20th European Meeting on Environmental Chemistry

2-5 December 2019
Lodz, Poland

Book Of Abstract

ASSOCIATION OF
CHEMISTRY AND THE
ENVIRONMENT


P Ł


POLITECHNIKA ŁÓDZKA
WYDZIAŁ CHEMICZNY


KOMITET CHEMII ANALITYCZNEJ
PAN


POLSKIE TOWARZYSTWO CHEMICZNE
PTCH


MAYOR OF THE CITY OF LODZ
HANNA ZDANOWSKA


P Ł

	Monday 2 Dec	Tuesday 3 Dec		Wednesday 4 Dec	Thursday 5 Dec
7.30		Registration 7.30-8.30			
8.30		Opening Ceremony 8.30-9.00		Registration 8.30-9.00	
9.00		Bogusław Buszewski 9.00-9.40		Seppo Hellsten 9.00-9.40	Kurt Rosentrater 9.00-9.40
9.40		P. Stepnowski 9.40-10.05		E. Bulska 9.40-10.05	L. Mojović 9.40-10.05
10.05		Coffee Break/Poster Session 10.05-10.35			Coffee Break ACE General Assembly 10.05-10.35
10.35		Session A O. Đuragić 10.35-11.00	Session B W.M. Wolf 10.35-11.00	Young Session B. Kubíčková 10.35-11.00	J. Igras 10.35-11.00
11.00		N. Zarić	F. Dal Bello	M. Stec	B. Godlewska-Żyłkiewicz 11.00-11.25
11.15		M. Bavcon Kralj	P. Trebše	Ż. Arciszewska	
11.30		M. Passananti	J. Kašlík	H. Zind	B. Krasnodębska-Ostręga 11.25-11.50
11.45		F. Prosenc	S. Pap	O. Matviichuk	
12.00		Coffee Break/Poster Session 12.00-12.30			Coffee Break 11.50-12.30
12.30		T. Milićević	M. Brumovský	P. Suková	K. Czarny
12.45		M. Kašanin-Grubin	J. Oborná	M. Madej	A-M. Delort
13.00		D.M. Mazur	J. Schwarzbauer	B. Kaur	A. Krejčova
13.15		A.T. Lebedev	I. Komorowicz	A. Kravchenko	K. Taran
13.30		Lunch 13.30-14.30			
14.30		EC1 Tour 14.30-18.00		Sponsor Presentation G. Przeliorz 14.30-14.45	M. Konkol 14.30-14.55
14.45				J. Salvé	
15.00				P. Cheng	R. Michalski 14.55-15.20
15.15				F. Rocha	
15.30				Y. Arbid	Coffee Break 15.20-16.00
15.45				Coffee Break/ Poster Session 15.45-16.00	
16.00				A. Marion	J. Rogowski
16.15				P. Irizar	C. Escude-Oñate
16.30	Registration 16.30-17.00			B. Rogalewicz	Award Ceremony Closing Session 16.30-17.30
16.45				M. Przydacz	
17.00				Sponsor Presentation J. Grodowski 17.00-17.10	
17.15	Welcome Reception 17.00-19.00			Coffee Break/ Poster Session 17.10-17.30	
17.30				T. Soleymani Angili	
17.45				D. Polikarpova	
18.00		Poster Session 18.00-20.00		N.P.F. Gonçalves	
18.15					
18.30					
19.00					
20.00				Gala Dinner 20.00	

Prince Sultan Bin Abdulaziz
International Prize for Water

COMEF

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Spectro-Lab®
Laboratoria Przyszłości

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TESTCHEM


MERAZET
POLYGEN


SELWA
LAB
CEM


NETZSCH

Prince Sultan Bin Abdulaziz
International Prize for Water

Recognizing Innovation

Invitation for Nominations

9th Award (2020)

Nominations open online until 31 December 2019

www.psipw.org e-mail: info@psipw.org

Winners for the 8th Award (2018)

Creativity Prize

The Prize is awarded to two teams of researchers:

1) Dr. Andre Geim and Dr. Rahul Nair (National Graphene Institute, University of Manchester, UK)
for developing novel graphene oxide membranes that promise to enable energy-efficient and high-volume water filtration and desalination.


Dr. Andre Geim


Dr. Rahul Nair

2) Dr. Günter Blöschl (TU Wien, Austria) and Dr. Murugesu Sivapalan (University of Illinois at Urbana-Champaign, USA)
for developing the new field of Sociohydrology, a ground-breaking paradigm for water management and a new validated approach for studying the dynamic interactions and bi-directional feedbacks between water systems and people.


Dr. Günter Blöschl


Dr. Murugesu Sivapalan

Surface Water Prize

Dr. Wilfried Brutsaert (Cornell University, USA)
for developing, demonstrating, and validating a new theory that can generate unprecedented estimates of evaporation from the natural landscape.


Dr. Wilfried Brutsaert

Groundwater Prize

Dr. Martinus Th. van Genuchten (Federal University of Rio de Janeiro, Brazil)
for the development and application of key theoretical and software tools that describe water flow and contaminant transport in the subsurface.


Dr. Martinus van Genuchten

Alternative Water Resources Prize

Dr. Omar Yaghi (University of California, Berkeley, USA) and Dr. Evelyn Wang (Massachusetts Institute of Technology, USA)
for creating a solar-powered device that uses an innovative porous metal-organic framework (MOF) to capture water from the atmosphere.


Dr. Omar Yaghi


Dr. Evelyn Wang

Water Management and Protection Prize

Dr. Jim W. Hall and Dr. Edoardo Borgomeo (Environmental Change Institute, Oxford University, UK)
for developing and applying a new risk-based framework to assess water security and plan water supply infrastructure in times of climate change.


Dr. Jim W. Hall


Dr. Edoardo Borgomeo

General Conditions for Nominations

1. All nominations are made online through an electronic application form that is available on the PSIPW website. All required documentation and submitted works are uploaded by way of the same form. Mail-in applications are not accepted.

2. In the event that a team of individuals are being nominated, all team members (up to five) must be named at the time of application and one member must be specified as their representative. Groups of people working on the same project may not be nominated separately. They must be nominated as a team with a single nomination form.

3. The nominee must be an individual or team of individuals. Organizations are not eligible to be nominated for the five prizes.

4. Nominations for the **Specialized Prizes** are by direct self-nomination. Nominations for the interdisciplinary **Creativity Prize** must be made by a university, institution, or government agency on behalf of the scientists and researchers. Individuals may not nominate themselves or others for the Creativity Prize.

5. The nominated body of work must have been completed no more than five (5) years prior to the nomination deadline for the current award.

6. Published research papers, published books, and registered patents may be submitted for consideration. Unpublished works and unregistered patents are ineligible for the prize.

7. No more than five (5) distinct works may be submitted. Multiple works should not be collected together and submitted as a single work.

8. Works will be reviewed and judged in English. A work published in another language must be submitted in the original language accompanied by a full translation or a translation of the parts of the work that are to be considered for the prize. If a partial English translation is provided, then only that portion of the work will be considered for assessment.

9. A nominee may only be nominated for one prize during an award period.

10. The work being nominated must not have previously been a recipient of any other international prize. (However, it may have been the recipient of local, national or regional prizes.)

11. Members of the PSIPW committees and their immediate relatives may not be nominated for the prize.

Founded in 2002, the Prince Sultan Bin Abdulaziz International Prize for Water (PSIPW) is a leading scientific award that focuses on cutting edge-innovation in water research.

PSIPW offers five distinctive prizes every two years, giving recognition to scientists, researchers and inventors around the world for pioneering work that addresses the problem of water scarcity in creative and effective ways.

There are four **Specialized Prizes**, each worth US$ 133,000. Individuals and research teams may nominate themselves for any of these prizes:

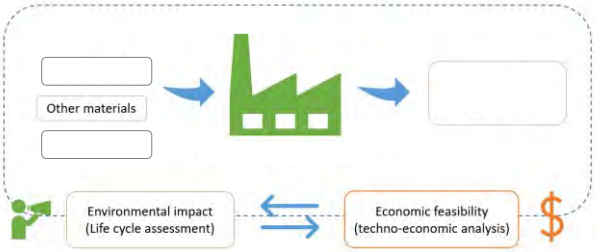
- **Surface Water Prize** – covering every aspect of the study & development of surface water resources.
- **Groundwater Prize** – covering every aspect of the study & development of groundwater resources.
- **Alternative Water Resources Prize** – covering desalination, wastewater treatment & other non-traditional water sources.
- **Water Management & Protection Prize** – covering the use, management, & protection of water resources.

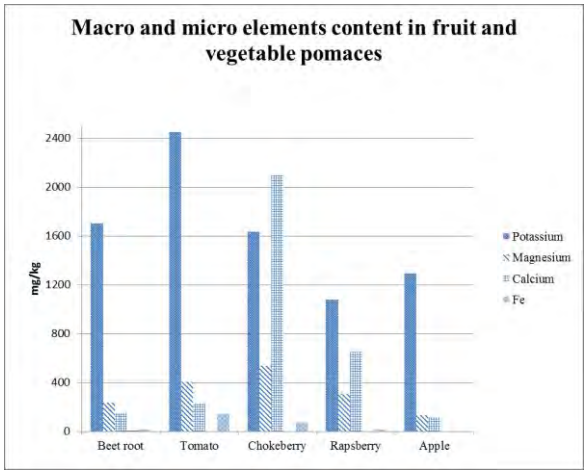
Then, there is the **Creativity Prize**. Worth US$ 266,000, it is awarded for interdisciplinary work that represents a major scientific breakthrough in any water-related field. Universities and other organizations may nominate scientists and researchers for this prize.

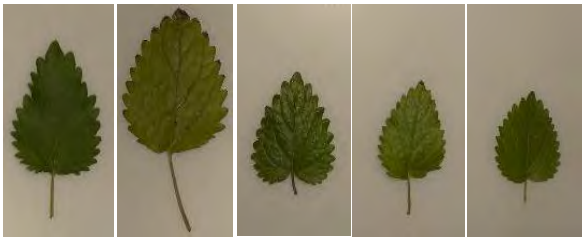
Award: Creativity Prize	**Value: $266,000**
Nominators:	universities, university departments, research institutes, companies, water organizations and agencies
Candidates:	scientists and researchers
Eligible Works:	published research papers, published books and registered patents within the past 5 years
Award: Specialized Prizes	**Value: $133,000**
Nominators:	self-nomination
Candidates:	scientists and researchers
Eligible Works:	published research papers, published books and registered patents within the past 5 years

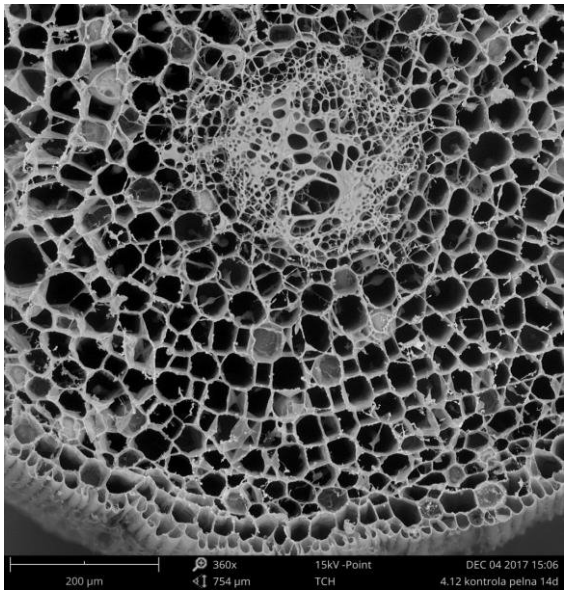
Nominations for all prizes can be made online at the PSIPW website:

www.psipw.org

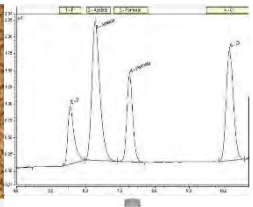

Other materials
Environmental impact
(Life cycle assessment)
Economic feasibility
(techno-economic analysis)

