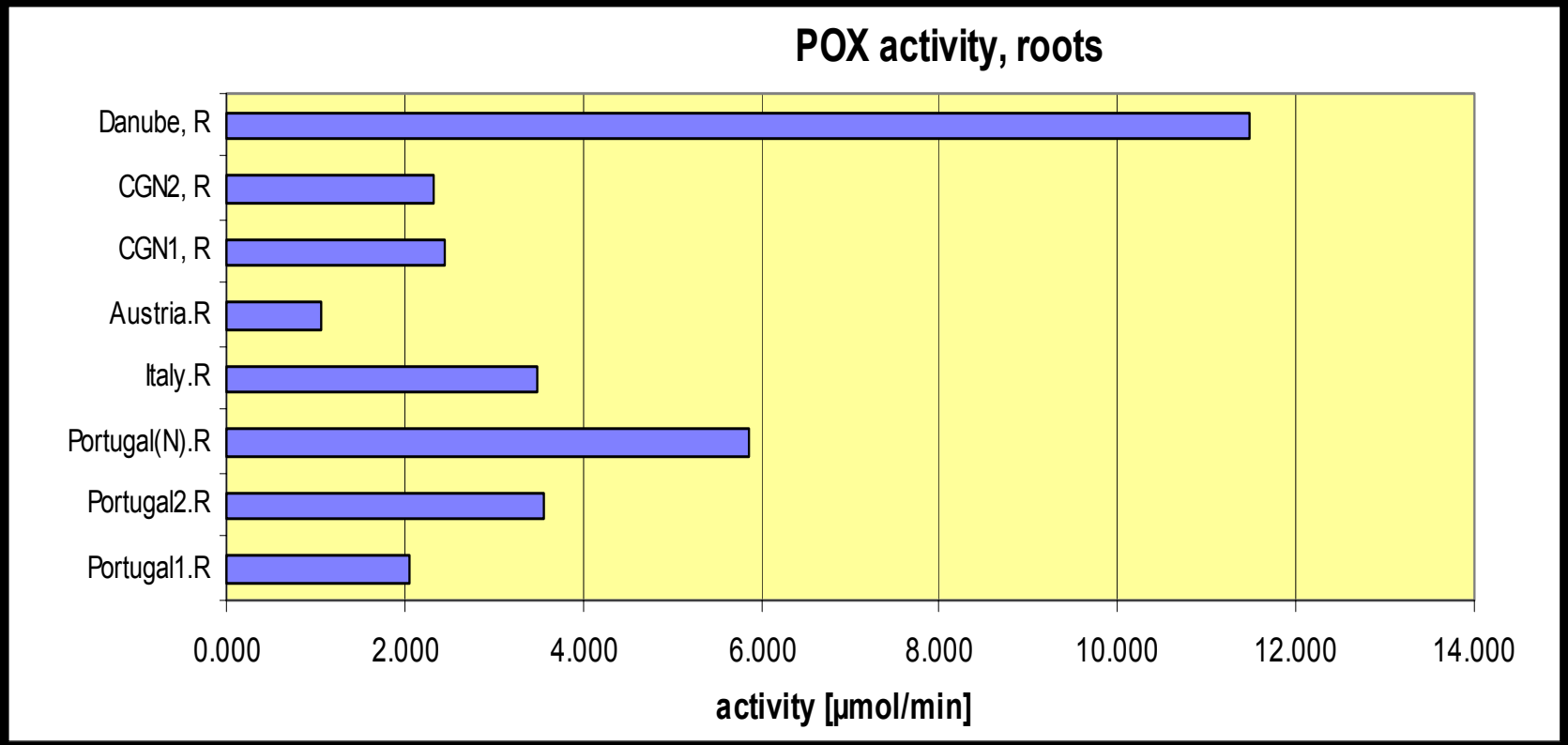
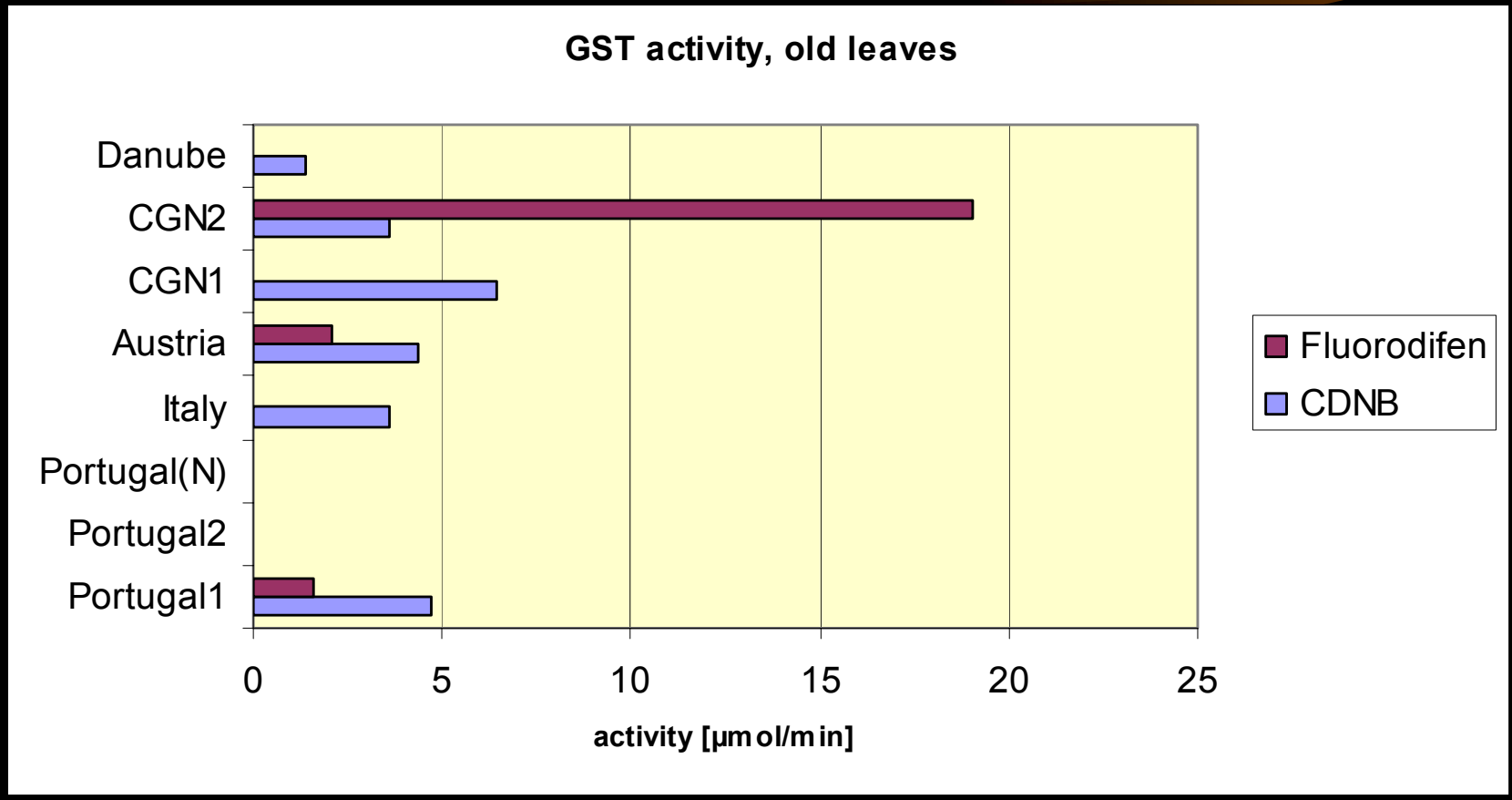


