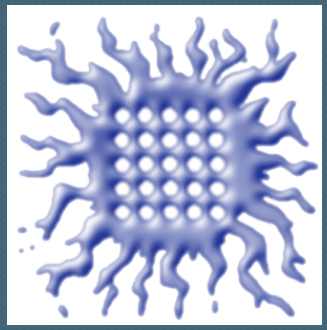
BAUXITE RESIDUE VALORISATION AND BEST PRACTICES CONFERENCE

Leuven 5-7 October 2015

METALS SPECIATION IN BAUXITE RESIDUE WITH IMPLICATIONS TO ITS USE AS AN IMMOBILIZATION AGENT



Ivana SMIČIKLAS[1],
Mihajlo JOVIĆ[1],
Marija ŠLJIVIĆ-IVANOVIĆ[1],
Aleksandra MILENKOVIĆ[1],
Slavko SMILJANIĆ[2]

[1] *University of Belgrade, "Vinča" Institute of Nuclear Sciences, Radiation and Environmental Protection Department, P.O. Box 522, 11000 Belgrade, Serbia*

[2] *University of East Sarajevo, Faculty of Technology, Karakaj bb, 75400 Zvornik, Republic of Srpska, Bosnia and Herzegovina*

Vinča Institute of Nuclear Sciences

•The largest Institute in Serbia

•The research at the Institute covers the following areas: physics, chemistry, biology, power engineering and technology, radiation and environmental protection, accelerator science, and materials science

•Nowadays, Vinča is pursuing a multidisciplinary line of research

One of the research interests is development of materials and methods for the treatment of nuclear waste and remediation of contaminated sites

Application of sorption process

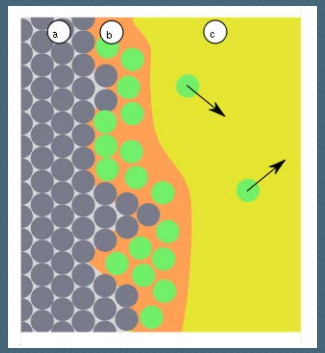
Toxicity doesn't depend only on the concentration, but on the chemical form of an element.

→ soluble forms - mobile – bioavailable - toxic

Sorption process converts the form of pollutant from soluble to insoluble.
Immobilization of pollutants
in situ or *ex situ*

→ WATER PURIFICATION

SOIL REMEDIATION



Sorbent material must be effective, selective, economic, abundant, chemically stabile and non-toxic.

→ Synthetic organic, inorganic and composite materials
Natural minerals –zeolites, clay
Modified materials
By-products and waste materials

Characterisation of waste materials as potential sorbents

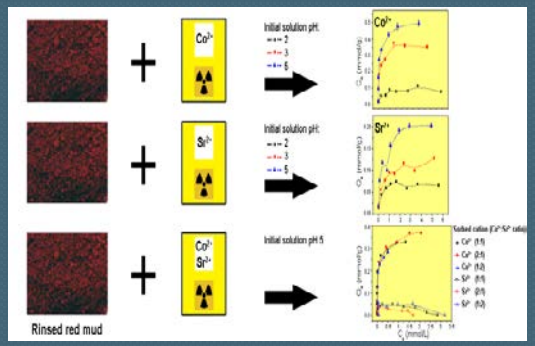
Rice husks ash

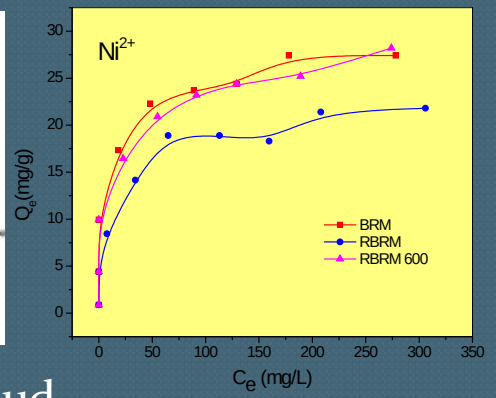
Fly ash

Blast furnice slag

Animal bones (apatite)