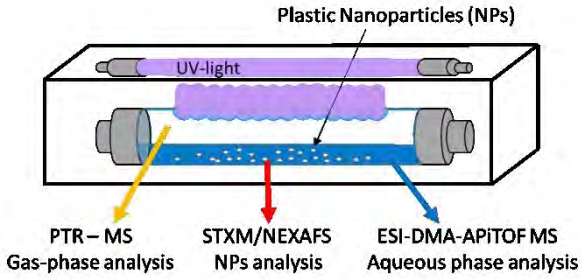

Macro and micro elements content in fruit and vegetable pomaces
mg/kg
2400
2000
1600
1200
800
400
0
Beet root
Tomato
Chokeberry
Rapsberry
Apple
Potassium
Magnesium
Calcium
Fe

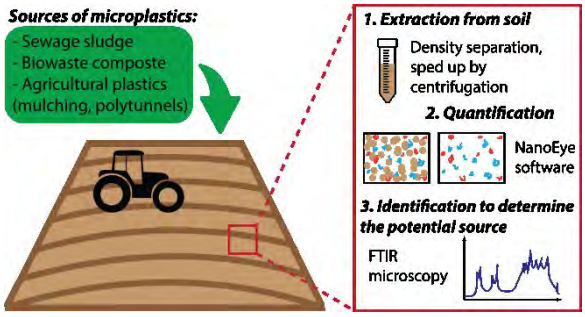


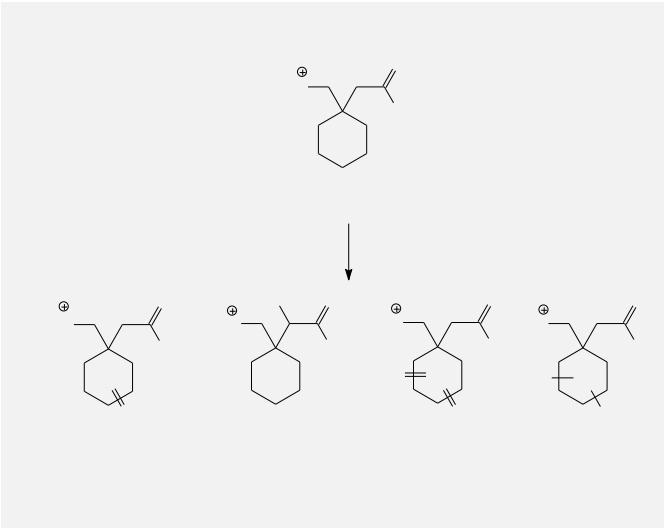

360x
15kV -Point
DEC 04 2017 15:06
200 µm
754 µm
TCH
4.12 kontrola pełna 14d

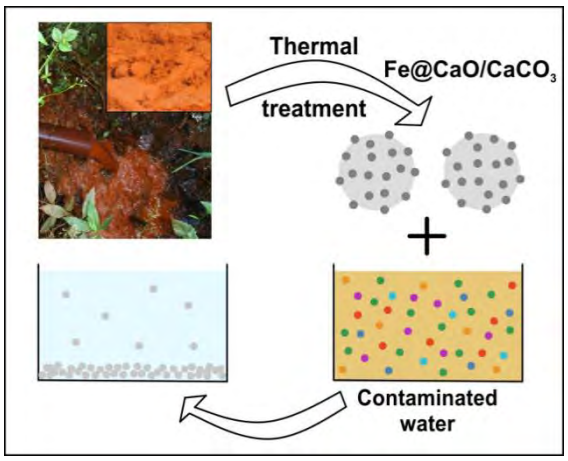

NaToxAq

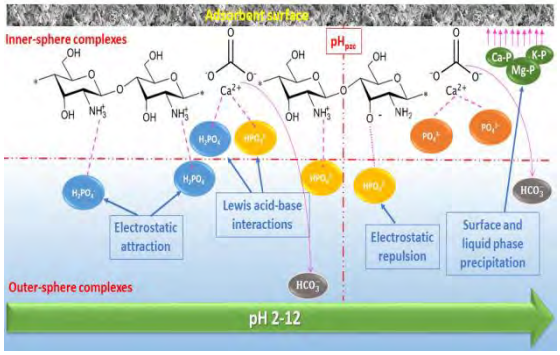


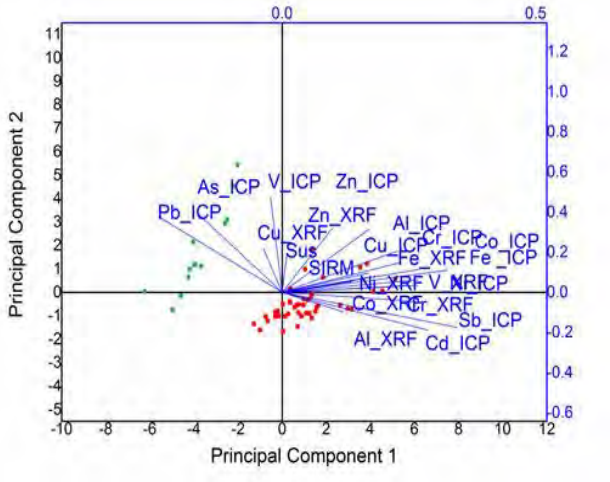

Plastic Nanoparticles (NPs)
UV-light
PTR – MS
Gas-phase analysis
STXM/NEXAFS
NPs analysis
ESI-DMA-APiTOF MS
Aqueous phase analysis

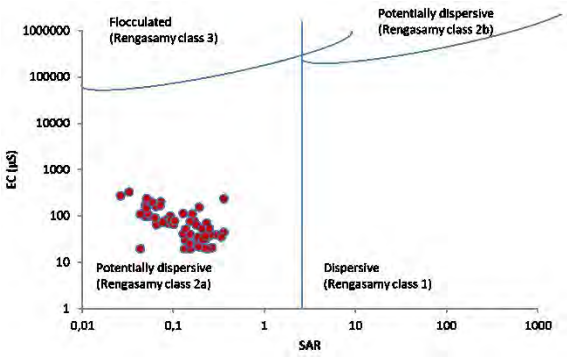

Sources of microplastics:
- Sewage sludge
- Biowaste composte
- Agricultural plastics
(mulching, polytunnels)
1. Extraction from soil
Density separation, sped up by centrifugation
2. Quantification
NanoEye software
3. Identification to determine the potential source
FTIR microscopy

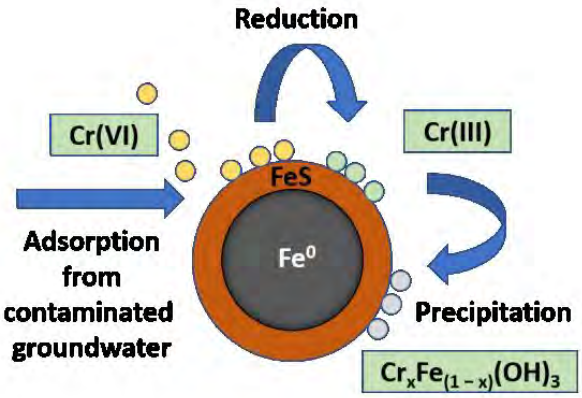


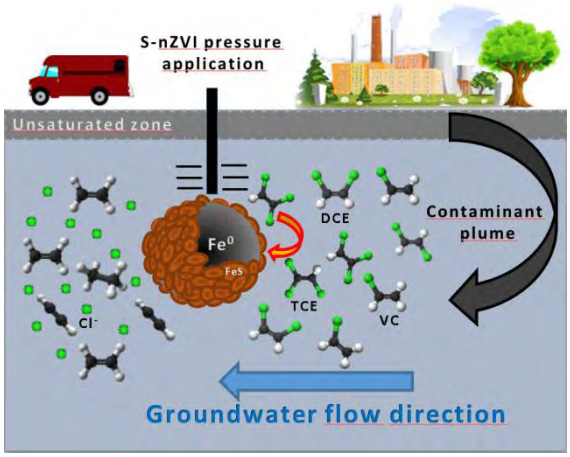

Thermal
treatment
Fe@CaO/CaCO3
Contaminated
water

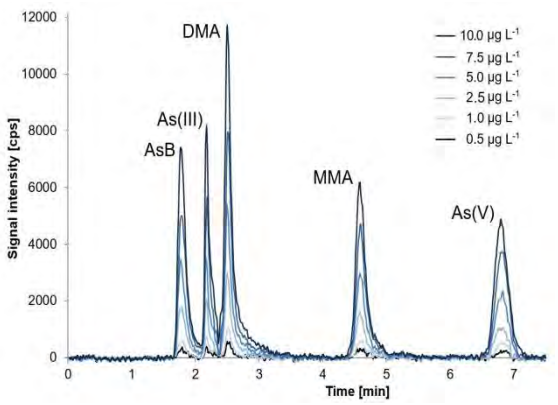

Adsorbent surface
Inner-sphere complexes
pHpzc
Ca-P
K-P
Mg-P
Electrostatic attraction
Lewis acid-base interactions
Electrostatic repulsion
Surface and liquid phase precipitation
Outer-sphere complexes
pH 2-12

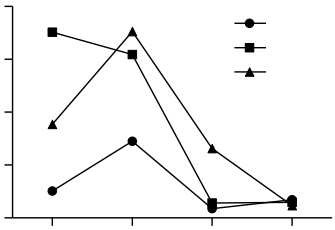

Principal Component 2
Principal Component 1
As_ICP
V_ICP
Zn_ICP
Pb_ICP
Zn_XRF
Al_ICP
Cu_XRF
Cr_ICP
Co_ICP
Cu_ICP
Sus
Fe_XRF
Fe_ICP
SRM
Ni_XRF
V_XRF
Co_XRF
Cr_XRF
Sb_ICP
Al_XRF
Cd_ICP

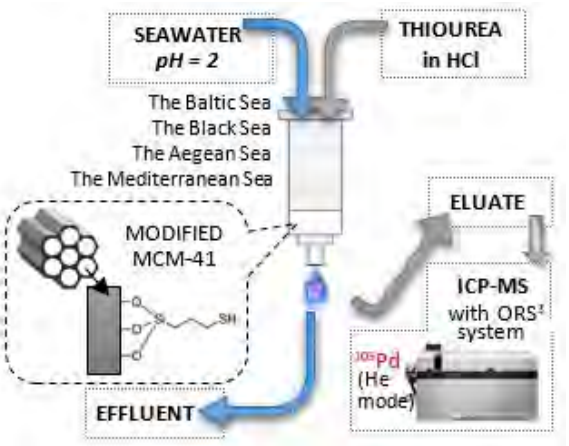

Flocculated
(Rengasamy class 3)
Potentially dispersive
(Rengasamy class 2b)
Potentially dispersive
(Rengasamy class 2a)
Dispersive
(Rengasamy class 1)
EC (µS)
SAR
1000000
100000
10000
1000
100
10
1
0,01
0,1
1
10
100
1000