Glutathione-S-transferase in *Phragmites* plants



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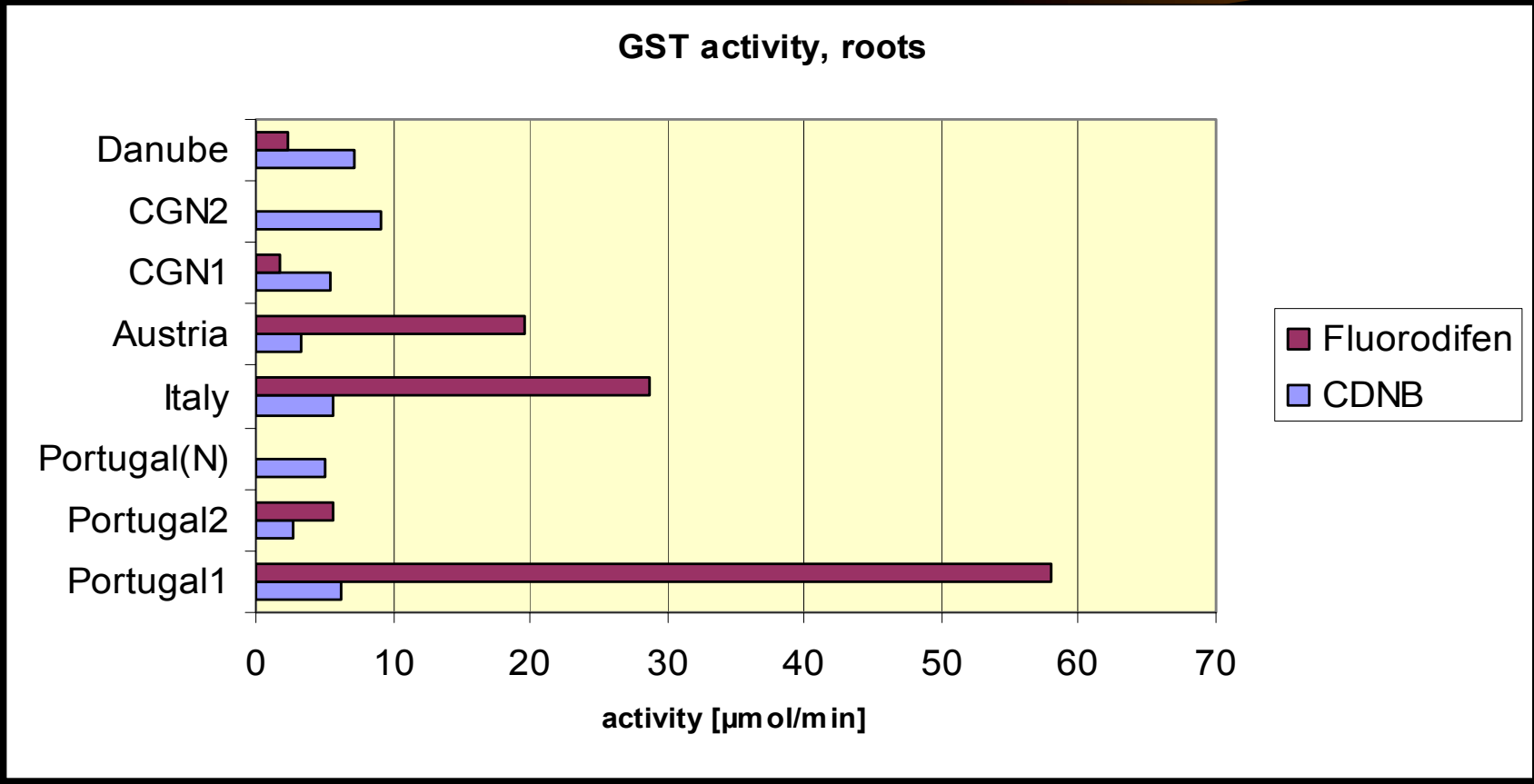
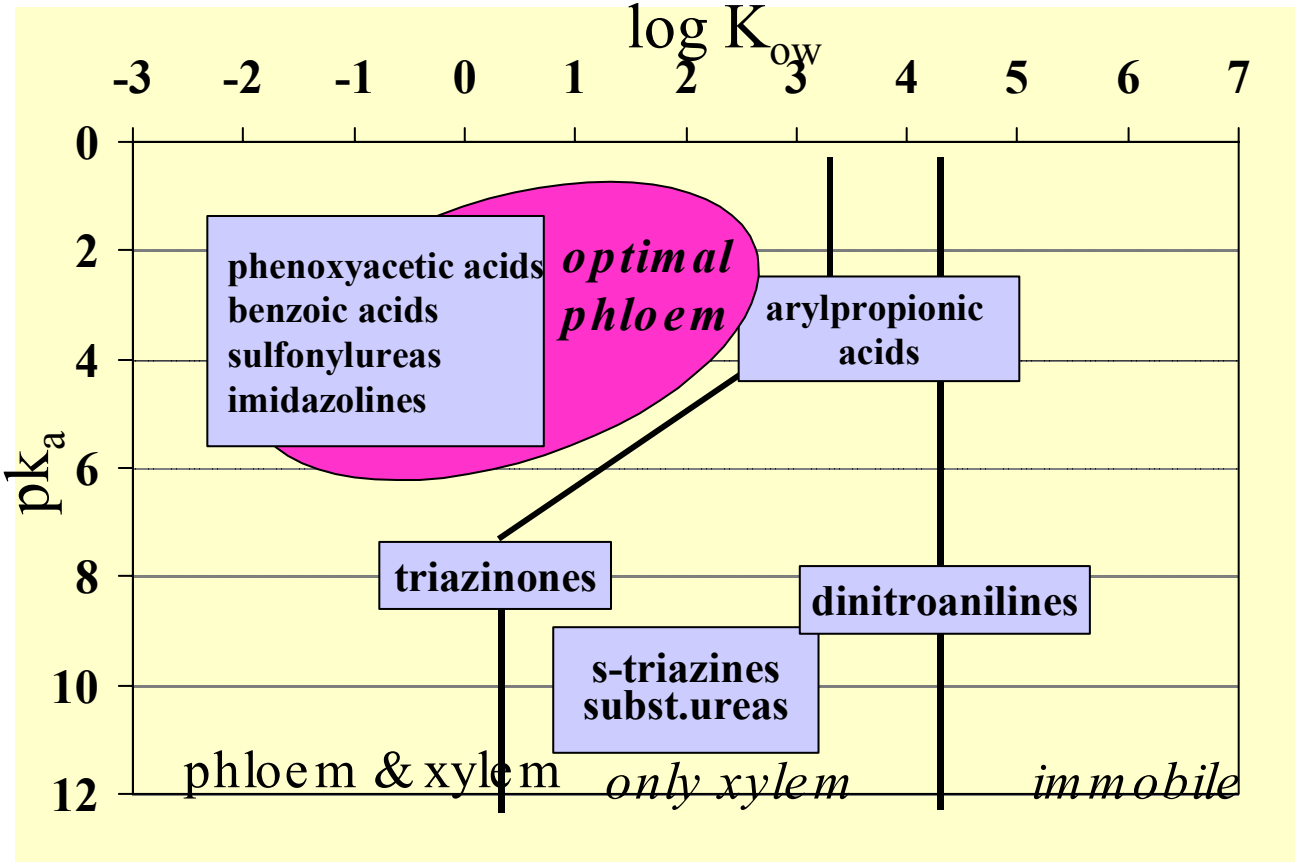


