

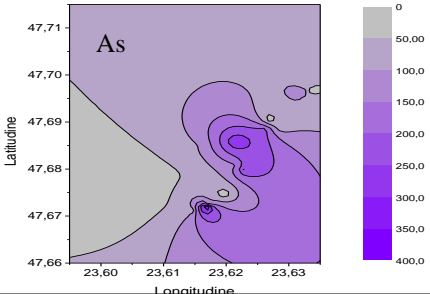
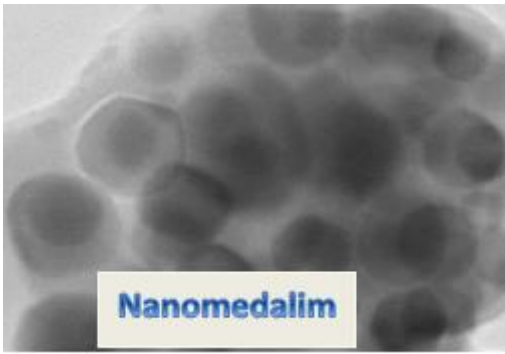


## NANOMATERIALS AND APPLICATION IN ENVIRONMENTAL AND FOOD ANALYSIS

### Contact details

Name	<b>Nanomaterials and application in environmental and food analysis</b>	   <p style="text-align: center;">Spatial prediction maps of As distribution in topsoil of a polluted area around a lead smelter</p>
Acronym	<b>Nanomedalim</b>	
Logo		
Site	<a href="http://research.utcluj.ro/tl_files/research/Research%20Domain/Chimie-Biologie/2_Oprea.pdf">http://research.utcluj.ro/tl_files/research/Research%20Domain/Chimie-Biologie/2_Oprea.pdf</a>	
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### Areas of expertise

#### Environmental chemistry

-Assessment of the degree of soil pollution due to microelements content, determination of microelements in plants; assessment of the health risk associated with the consumption of plants (vegetables and fruit) cultivated on polluted areas

#### Mathematical modelling of environmental data;

-transfer of microelements from soil to plant, study of the influence of ionic exchange processes on microelements transfer in the soil-plant system.

-analysis of soil characteristics (pH, conductivity, ionic exchange capacity)

-analysis of water quality characteristics

-QSPR/QSAR studies

#### Air quality analysis and monitoring

-Analysis of air pollutant and their spatial and temporal distribution;

-analysis of wet air deposition.

#### Synthesis and characterisation of nanoparticles embedded in silica matrix

- synthesis of the nanocomposit system  $\text{Co}_x\text{Fe}_{3-x}\text{O}_4/\text{SiO}_2$ ;

-analysis and interpretation of the thermogravimetric curves (TG), of the derivative thermogravimetric curves (DTG), differential thermogravimetric analysis;

-the analysis and interpretation of diffractograms;

-plotting and interpretation of FT-IR and Mossbauer spectra;

-interpretation of electron microscopy SEM and TEM + EDX

- the study of the distribution of  $\text{CoFe}_2\text{O}_4$  nanoparticles;

- interpretation of the BET absorption isotherms;

- tracing and interpretation of magnetic hysteresis curves;

#### Monitoring of drinking water quality

Monitoring of water quality in the municipal distribution network;

- analysis of physico-chemical parameters of water and the interpretation of their trend;

-assessment and monitoring of the water quality in water reservoirs and lakes;

-spectrometric analysis by molecular absorption spectrometry and by atomic absorption spectrometry;

- cluster analysis of data;

-mathematical modelling of environmental data;

-Drawing the map of the heavy metal distribution in the water reservoirs.

#### **Analysis of physico-chemical and sensory parameters of food**

-Assessment of physico-chemical parameters of wines;

-comparative sensory assessment of wines assortments;

-chromatographic analysis of food components by HPLC and thin layer chromatography.

#### **Physico-chemical and sensory characterization of food**

- assesment of hydrolysis and oxidation processes in animal fats

- monitoring of chemical parameters during storage

- increasing the oxidative stability of alimentary fat by the addition of antioxidants

### **Team**

Assoc. prof. dr. Cristina Mihali ; Assoc. prof. dr. Zoita Marioara Berinde ; Lecturer dr. eng. Claudia Butean, Assoc. prof. dr. eng. Thomas Dipping, Lecturer dr. eng. Flavia Pop

### **Representative projects**

**CLAMROUA, "Clean Air Management in the Romania - Ukraine Transboundary Area"**, European Union, Hungary-Slovakia-Romania-Ukraine, ENPI- Cross-border Cooperation Program project,  
<http://www.territorialcooperation.eu/frontpage/show/20419> (2013-2015)

**CISPPA, Interdisciplinary Research Concerning Soil-Plant Correlation, Establishing of Transfer Factors for Areas with Historic Anthropogenic Pollution**, CNMP-PNCII II, Program 4, Partnerships in priority areas,  
[www.ubm.ro/sites/CISPPA\\_2008/cisppa\\_2008.html](http://www.ubm.ro/sites/CISPPA_2008/cisppa_2008.html) (2008-2011)