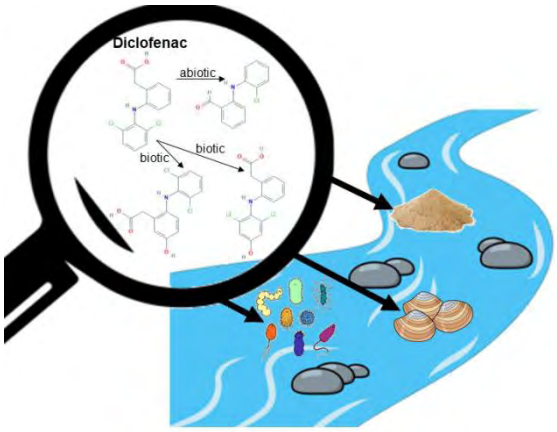

Reduction
Cr(VI)
Cr(III)
FeS
Fe0
Adsorption
from
contaminated
groundwater
Precipitation
CrxFe(1 - x)(OH)3

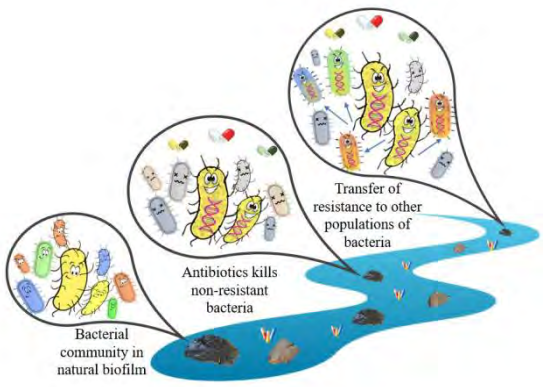

S-nZVI pressure application
Unsaturated zone
Contaminant plume
DCE
TCE
VC
Cl-
Fe0
FeS
Groundwater flow direction

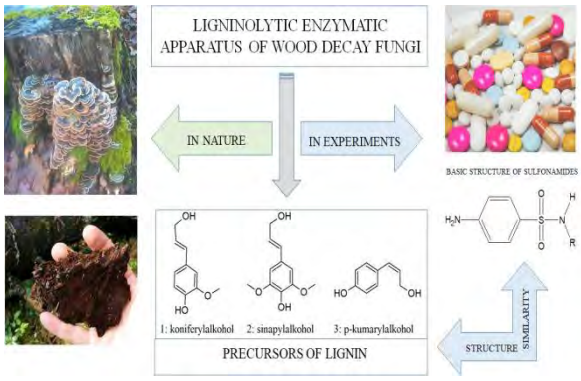

12000
10000
8000
6000
4000
2000
0
Signal intensity [cps]
0
1
2
3
4
5
6
7
Time [min]
DMA
As(III)
AsB
MMA
As(V)
10.0 µg L-1
7.5 µg L-1
5.0 µg L-1
2.5 µg L-1
1.0 µg L-1
0.5 µg L-1

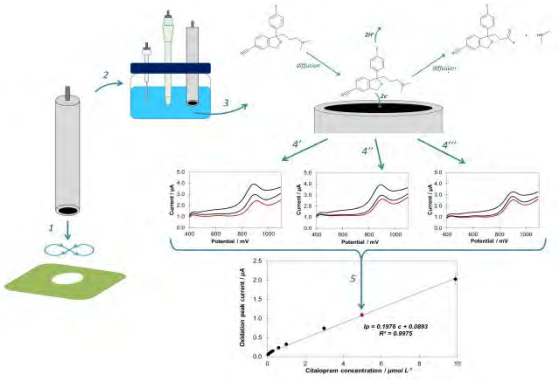


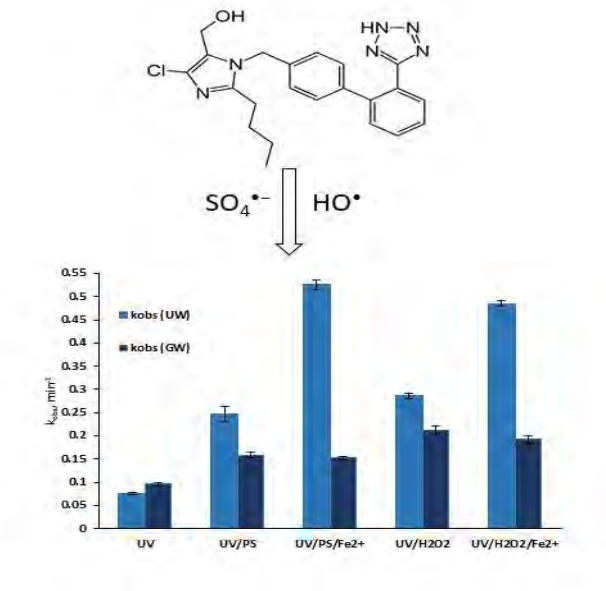

SEAWATER
pH = 2
THIOUREA
in HCl
The Baltic Sea
The Black Sea
The Aegean Sea
The Mediterranean Sea
MODIFIED
MCM-41
SH
ELUATE
ICP-MS
with ORS¹
system
105Pd
(He
mode)
EFFLUENT

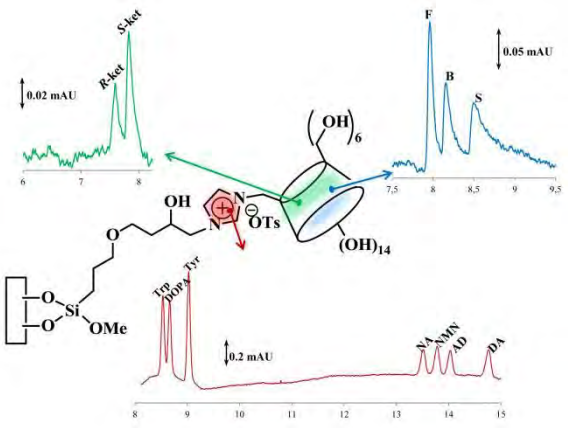

Diclofenac
abiotic
biotic
biotic

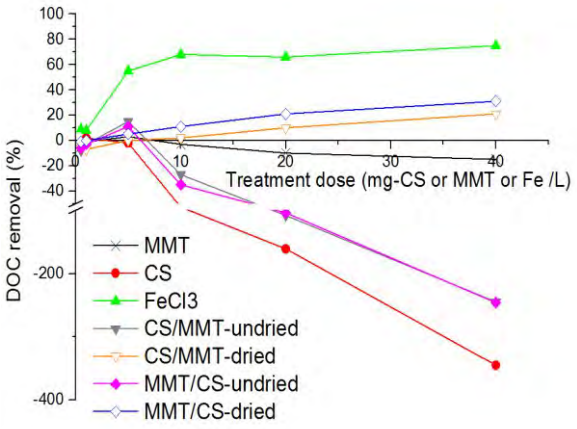

Transfer of
resistance to other
populations of
bacteria
Antibiotics kills
non-resistant
bacteria
Bacterial
community in
natural biofilm

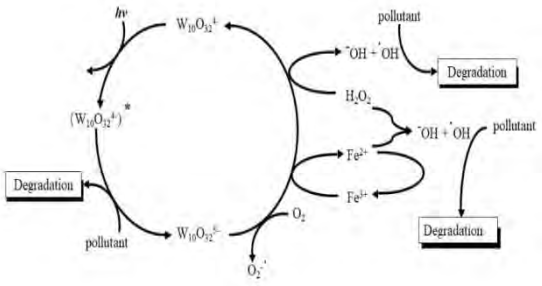

LIGNINOLYTIC ENZYMATIC APPARATUS OF WOOD DECAY FUNGI
IN NATURE
IN EXPERIMENTS
BASIC STRUCTURE OF SULFONAMIDES
1: koniferylalkohol
2: sinapylalkohol
3: p-kumarylalkohol
PRECURSORS OF LIGNIN
STRUCTURE
SIMILARITY

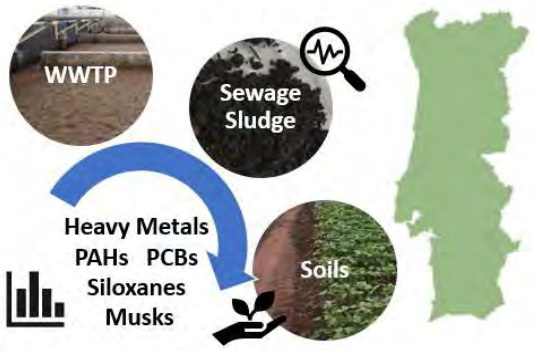

1
2
3
4'
4''
4'''
5
Potential / mV
Oxidation peak current / µA
Citalopram concentration / µmol L⁻¹
Ip = 0.1976 c + 0.0893
R² = 0.9970


OH
Cl
N
N
HN
N
N
N
$SO_4^{\bullet-}$
$HO^{\bullet}$
0.55
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
kobs (UW)
kobs (GW)
UV
UV/PS
UV/PS/Fe2+
UV/H2O2
UV/H2O2/Fe2+

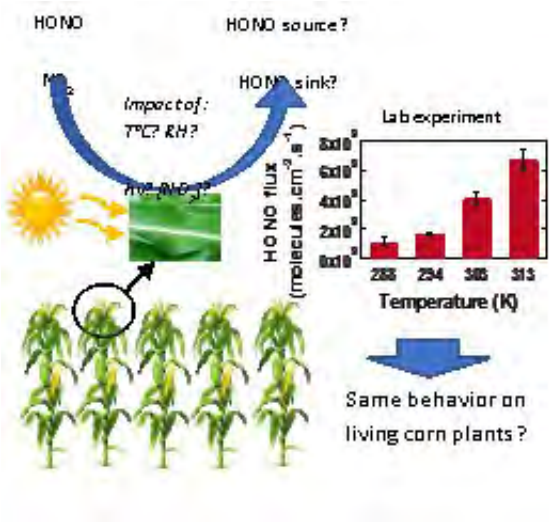

S-ket
R-ket
0.02 mAU
6
7
8
F
B
S
0.05 mAU
7,5
8
8,5
9
9,5
OH
6
OH
N
N
OTs
O
(OH)14
O
Si
O
OMe
Trp
DOPA
Tyr
0.2 mAU
NA
NMN
AD
DA
8
9
10
11
12
13
14
15

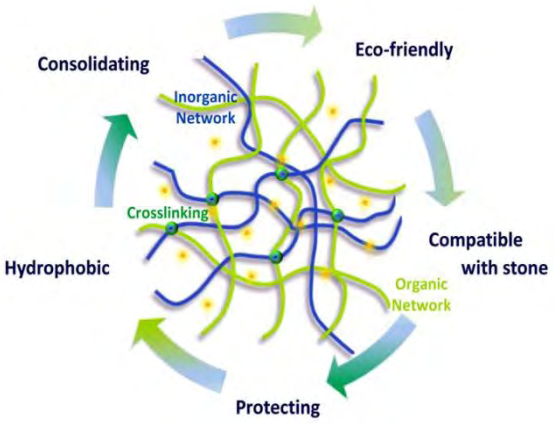

DOC removal (%)
Treatment dose (mg-CS or MMT or Fe /L)
MMT
CS
FeCl3
CS/MMT-undried
CS/MMT-dried
MMT/CS-undried
MMT/CS-dried

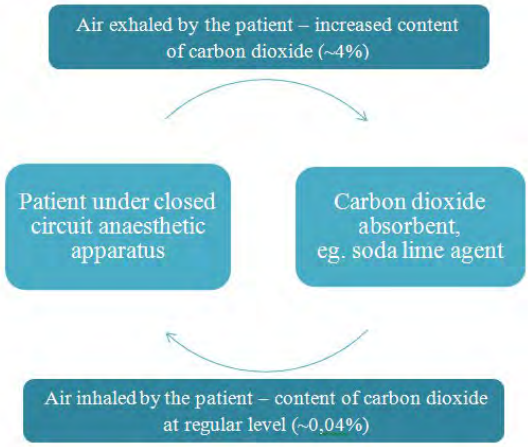

hν
$W_{10}O_{32}^{4-}$
pollutant
˙OH + ˙OH
Degradation
H_2O_2
$(W_{10}O_{32}^{4-})^*$
˙OH + ˙OH
pollutant
Fe^{2+}
Fe^{3+}
Degradation
Degradation
O_2
pollutant
$W_{10}O_{32}^{5-}$
$O_2^{\cdot-}$