Will the pollutant enter the plant ??



from: Hock et al. 1995

Comments

- *Phragmites* is utilized in many waste water treatment systems
- Support for biofilms, filtering capacity for pollutants, C-source
- Uptake is demonstrated; Detoxification enzymes are present
- Distribution of enzymes depends on plant status and age
- Several xenobiotics are detoxified
- Remediation might be more effective if mechanisms were known

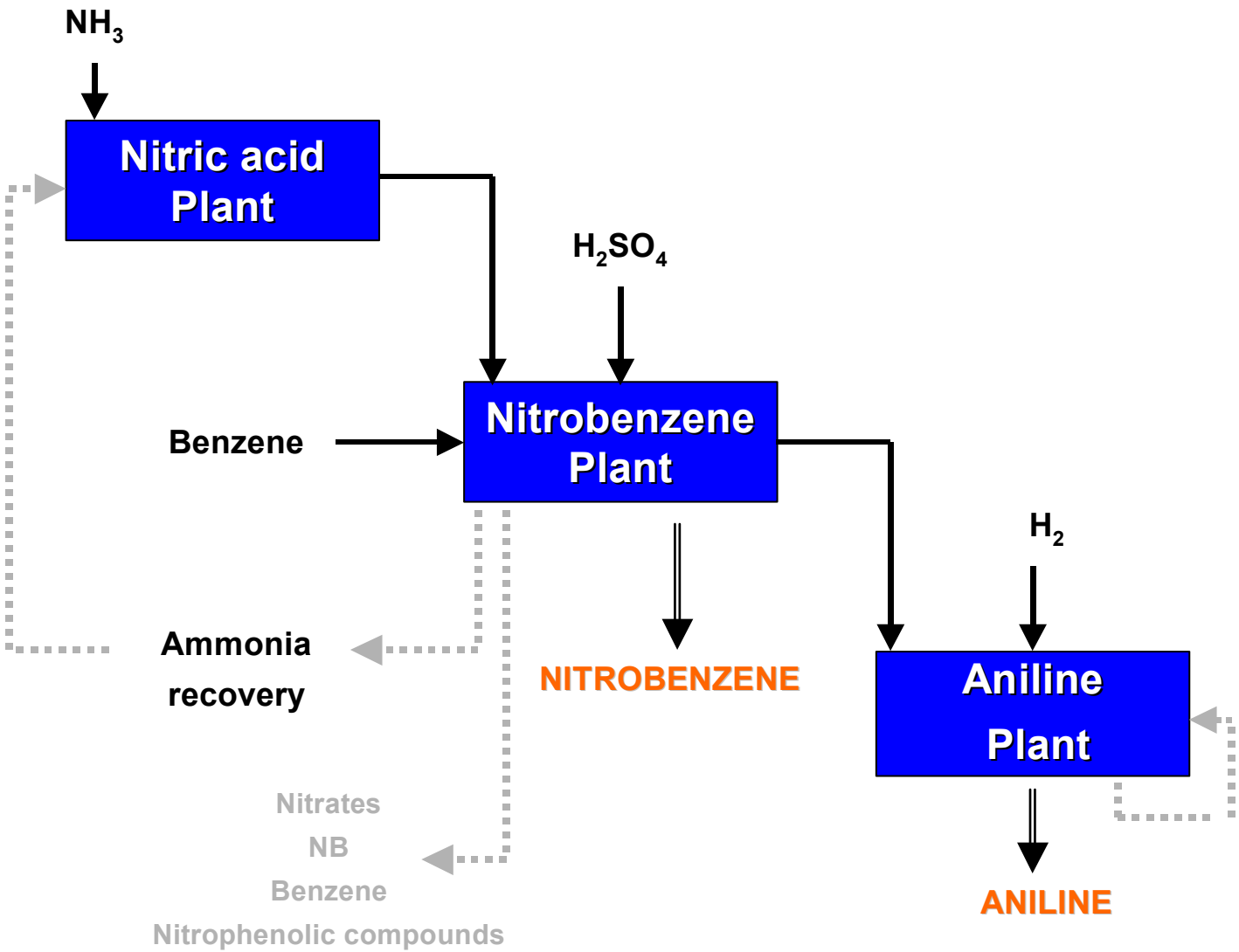
3) New applications for constructed wetlands

