

Analytical chemistry in investigation and protection of the environment



HEAD:

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RESEARCH PROFILE:

Analytical chemistry applied in environmental studies: environmental monitoring, evaluation of environmental pollution caused by human activity, fate of the pollutants in the environment, development of analytical tools dedicated for environmental analysis.

The main topics and analytical challenges that we meet are: determination of trace amounts of metals and metalloids in environmental samples (water, soil, sediments, plant and animal tissues, food), development of new methods of electrochemical determination of elements and their speciation in natural samples, phytoremediation processes, waste management and disposal, speciation analysis (chemical and physical speciation, fractionation), preparation of new control materials, biomonitoring and sample banking, methods of sample pretreatment (sampling, milling, homogenization), digestion/mineralization in open and closed systems (microwave assisted) and UV digestion (chemically or catalytically accelerated), application of solid phase extraction in trace speciation analysis (sample matrix simplification, separation and/or preconcentration of analytes).

CURRENT RESEARCH ACTIVITIES:

Recognition of defense mechanisms developed by plants, e.g. white mustard cultivated in the presence of high concentrations of As, Tl, Cd, Pt, Pd and Rh.



Reagent-free photodegradation of organic compounds used as a method of preparation of water samples for speciation analysis (HPLC with UV-Vis detection, ICP MS, voltammetry). Study of the stability of speciation (Tl, Cr, As) during sampling and sample pretreatment. Fractionation studies applied for evaluation of mobility and bioavailability of harmful and nutritious substances from soil.

Application of anodic and cathodic stripping voltammetry for trace analysis (below ppb level) of hazardous elements (Sn, Cd, Tl, Pb, Cr, As, Pt, Pd, Rh) in natural samples.



SELECTED PUBLICATIONS:

1. E. Biaduń, K. Miecznikowski, M. Sadowska, A. Kuźlewska, K. Drwal, B. Krasnodębska-Ostręga, Simplification of organic matter before voltammetric determination of Tl(I) and Tl(III) in water using nanostructured photocatalyst and solar light, *Anal. Chim. Acta.* 1076 (2019) 48-54.
2. K. Kińska, J. Jimenez-Lamana, J. Kowalska, B. Krasnodębska-Ostręga, J. Szpunar, Study of the uptake and bioaccumulation of palladium nanoparticles by *Sinapis alba* using Single Particle ICP-MS, *Sci. Total Environ.* 615 (2018) 1078-1085.
3. J. Kowalska, K. Kińska, M. Biesaga, M. Asztemborska, Application of selective extraction and reverse phase chromatography with three detectors – PAD, FLD and ESI MS for characterization of platinum metabolites and identification of phytochelatins in *Sinapis alba* L. tissues, *Microchem. J.* 132 (2017) 198-204.
4. M. Sadowska, E. Biaduń, B. Krasnodębska-Ostręga, Stability of Tl(III) in the context of speciation analysis of thallium in plants, *Chemosphere.* 144 (2016) 1216-1223.
5. E. Biaduń, M. Sadowska, N. Ospina-Alvarez, B. Krasnodębska-Ostręga, Direct speciation analysis of thallium based on solid phase extraction and specific retention of a Tl(III) complex on alumina coated with sodium dodecyl sulfate, *Microchim Acta.* 183 (2016) 177-183.
6. J. Kowalska, K. Kińska, J. Pałdyna, M. Czyżewska, K. Boder, B. Krasnodębska-Ostręga, Determination of traces of Pt and Rh in soil and quartz samples contaminated by automobile exhaust after an ion-exchange matrix separation, *Talanta.* 127 (2014) 250-254.
7. B. Krasnodębska-Ostręga, M. Sadowska, K. Piotrowska, M. Wojda, Thallium (III) determination in the Baltic seawater samples by ICP MS after preconcentration on SGX C18 modified with DDTC, *Talanta.* 112 (2013) 73-79.
8. B. Krasnodębska-Ostręga, M. Sadowska, S. Ostrowska, Thallium speciation in plant tissues – Tl(III) found in *Sinapis alba* L. grown in soil polluted with tailing sediment containing thallium minerals, *Talanta.* 93 (2012) 326-329.
9. Ł. Jedynek, J. Kowalska, Stability of arsenic species in hydroponic medium and its influence on arsenic uptake and distribution in White mustard (*Sinapis alba* L.), *Microchem. J.* 98 (2011) 163-169.
10. B. Krasnodębska-Ostręga, J. Pałdyna, J. Kowalska, Ł. Jedynek, J. Golimowski, Fractionation study in bioleached metallurgical wastes using six-step sequential extraction, *J. Hazard. Mater.* 167 (2009) 128-135.