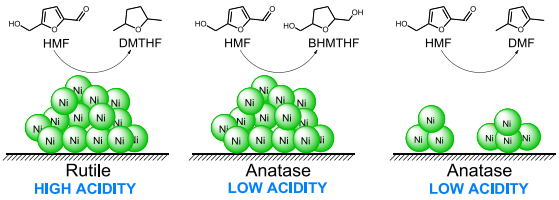

WWTP
Sewage Sludge
Heavy Metals
PAHs PCBs
Siloxanes
Musks
Soils

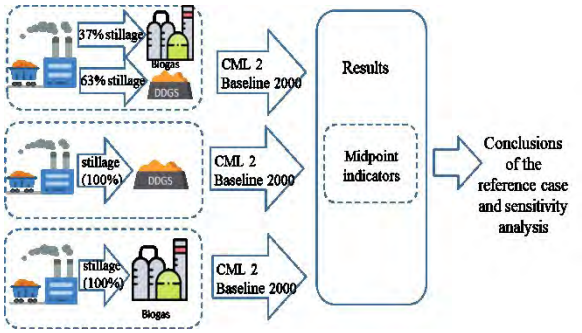

O_3
NOx (NO_2/NO)
Products
NOx, HONO
VOC


HONO
HONO source?
HONO sink?
Impact of :
T°C? RH?
Lab experiment
HONO flux (molecules.cm-2.s-1)
5x10^5
4x10^5
2x10^5
0x10^0
288
294
305
313
Temperature (K)
Same behavior on
living corn plants ?


Consolidating
Eco-friendly
Inorganic
Network
Crosslinking
Hydrophobic
Compatible
with stone
Organic
Network
Protecting

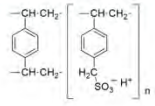

Air exhaled by the patient – increased content of carbon dioxide (~4%)
Patient under closed circuit anaesthetic apparatus
Carbon dioxide absorbent, eg. soda lime agent
Air inhaled by the patient – content of carbon dioxide at regular level (~0,04%)


HMF
DMTHF
HMF
BHMTHF
HMF
DMF
Rutile
HIGH ACIDITY
Anatase
LOW ACIDITY
Anatase
LOW ACIDITY

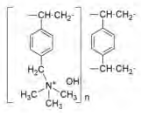

37% stillage
63% stillage
Biogas
DDGS
stillage (100%)
DDGS
stillage (100%)
Biogas
CML 2 Baseline 2000
CML 2 Baseline 2000
CML 2 Baseline 2000
Results
Midpoint indicators
Conclusions of the reference case and sensitivity analysis

Nanoparticles as modifiers of electrophoretic systems:

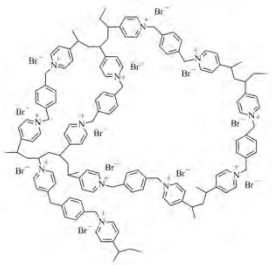
Nano-sized cation exchanger

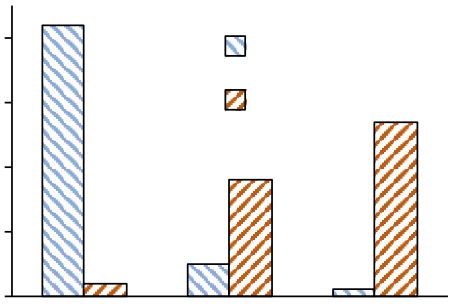


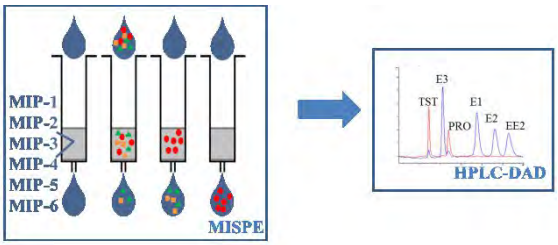
Nano-sized anion exchanger

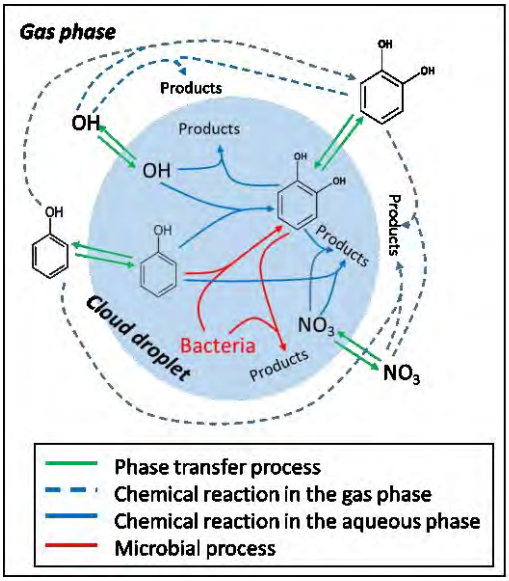


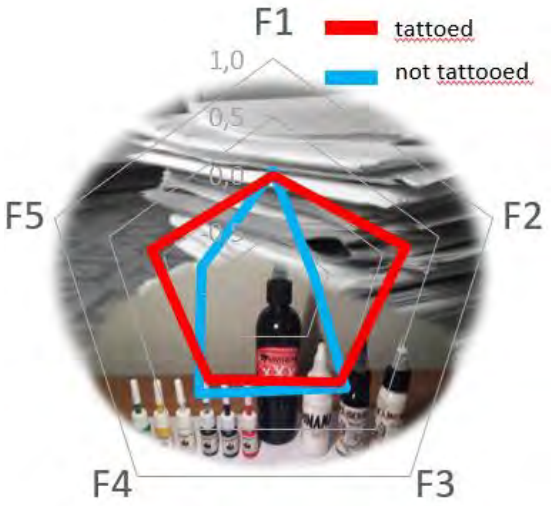
Nanosponges

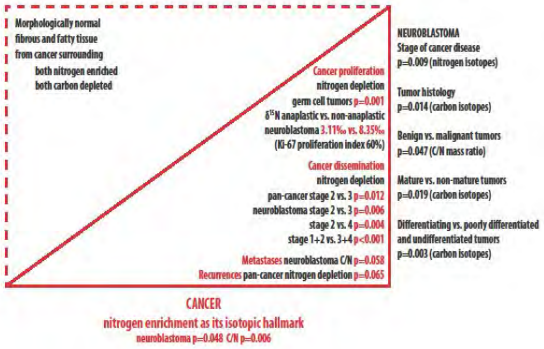




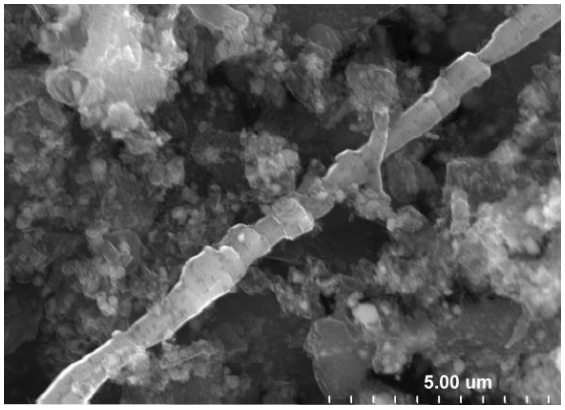

MIP-1
MIP-2
MIP-3
MIP-4
MIP-5
MIP-6
MISPE
E3
TST
E1
PRO
E2
EE2
HPLC-DAD

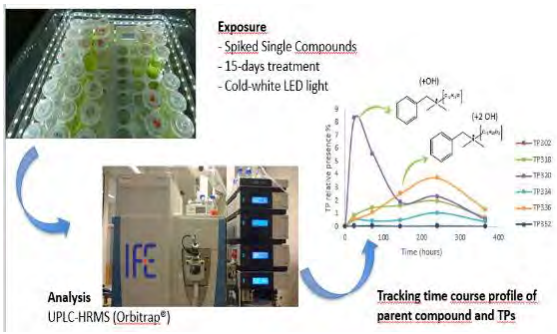

Gas phase
Products
OH
Products
OH
OH
OH
OH
OH
OH
Products
Products
Cloud droplet
Bacteria
Products
NO_3
NO_3
Phase transfer process
Chemical reaction in the gas phase
Chemical reaction in the aqueous phase
Microbial process

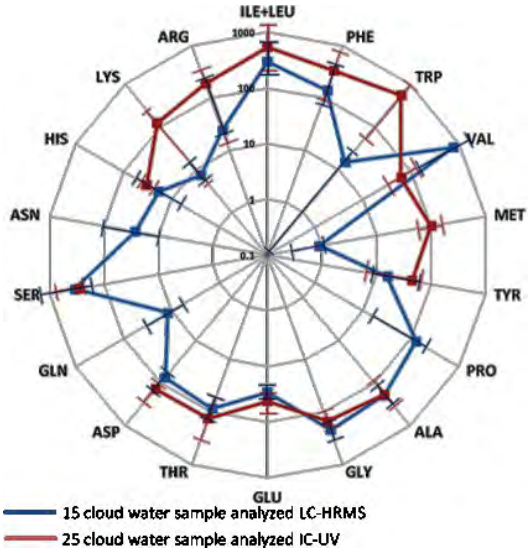

F1
tattoed
not tattooed
1,0
0,5
F5
F2
F4
F3

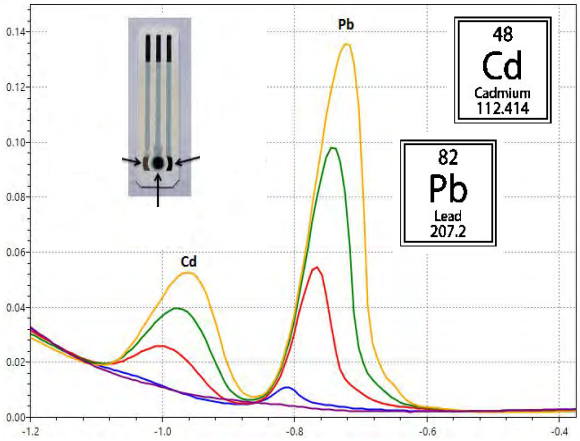

Morphologically normal
fibrous and fatty tissue
from cancer surrounding
both nitrogen enriched
both carbon depleted
Cancer proliferation
nitrogen depletion
germ cell tumors p=0.001
δ15N anaplastic vs. non-anaplastic
neuroblastoma 3.11‰ vs. 0.35‰
(KI-67 proliferation index 60%)
Cancer dissemination
nitrogen depletion
pan-cancer stage 2 vs. 3 p=0.012
neuroblastoma stage 2 vs. 3 p=0.006
stage 2 vs. 4 p=0.004
stage 1+2 vs. 3+4 p<0.001
Metastases neuroblastoma C/N p=0.058
Recurrences pan-cancer nitrogen depletion p=0.065
CANCER
nitrogen enrichment as its isotopic hallmark
neuroblastoma p=0.048 C/N p=0.006
NEUROBLASTOMA
Stage of cancer disease
p=0.009 (nitrogen isotopes)
Tumor histology
p=0.014 (carbon isotopes)
Benign vs. malignant tumors
p=0.047 (C/N mass ratio)
Mature vs. non-mature tumors
p=0.019 (carbon isotopes)
Differentiating vs. poorly differentiated
and undifferentiated tumors
p=0.003 (carbon isotopes)