Susete Martins Dias
Instituto Superior Técnico
Lisbon (Portugal)

Case Studies of Industrial Wastewater Treatment in Constructed Wetlands

IST/Centre of Biological and Chemical Eng.
PORTUGAL

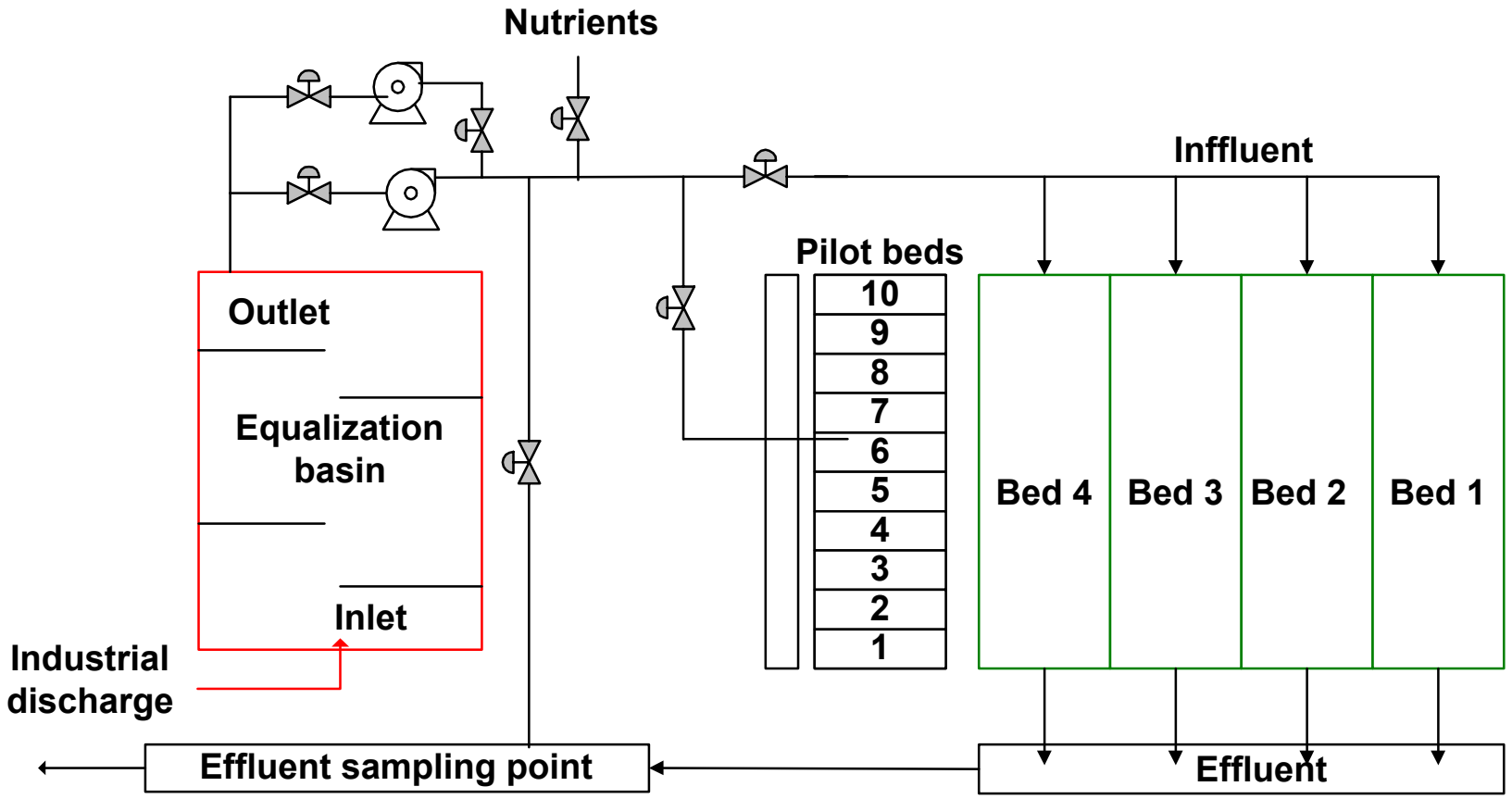
Industrial Site



Effluent contaminants

Inorganic	Organic
✓Nitrates SO_4^- Cl^-	✓Benzene ✓Nitrobenzene ✓Aniline ✓Nitrophenolic compounds
Up to 1000 ppm	**Up to 150 ppm**