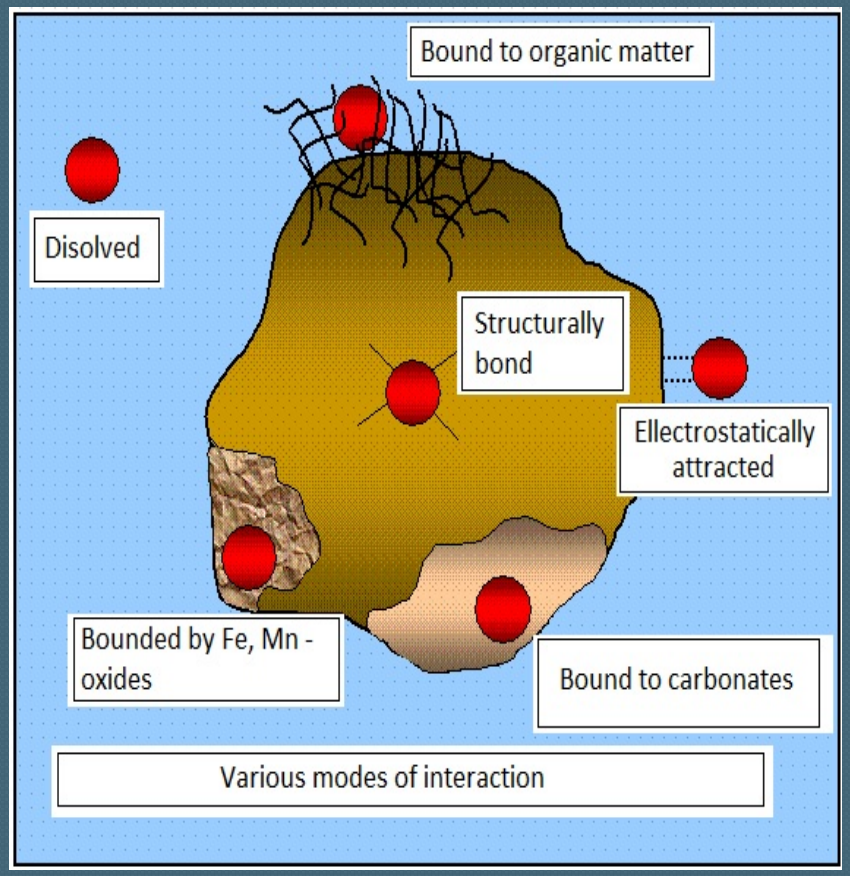
- ✓Physico-chemical characterisation of the sorbent (Sp, XRD, FT-IR, SEM-EDS, ICP-OES, XPS…)
- ✓Modifications of sorbents
- ✓Determination of sorption and desorption characteristics under a range of experimental conditions
- ✓Evaluation of sorption mechanism
- ✓Aplicability





Red mud

Sequential extraction



Extraction step		Mobility Toxicity	Stability
F_1	Exchangeable	↑	↓
F_2	Bound to Carbonates		
F_3	Bound to Fe, Mn Oxides		
F_4	Bound to Organic Matter		
F_5	Residual		

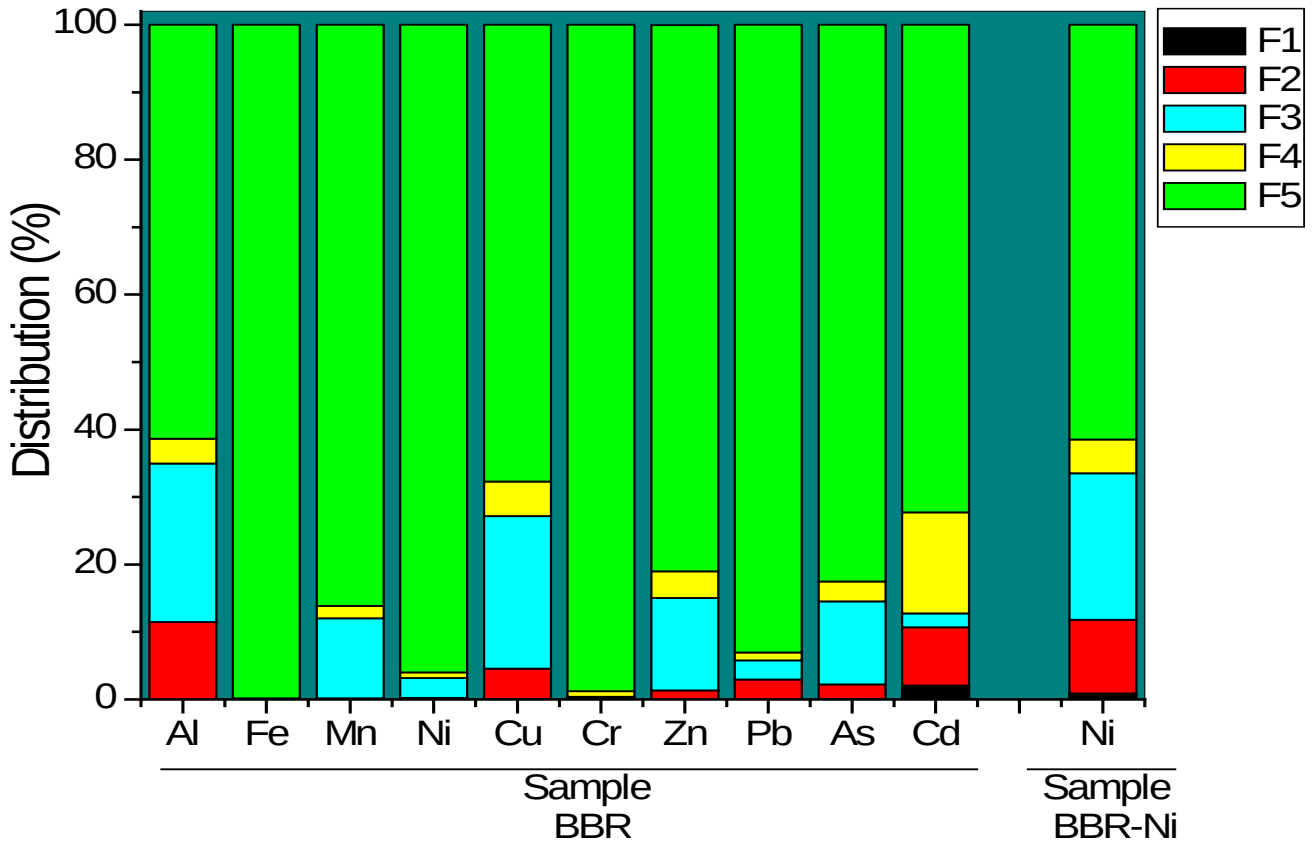
Applicability:

- determination of the mobility of elements in the waste material
- determination of the mobility of sorbed elements
- Comparison between different elements, sorbents, processes ...

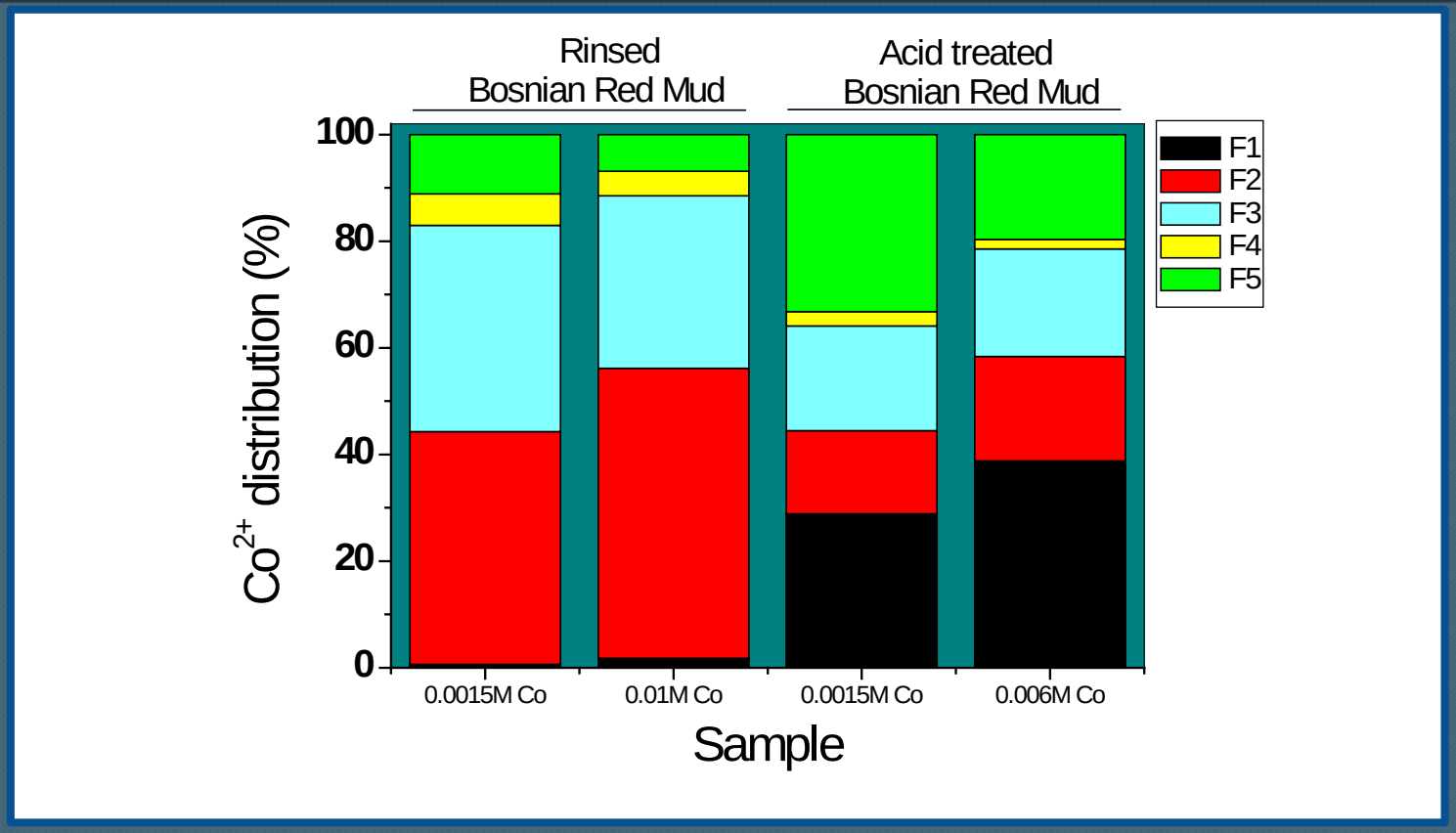
Pseudo-total concentrations of selected elements in BR