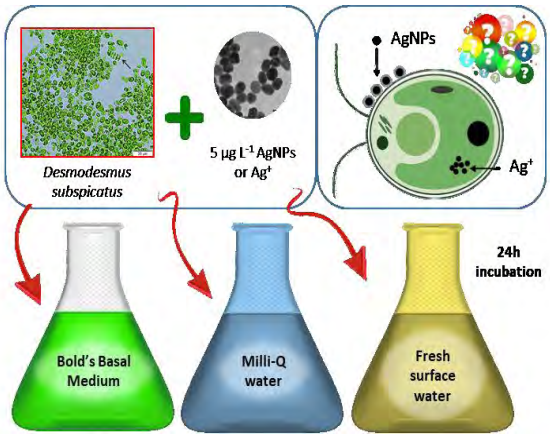

LABORATORY OF ISOTOPIC FRACTIONATION IN PATHOLOGICAL PROCESSES
IFPP
LAB

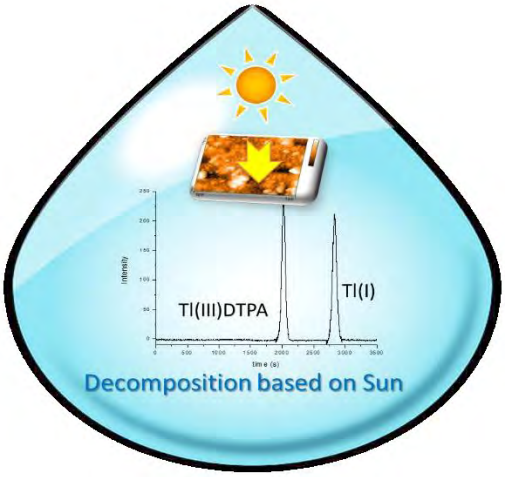

5.00 um

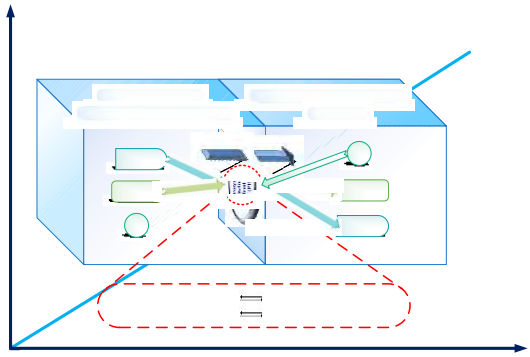

Exposure
- Spiked Single Compounds
- 15-days treatment
- Cold-white LED light
(+OH)
(+2 OH)
TP relative presence %
Time (hours)
0
100
200
300
400
IFE
Analysis
UPLC-HRMS (Orbitrap®)
Tracking time course profile of parent compound and TPs

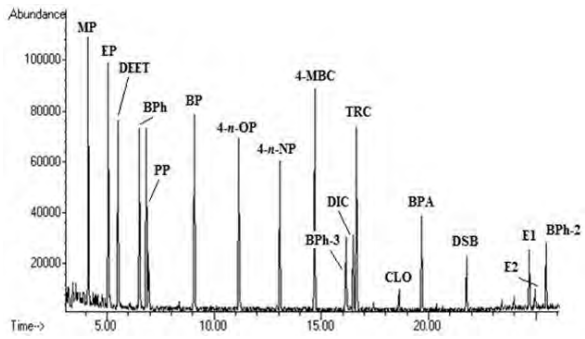

ILE+LEU
PHE
TRP
VAL
MET
TYR
PRO
ALA
GLY
GLU
THR
ASP
GLN
SER
ASN
HIS
LYS
ARG
1000
100
10
1
0.1
15 cloud water sample analyzed LC-HRMS
25 cloud water sample analyzed IC-UV

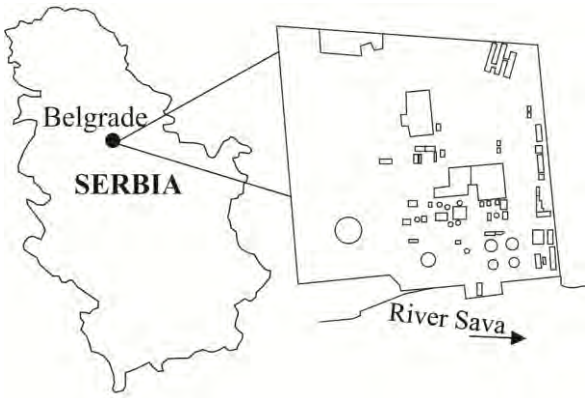

Pb
48
Cd
Cadmium
112.414
82
Pb
Lead
207.2
Cd
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
-1.2
-1.0
-0.8
-0.6
-0.4


Desmodesmus subspicatus
5 µg L-1 AgNPs or Ag+
AgNPs
Ag+
24h incubation
Bold's Basal Medium
Milli-Q water
Fresh surface water

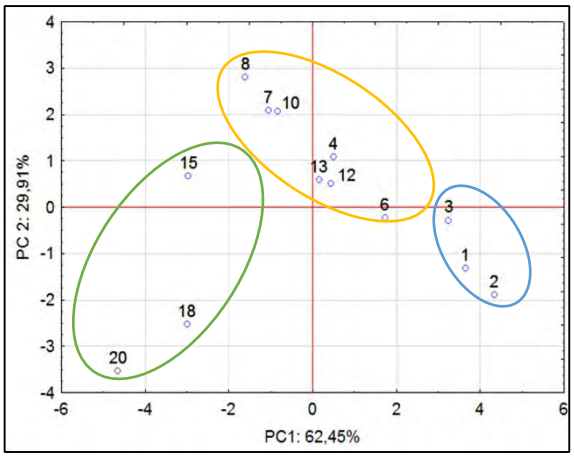

Tl(III)DTPA
Tl(I)
Decomposition based on Sun

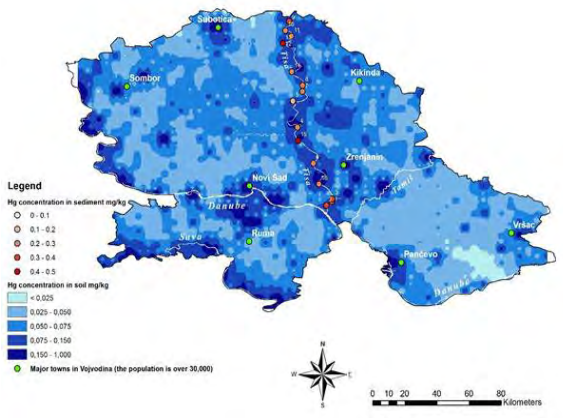



Abundance
MP
EP
DEET
BPh
BP
4-n-OP
4-n-NP
4-MBC
TRC
PP
DIC
BPA
BPh-3
DSB
E1
BPh-2
E2
CLO
100000
80000
60000
40000
20000
Time-->
5.00
10.00
15.00
20.00

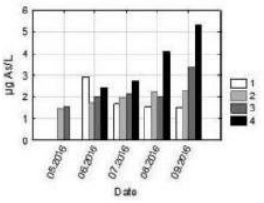

Belgrade
SERBIA
River Sava

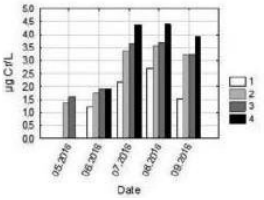

Banja Luka
Croatia
Bosnia and Herz.
Serbia
Montenegro
Albania


PC 2: 29,91%
PC1: 62,45%
8
7
10
4
13
12
15
6
3
1
2
18
20

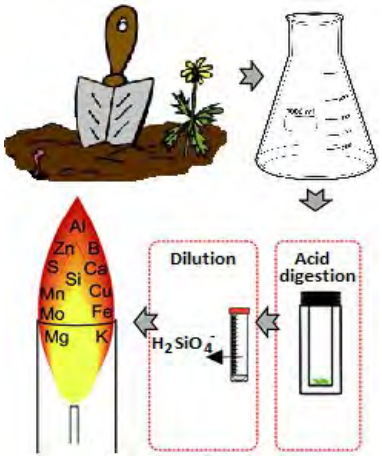

Subotica
Sombor
Kikinda
Zrenjanin
Novi Sad
Ruma
Vršac
Pančevo
Danube
Sava
Tisa
Legend
Hg concentration in sediment mg/kg
0 - 0.1
0.1 - 0.2
0.2 - 0.3
0.3 - 0.4
0.4 - 0.5
Hg concentration in soil mg/kg
< 0,025
0,025 - 0,050
0,050 - 0,075
0,075 - 0,150
0,150 - 1,000
Major towns in Vojvodina (the population is over 30,000)
N
W
E
S
0 10 20 40 60 80
Kilometers