Constructed Wetland for Wastewater Treatment

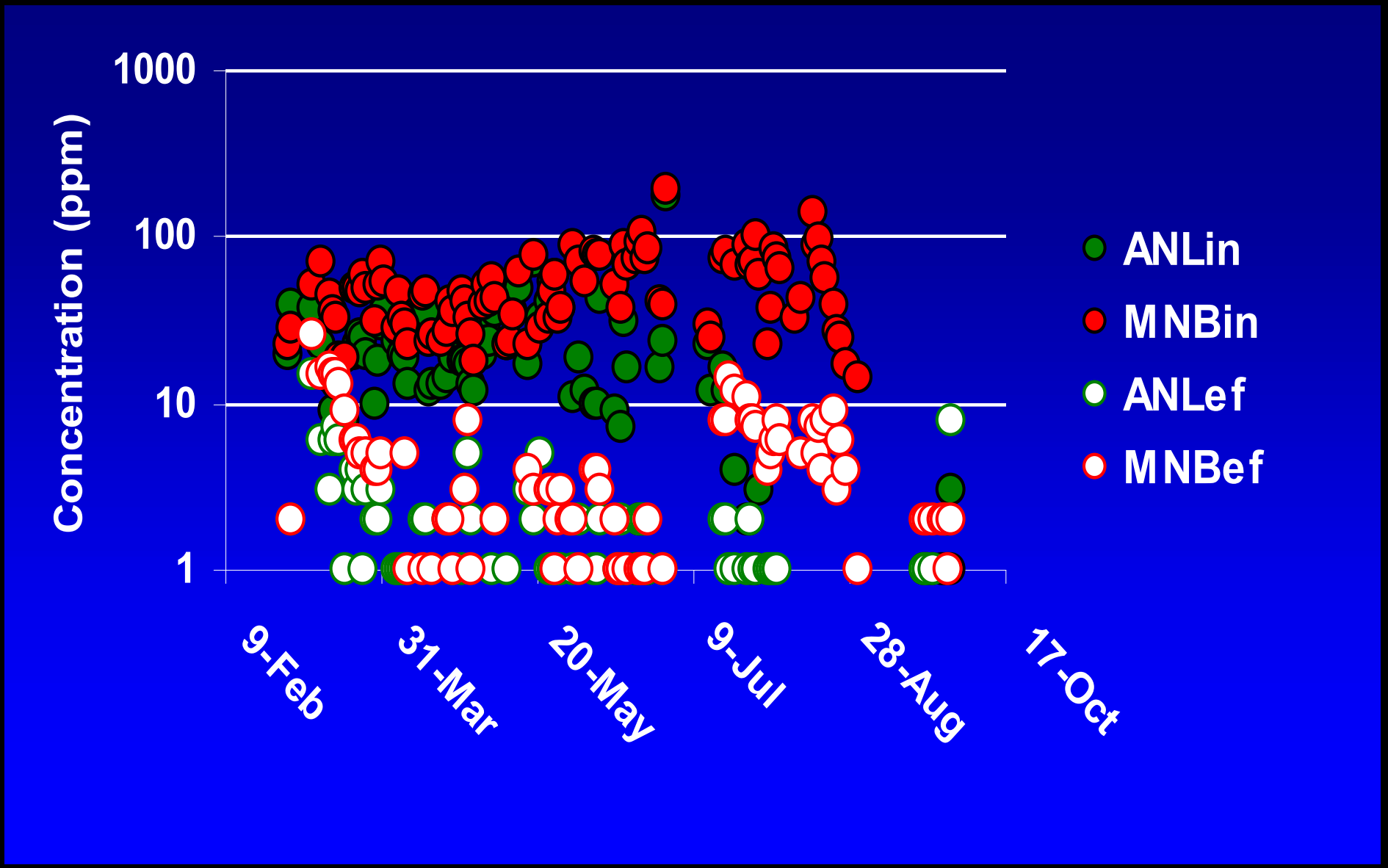


Construction – October 1994

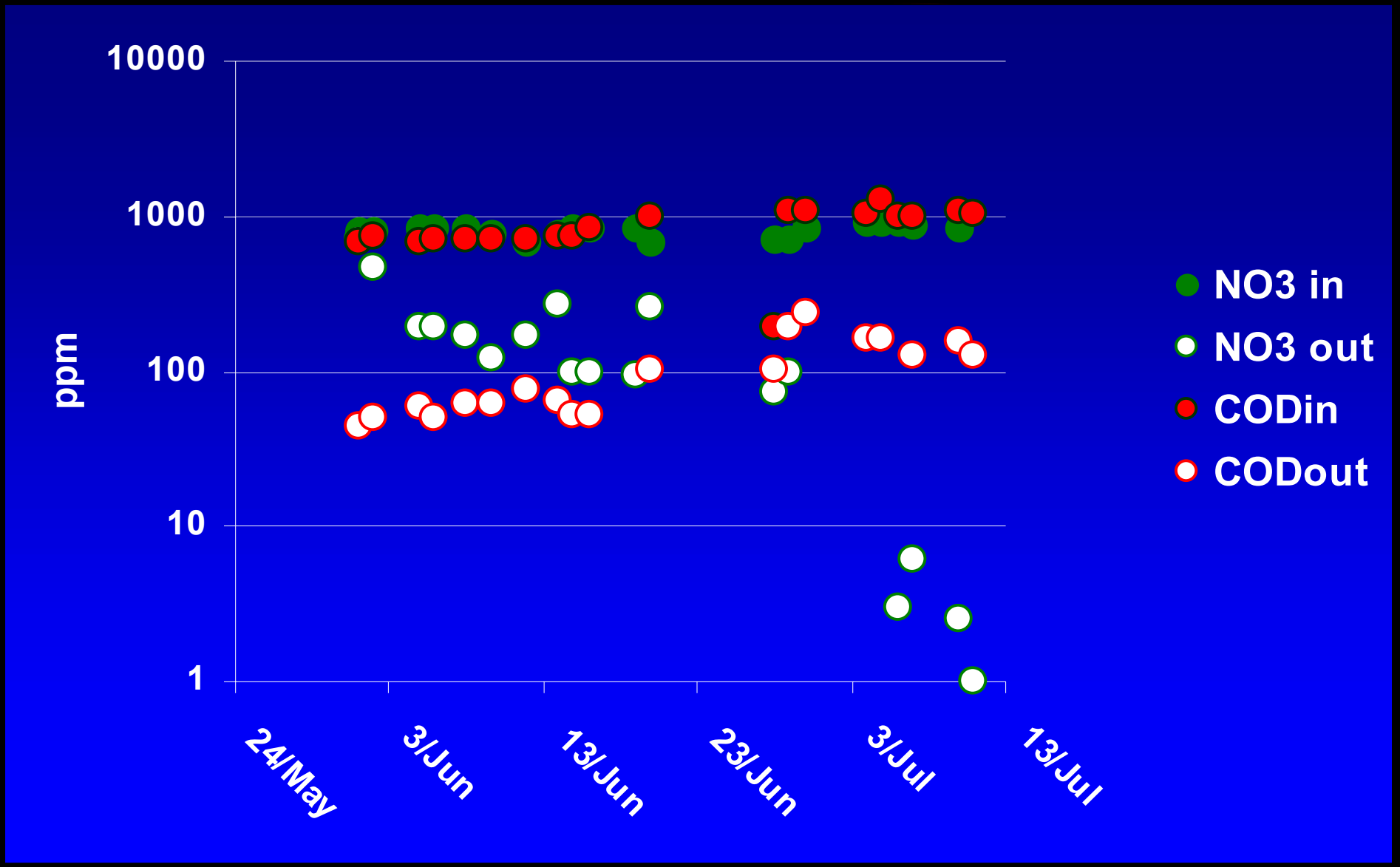
Feeding system detail

Constructed wetland

Aromatics removal (1999)



Nitrate and COD removal



Comments

- **The feasibility of constructed wetlands to treat industrial wastewater is a reality**
- **Constructed wetlands reaches efficiencies up to 99% to remove nitroaromatics from industrial wastewaters**
- **Denitrification of industrial wastewater with nitrate concentrations up to 1000 mg/L is being carried out**
- **The recirculation of the treated wastewater to the cooling tower is possible**

4) The Epuvalisation system

Philippe Dumont and Dimitri Xanthoulis
FUSAGx, Gembloux (Belgium)