Element	This study Alumina, BIH	Alcoa (Spain)	Ajka (Hungary)	Kidričevo (Slovenia)
Fe (mg/g)	550±40	261±2	560±30	380±20
Al (mg/g)	106±6	65.7±5.7	200±10	220±10
Mn(µg/g)	3850±160	406±20	1180±60	367±18
Cr (µg/g)	580±10	1350±102	1120±60	450±20
Ni (µg/g)	820±30	80±3	375±20	51±3
Zn (µg/g)	300±10	80±4	n.a.	n.a.
Pb (µg/g)	230±15	50±8	230±10	73±4
As (µg/g)	75±4	1.0±0.1	213±11	53±3
Cu (µg/g)	61±3	52±3	71±4	30±2
Cd (µg/g)	0.250±0.017	1.3±0.1	3.0±0.2	1.00±0.05

Distribution of elements in BBR



Applicability of sequential exstraction

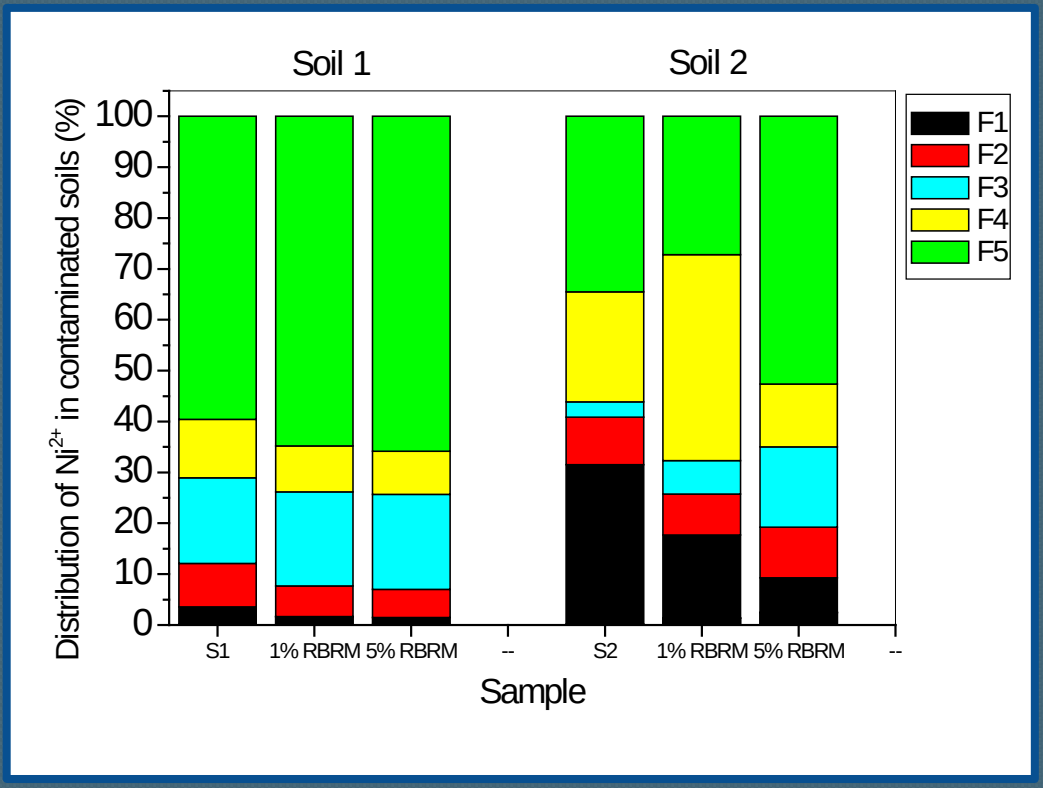


Distribution of sorbed Co ions
as a function of BR treatment and load

Applicability of BR in soil remediation

Soil mixing

Reactive barierers and liners



Distribution of Ni ions in contaminated soil as a function of soil type and the amount of added RBRM