Poland
Germany
Czech Republic

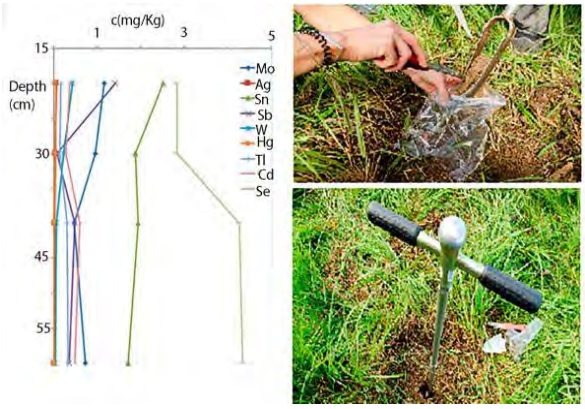

µg As/L
Date
05.2016
06.2016
07.2016
08.2016
09.2016
1
2
3
4

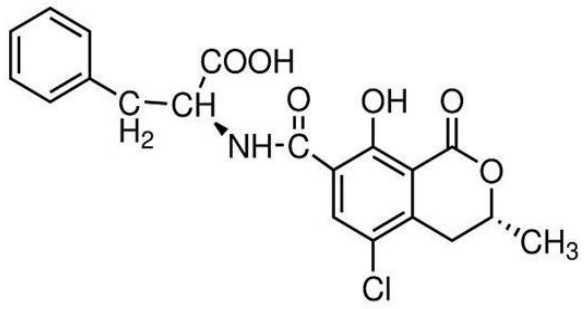

µg Cr/L
Date
05.2016
06.2016
07.2016
08.2016
09.2016
1
2
3
4


Google Earth

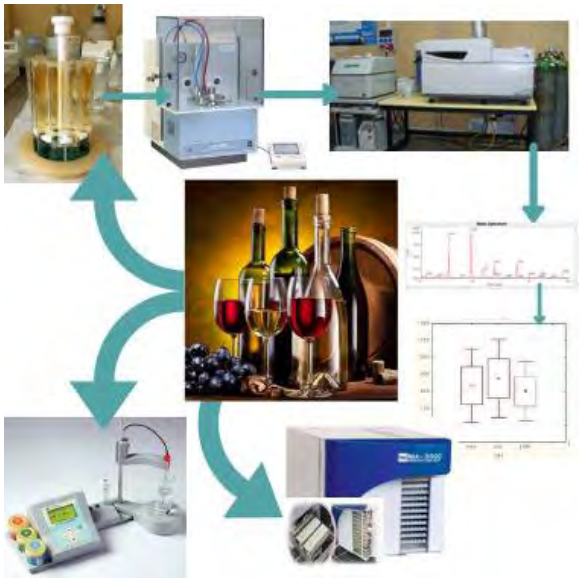

Al
Zn
B
S
Ca
Si
Mn
Cu
Mo
Fe
Mg
K
Dilution
Acid digestion
$H_2SiO_4^-$

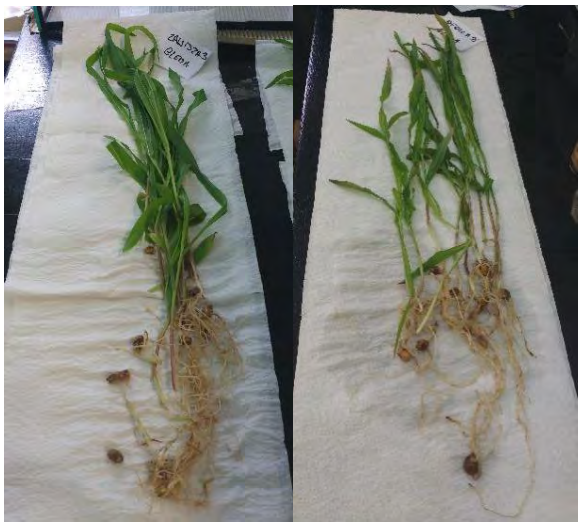

Google Earth

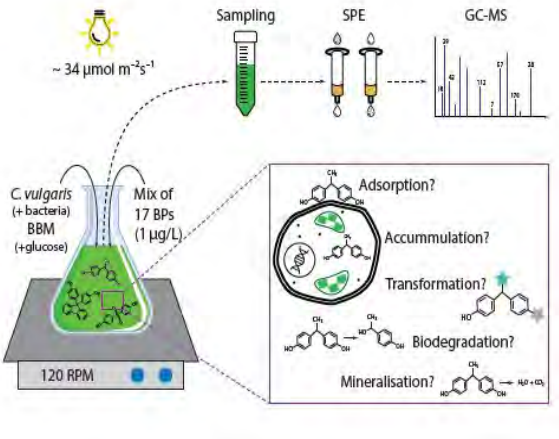

c(mg/Kg)
1
3
5
15
Depth
(cm)
30
45
55
Mo
Ag
Sn
Sb
W
Hg
Tl
Cd
Se

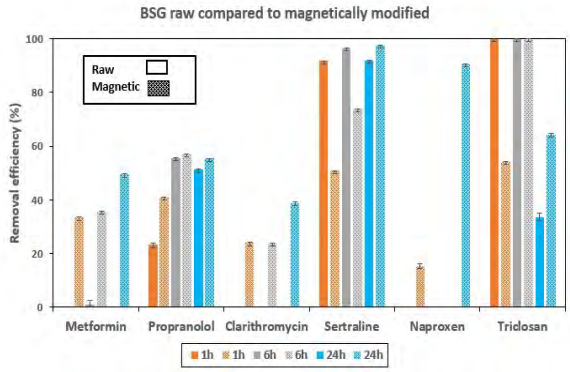

COOH
C
CH
H2
NH
C
O
OH
O
O
CH3
Cl

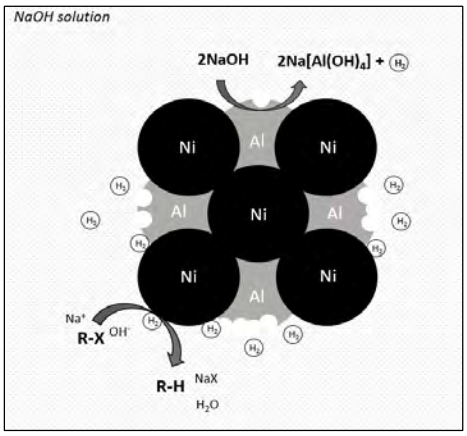

???
Mass Spectrum



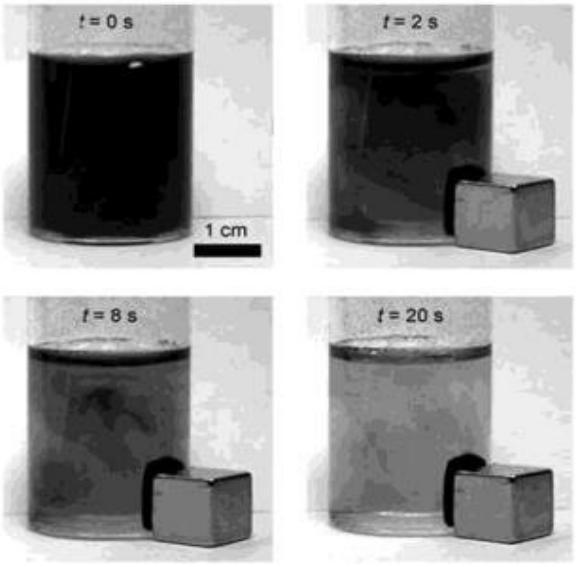


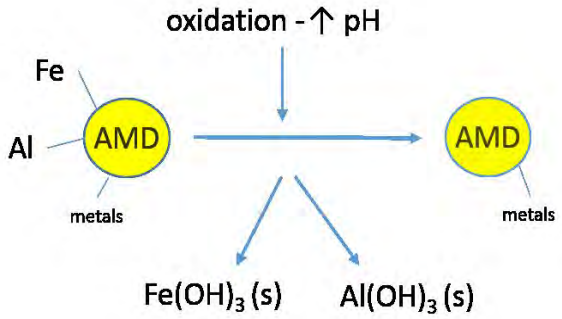

~ 34 µmol m⁻²s⁻¹
Sampling
SPE
GC-MS
C. vulgaris
(+ bacteria)
BBM
(+glucose)
Mix of
17 BPs
(1 µg/L)
120 RPM
Adsorption?
Accummulation?
Transformation?
Biodegradation?
Mineralisation?

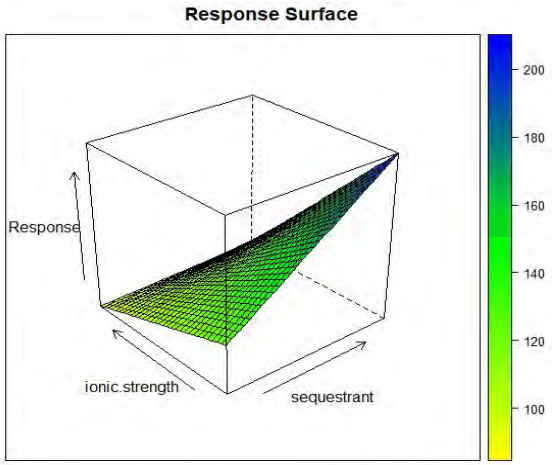

BSG raw compared to magnetically modified
Raw
Magnetic
Removal efficiency (%)
100
80
60
40
20
0
Metformin
Propranolol
Clarithromycin
Sertraline
Naproxen
Triclosan
1h
1h
6h
6h
24h
24h

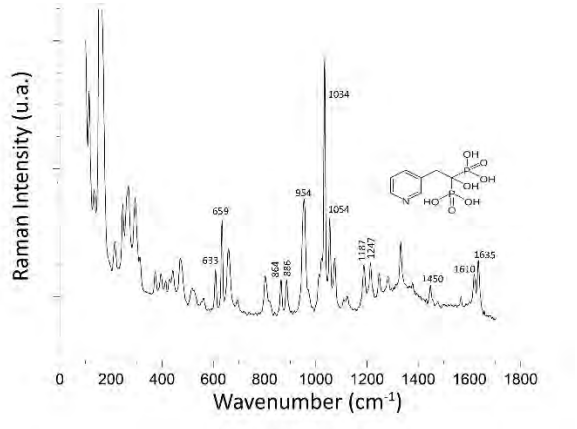

NaOH solution
2NaOH
2Na[Al(OH)4] + H2
Ni
Al
Ni
Al
Ni
Al
Ni
Al
Ni
Na+
R-X
OH-
R-H
NaX
H2O

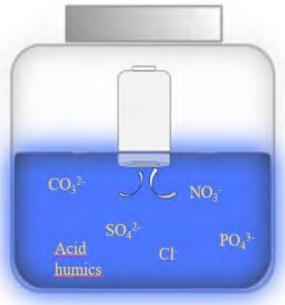

Abandoned adits
Technological columns device
Neutral mine drainage
LDH-Biochar

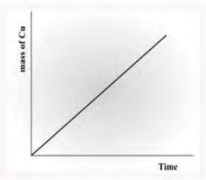

t = 0 s
1 cm
t = 2 s
t = 8 s
t = 20 s

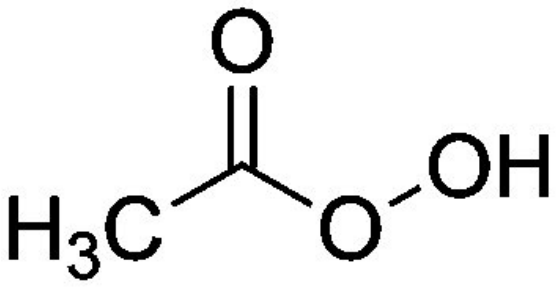

oxidation - ↑ pH
Fe
Al
AMD
metals
AMD
metals
$Fe(OH)_3$ (s)
$Al(OH)_3$ (s)

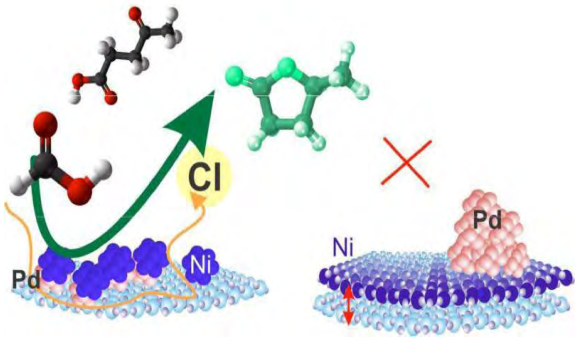

Response Surface
Response
ionic.strength
sequestrant
200
180
160
140
120
100

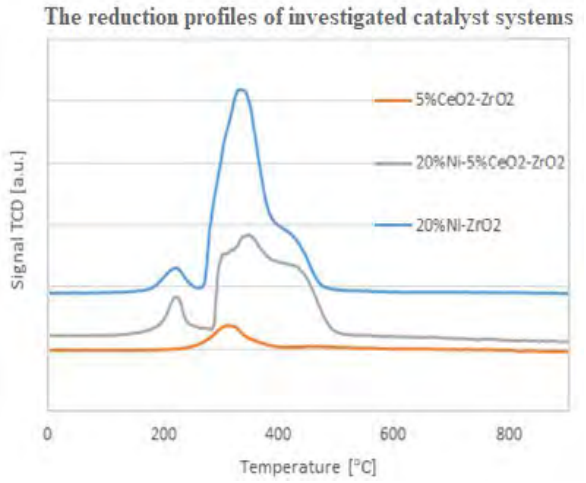

Raman Intensity (u.a.)
Wavenumber (cm-1)
0
200
400
600
800
1000
1200
1400
1600
1800
1034
659
954
1054
633
864
886
1187
1247
1450
1610
1635
OH
O
P
OH
OH
N
HO
P
OH
O