Tertiary treatment of domestic wastewater

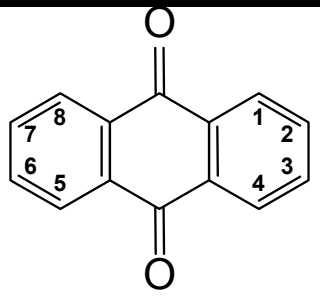
Parameter	Removal
Suspended solids	87%
BOD5	83%
COD	77%
N Kjeldahl	47%
NH4	30%
PO4	20%
Coliforms	99%

5) Development of a process to treat wastewater from dye and textile industry

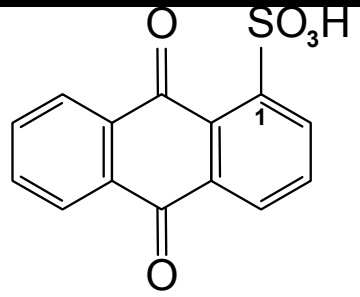
Sylvie Aubert, Stéphanie Braillard, Stéphanie Jullien, Regula Buser and Jean-Paul Schwitzguébel

LBE, EPFL, Lausanne (Switzerland)

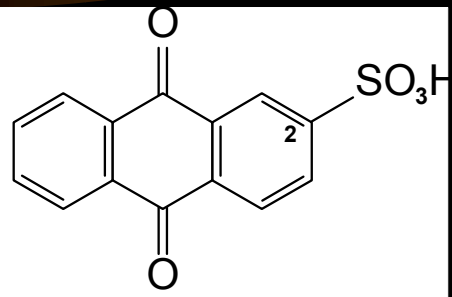
Sulphonated anthraquinones



AQ



AQ-1-S



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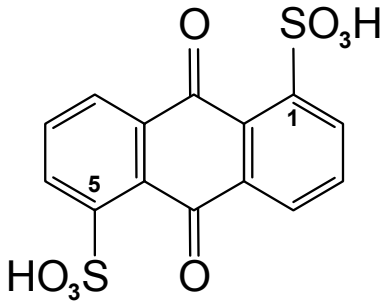

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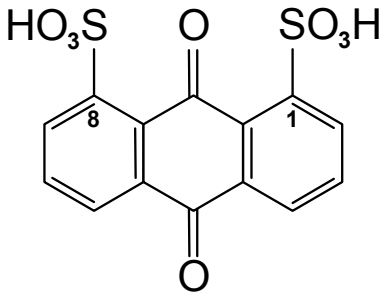
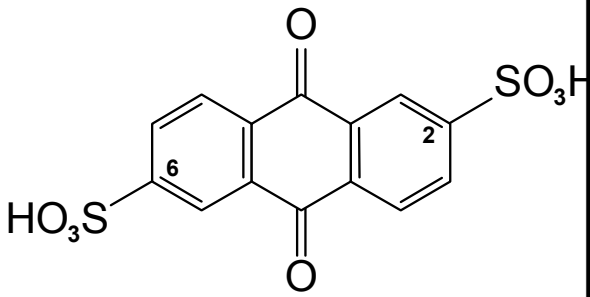


AQ-1,8-SS

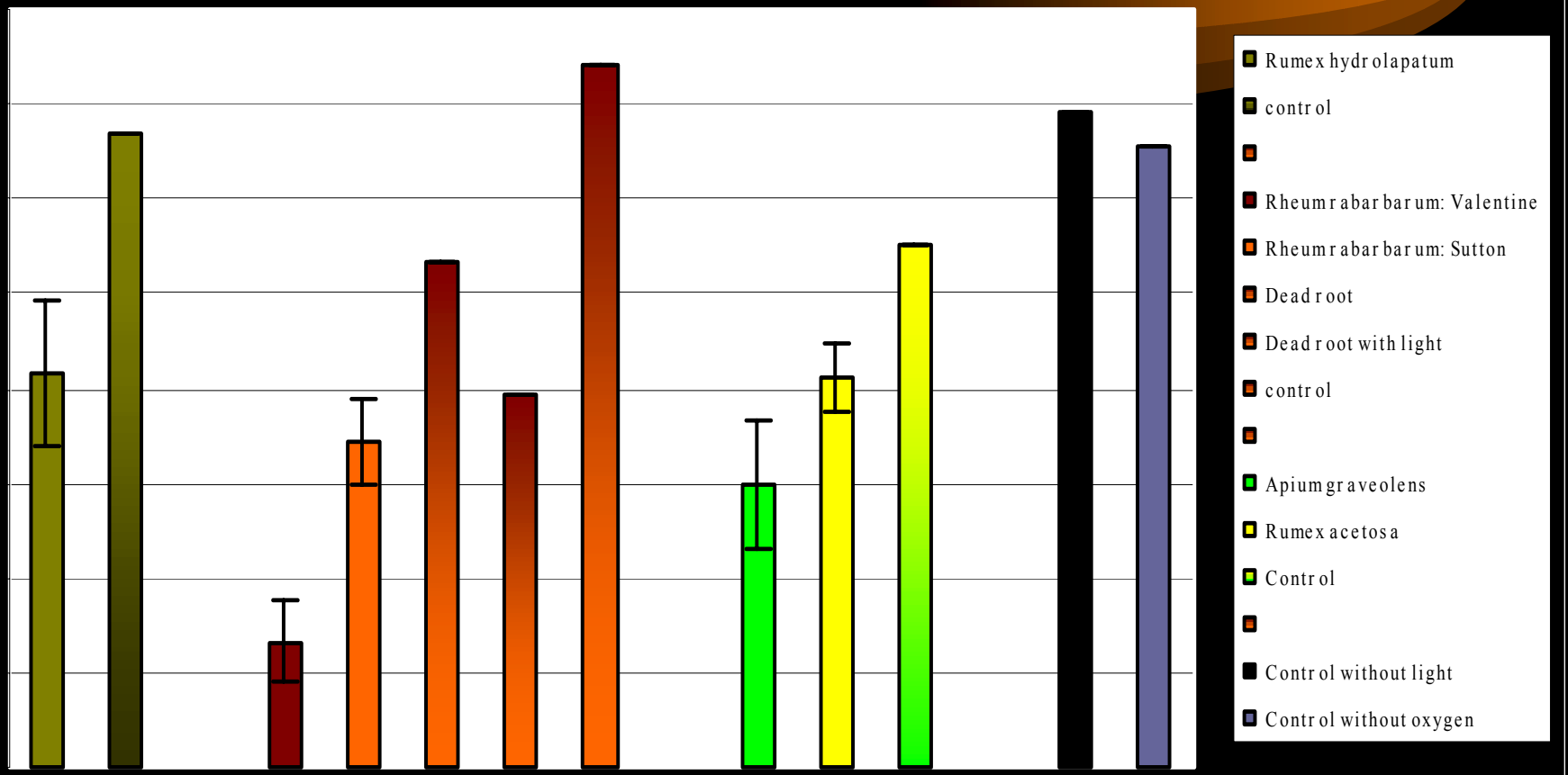


AQ-2,6-SS

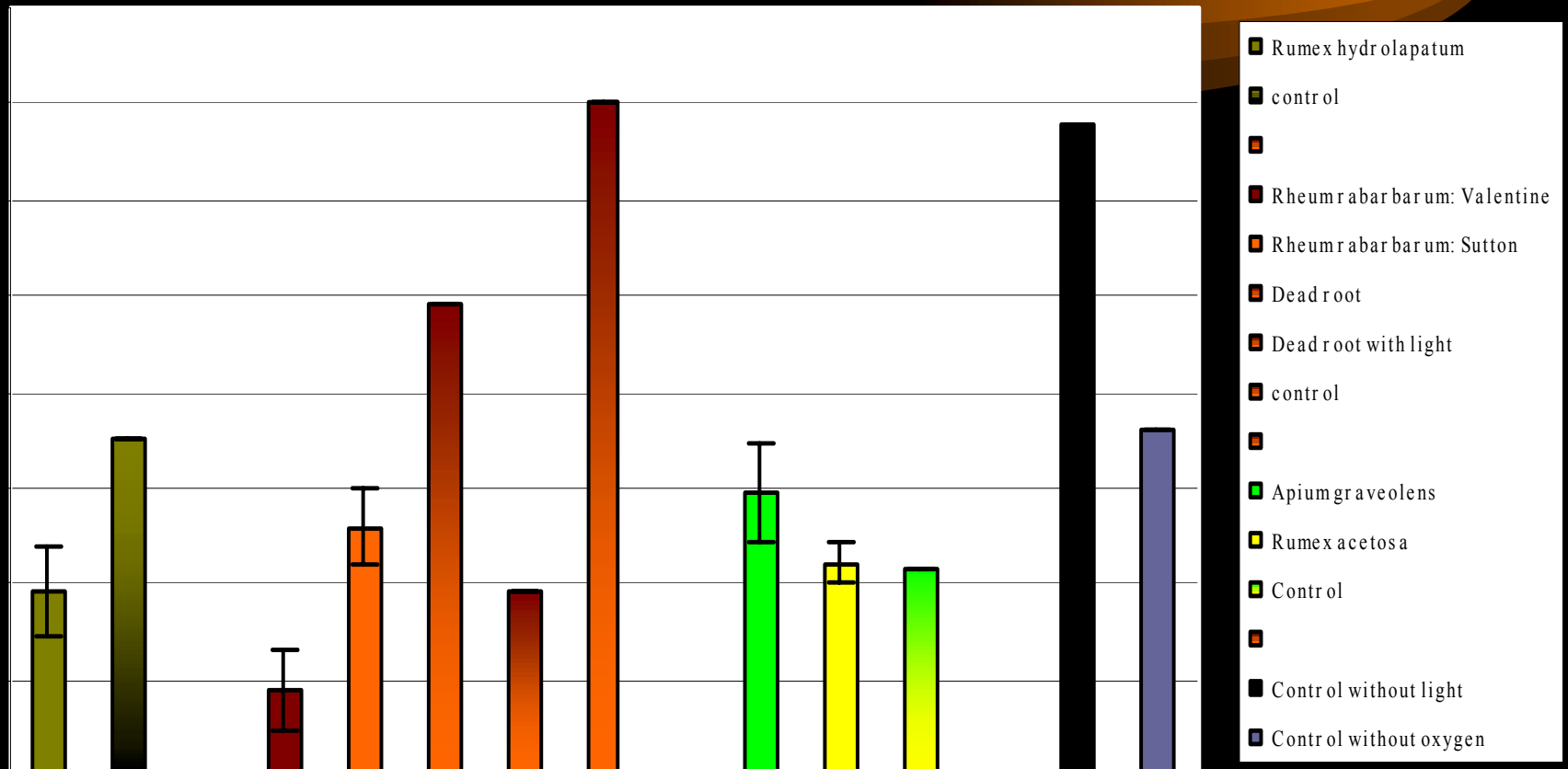
Hydroculture and hydroponic culture of *Rheum* and *Rumex*