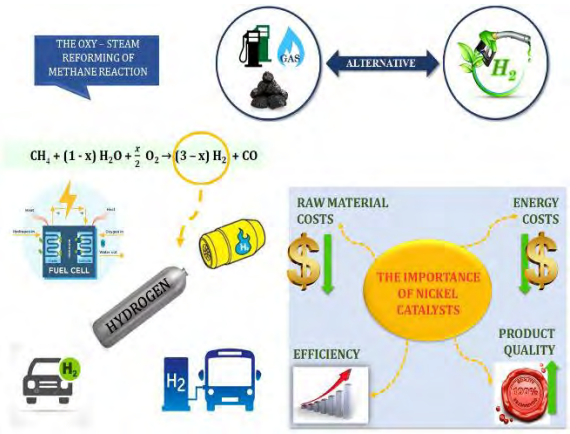

CO_3^{2-}
NO_3^-
SO_4^{2-}
Acid humics
Cl^-
PO_4^{3-}

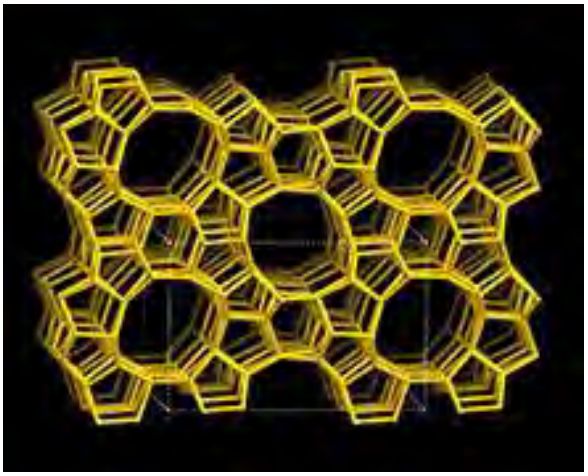

mass of Cu
Time

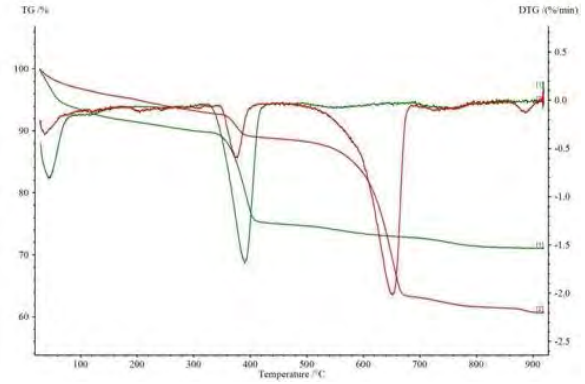

O
H3C
O
OH

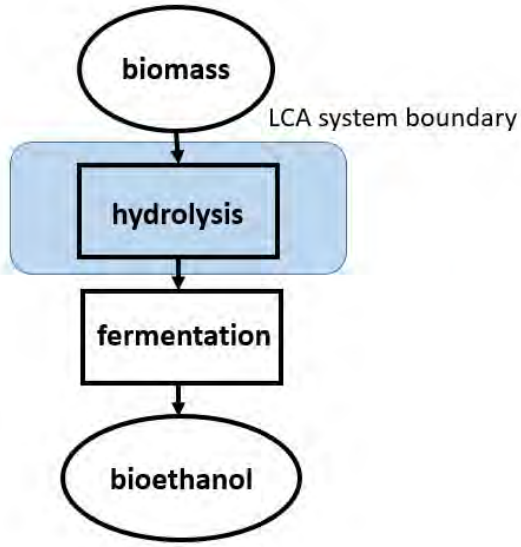

Cl
Pd
Ni
Ni
Pd

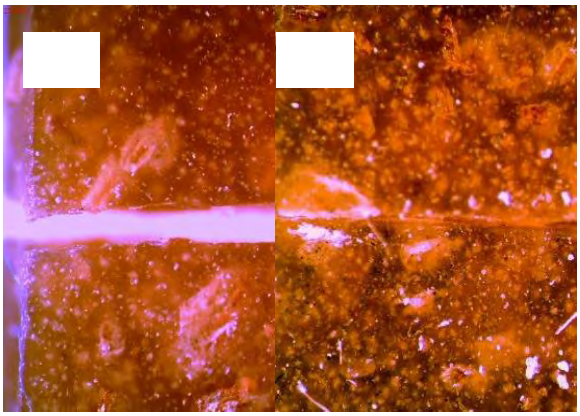

The reduction profiles of investigated catalyst systems
5%CeO2-ZrO2
20%Ni-5%CeO2-ZrO2
20%Ni-ZrO2
Signal TCD [a.u.]
0
200
400
600
800
Temperature [°C]

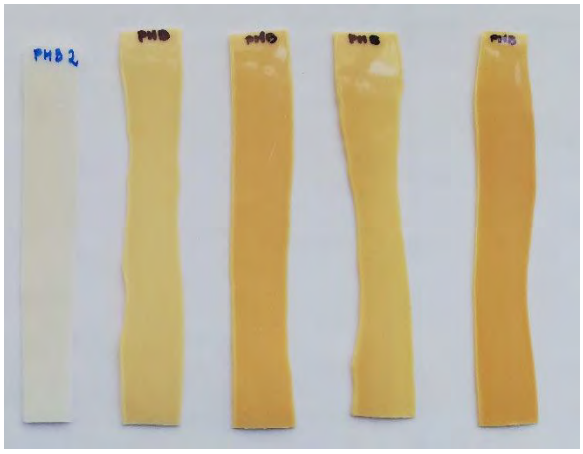

THE OXY – STEAM REFORMING OF METHANE REACTION
GAS
ALTERNATIVE
H_2
$CH_4 + (1 - x)\,H_2O + \frac{x}{2}\,O_2 \rightarrow (3 - x)\,H_2 + CO$
FUEL CELL
HYDROGEN
H_2
RAW MATERIAL COSTS
ENERGY COSTS
THE IMPORTANCE OF NICKEL CATALYSTS
EFFICIENCY
PRODUCT QUALITY

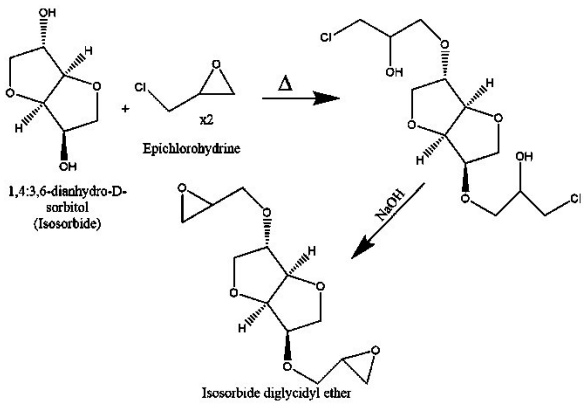


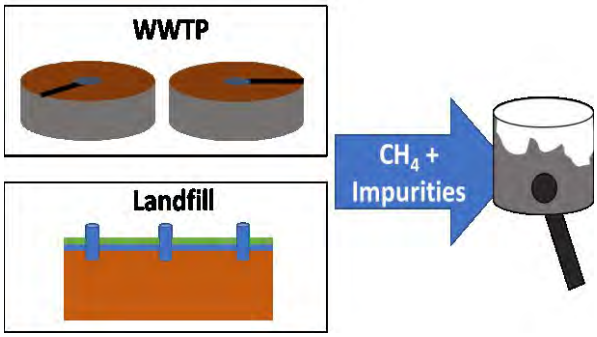

TG /%
DTG /(%/min)
100
90
80
70
60
0.5
0.0
-0.5
-1.0
-1.5
-2.0
-2.5
100
200
300
400
500
600
700
800
900
Temperature /°C

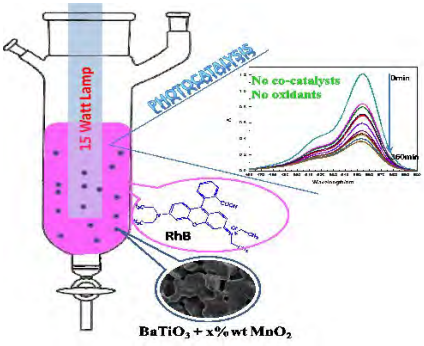

biomass
LCA system boundary
hydrolysis
fermentation
bioethanol

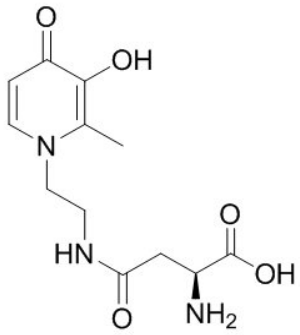



PHB 2

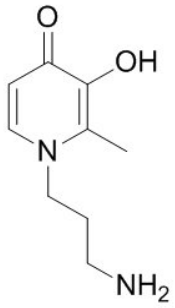

1,4:3,6-dianhydro-D-sorbitol
(Isosorbide)
x2
Epichlorohydrine
Δ
NaOH
Isosorbide diglycidyl ether