Hydroculture and hydroponic culture of *Rheum* and *Rumex*

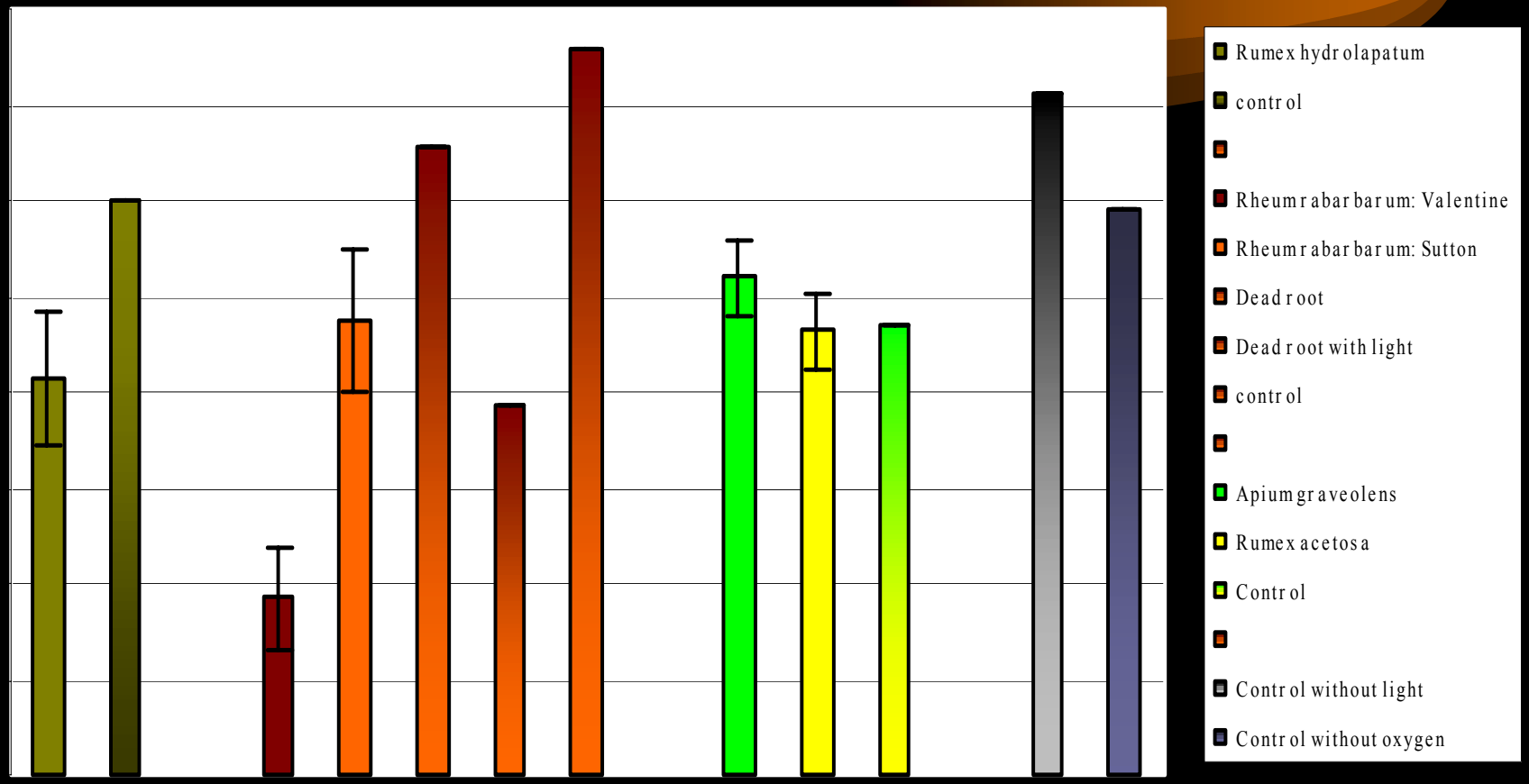
Removal of anthraquinone-1-sulphonate (2 mmol, 6 weeks)



Removal of anthraquinone-2-sulphonate (2 mmol, 6 weeks)



Removal of anthraquinone 2,6 disulphonate (2 mmol, 6 weeks)



Outlook:
Green Wastewater Treatment Plants