WWTP
Landfill
CH_4 +
Impurities

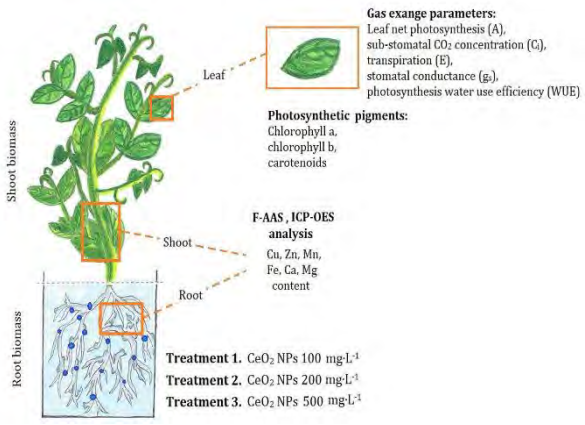

15 Watt lamp
PHOTOCATALYSIS
No co-catalysts
No oxidants
0min
120min
RhB
BaTiO3 + x% wt MnO2

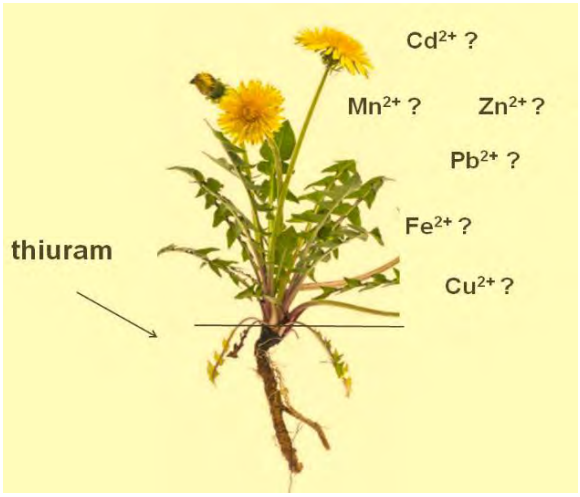


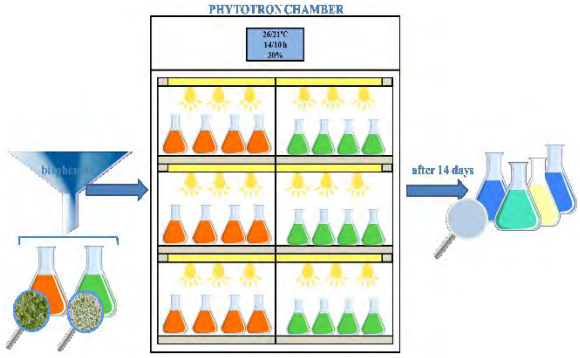
L1

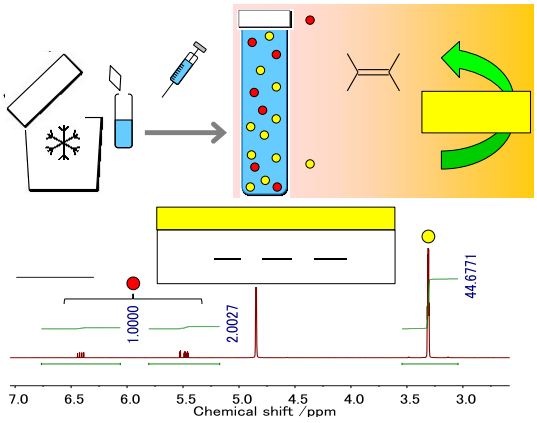


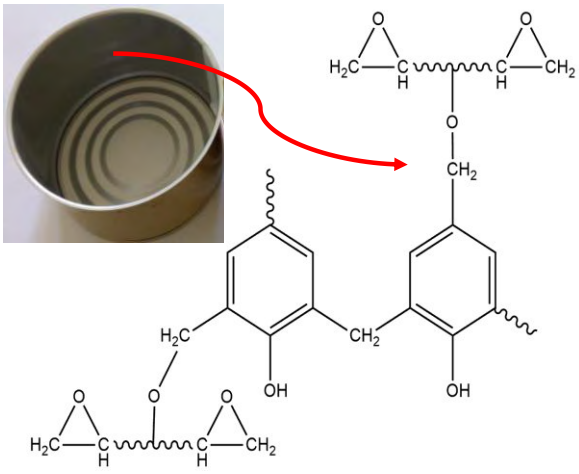
L2

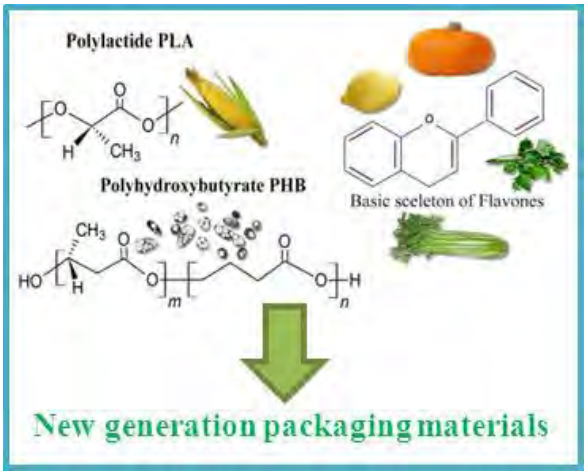

Gas exange parameters:
Leaf net photosynthesis (A),
sub-stomatal CO_2 concentration (C_i),
transpiration (E),
stomatal conductance (g_s),
photosynthesis water use efficiency (WUE)
Leaf
Photosynthetic pigments:
Chlorophyll a,
chlorophyll b,
carotenoids
Shoot biomass
F-AAS , ICP-OES analysis
Cu, Zn, Mn,
Fe, Ca, Mg
content
Shoot
Root
Root biomass
Treatment 1. CeO_2 NPs 100 $mg{\cdot}L^{-1}$
Treatment 2. CeO_2 NPs 200 $mg{\cdot}L^{-1}$
Treatment 3. CeO_2 NPs 500 $mg{\cdot}L^{-1}$

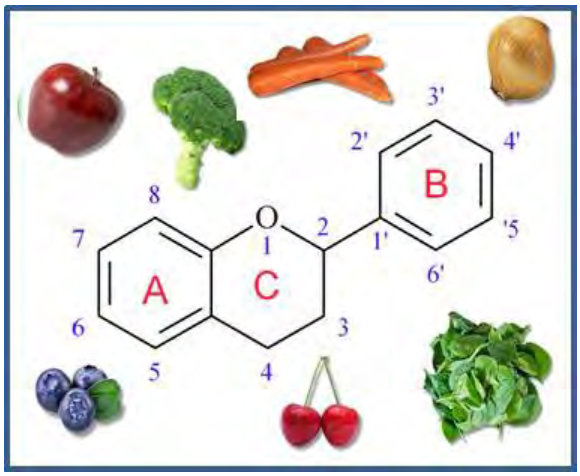

Cd2+ ?
Mn2+ ?
Zn2+ ?
Pb2+ ?
Fe2+ ?
thiuram
Cu2+ ?

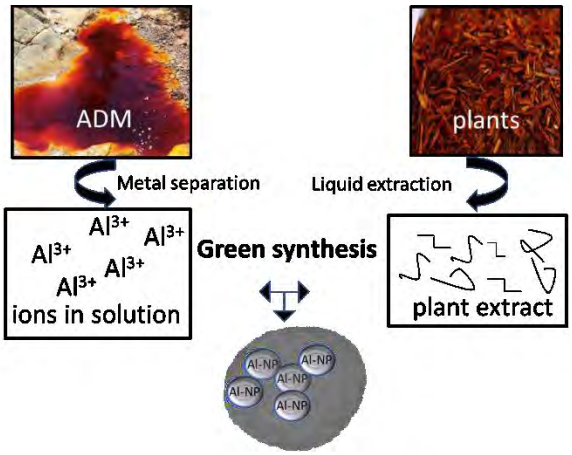

PHYTOTRON CHAMBER
26/21°C
14/10 h
30%
after 14 days

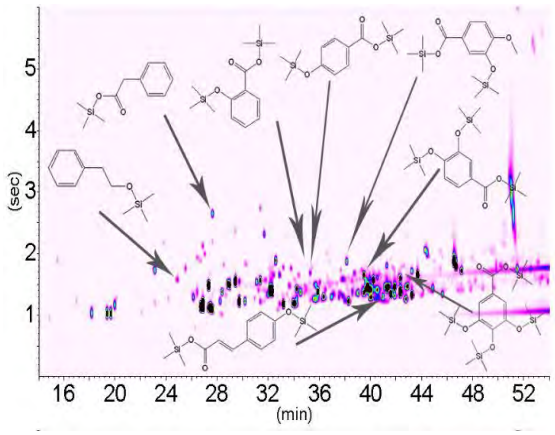

1.0000
2.0027
44.6771
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
Chemical shift /ppm

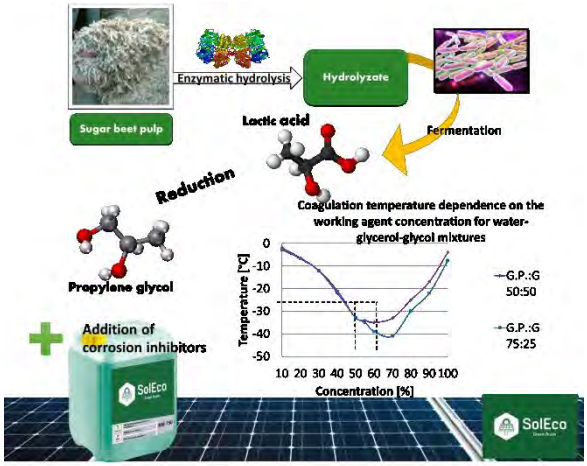


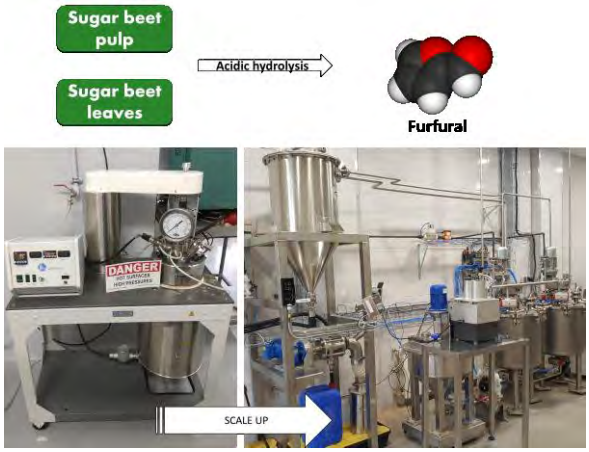

Polylactide PLA
Polyhydroxybutyrate PHB
Basic sceleton of Flavones
New generation packaging materials

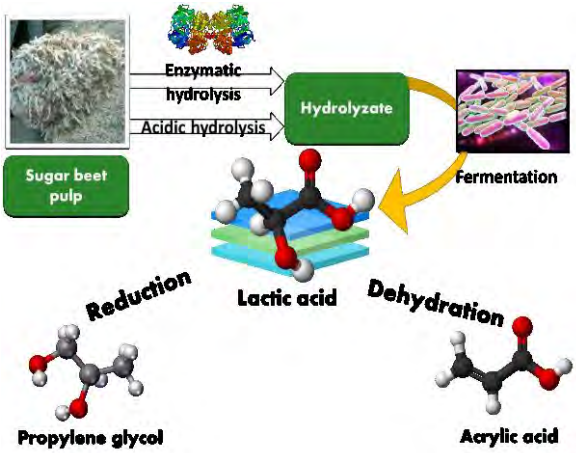

3'
2'
4'
B
8
O
7
1
2
1'
'5
A
C
6'
6
3
5
4

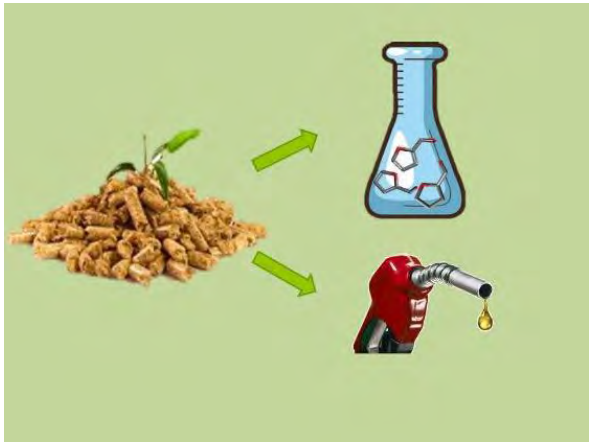

ADM
plants
Metal separation
Liquid extraction
Al3+
Al3+
Al3+
Al3+
Al3+
ions in solution
Green synthesis
plant extract
Al-NP
Al-NP
Al-NP
Al-NP
Al-NP

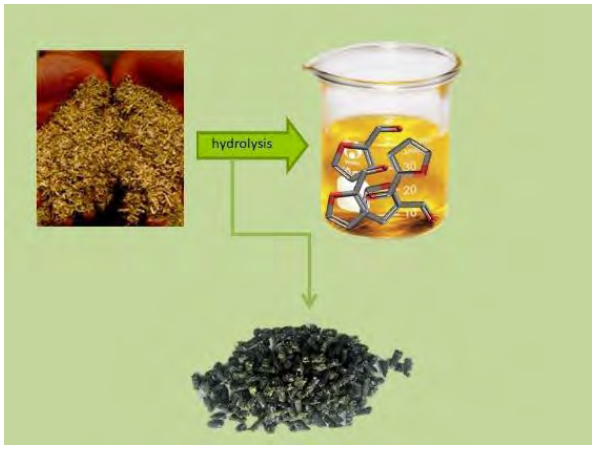

5
4
3
2
1
(sec)
16
20
24
28
32
36
40
44
48
52
(min)


Enzymatic hydrolysis
Hydrolyzate
Sugar beet pulp
Lactic acid
Fermentation
Reduction
Propylene glycol
Addition of
corrosion inhibitors
Coagulation temperature dependence on the
working agent concentration for water-
glycerol-glycol mixtures
Temperature [°C]
0
-10
-20
-30
-40
-50
10 20 30 40 50 60 70 80 90 100
Concentration [%]
G.P.:G
50:50
G.P.:G
75:25
SolEco
SolEco


Sugar beet pulp
Sugar beet leaves
Acidic hydrolysis
Furfural
DANGER
SCALE UP


Enzymatic hydrolysis
Acidic hydrolysis
Hydrolyzate
Sugar beet pulp
Fermentation
Lactic acid
Reduction
Dehydration
Propylene glycol
Acrylic acid




hydrolysis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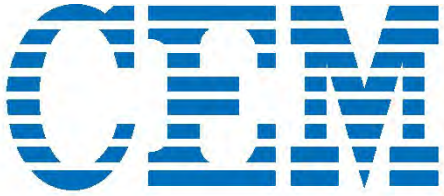

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