### **Significant results**

#### **The most representative publications of the past 5 years:**

1. C. Mihali, G. Oprea, A. Michnea, S.G. Jelea, M. Jelea, C. Man, M. Şenilă, L. Grigor, „Assessment of heavy metals content and pollution level in soil and plants in Baia Mare area, NW Romania”, in *Carpathian Journal of Earth and Environmental Sciences*, vol. 8, no.2, 2013, pp. 143-152
2. T. Dipping, Z. Berinde, I. Pauliuc, “Formation and evolution of crystalline magnetic phases of CoFe<sub>2</sub>O<sub>4</sub> with temperature depending on the nature of the diol used”, in *Journal of Magnetism and Magnetic Materials*, vol. 334, 2013, pp. 87–95
3. C. Butean, C. Mihali, Z. M. Berinde, Angela Michnea, Ana M. Gavra, M. Simionescu, Wet deposition analysis using UV-VIS spectrometry in Maramures county (Romania), *ECOTERRA - Journal of Environmental Research and Protection*, 2014, Vol 11 (4), p.11-16. p-ISSN:1584-707.
4. C. Butean, Z. M. Berinde, C. Mihali, A. M. Michnea, A. Gavra, M. Simionescu “Atmospheric Deposition of Copper and Zinc in Maramures County (Romania)”, *ACTA CHEMICA IASI*, 2014, Vol. 22(2), p. 165-176., ISSN 2067 – 2438, ISSN online 2067 – 2446
5. C. Mihali, A. Michnea, G. Oprea, I. Gogoasa, C. Pop, M. Senila, L. Grigor, „Trace element contents in soil and vegetables around the lead smelter in Baia Mare, NW Romania”, in *Journal of Food, Agriculture & Environment, JFAE, Helsinki, Finlanda*, vol 10, no 1, 2012, pp. 828-834
6. M. Senila, E. A. Levei, L. Senila, G. M. Oprea, C. M. Roman, „Mercury in soil and perennial plants in a mining-affected urban area from Northwestern Romania”, in *Journal of Environmental Science and Health, Part A: Toxic/Hazardous Substances and Environmental Engineering*, vol. 47, no. 4, 2012, pp. 614-621
7. G. Oprea, A. Michnea, C. Mihali, „Adsorption kinetics of 8-hydroxyquinoline on Smithsonite”, in *Revue Roumaine de Chimie*, vol. 56, no 10-11, 2011, pp. 1021-1027
8. C. Mihali, G. Oprea, C. Butean, A. Michnea, N. Pop, “Application of pollution indexes, cluster analysis and isocontent chart to the study of soil pollution”, in *Creative Math. Inform.*, vol. 22, no. 2, 2013, pp. 207-214.
9. Z. Berinde, A.M. Michnea, “A comparative study on the evolution of environmental and honey pollution with heavy metals”, in *Journal of Science and Arts*, Year 13, no. 2(23), 2013, pp. 173-180
10. Z. Berinde, „QSTR mathematical models for the toxicity of aliphatic carboxylic acids on tetrahymena pyriformis”, in *Creative Math. Inform.*, vol. 22, no. 2, 2013, pp. 151- 160
11. Z. Berinde, “A QSPR study of hydrophobicity of phenols and 2-(aryloxy- $\alpha$ -acetyl)-phenoxathiin derivatives using the topological index ZEP”, *Creative Math. Inform.* vol 22, no 1, 2013, pp. 33-40.
12. G. Oprea, C. Mihali, A. Michnea, M. Senila, L. Mihalescu, O. Mare, „The traceability of copper and zinc in some vegetables from old mining area in Baia Mare, NW Romania”, in *Journal of Agroalimentary Processes and Technologies*, vol. 17, no. 3, 2011, pp. 246-253
13. T. Dipping, O. Cadar, E. Andrea Levei, I. Bibicu, L. Diamandescu, C. Leostean, M. Lazar, G. Borodi, L. Barbu Tudoran, Structure and magnetic properties of CoFe<sub>2</sub>O<sub>4</sub>/SiO<sub>2</sub> nanocomposites obtained by sol-gel and post annealing pathways, *Ceramics International*, vol. 43, 2017, pp. 2113 – 2122.
14. T. Dipping, E. A. Levei, O. Cadar, F. Goga, G. Borodi, L. Barbu-Tudoran, Thermal behavior of Co<sub>x</sub>Fe<sub>3-x</sub>O<sub>4</sub>/SiO<sub>2</sub> nanocomposites obtained by a modified sol-gel method, *Journal of Thermal Analysis and Calorimetry (2016)* DOI: 10.1007/s10973-016-5930-8
15. T. Dipping, E.-A. Levei, C. Tanaselia, M. Gabor, M. Nasui, L. Barbu Tudoran, G. Borodi, Magnetic properties evolution of the Co<sub>x</sub>Fe<sub>3-x</sub>O<sub>4</sub>/SiO<sub>2</sub> system due to advanced thermal treatment at 700°C and 1000°C, *Journal of Magnetism and Magnetic Materials*, 2016, 410, 47-54
16. T. Dipping, E.-A. Levei, L. Diamandescu, I. Bibicu, C. Leostean, G. Borodi, L. Tudoran Barbu, Structural and

magnetic properties of  $\text{CoFe}_3\text{-xO}_4$  versus Co/Fe molar ratio, *Journal of Magnetism and Magnetic Materials* 394 (2015) 111-116.

17. T. Dippong, E.-A. Levei, G. Borodi, F. Goga, L. Tudoran Barbu, Influence of Co/Fe ratio on the oxide phases in nanoparticles of  $\text{CoFe}_3\text{-xO}_4$ , *Journal of Thermal Analysis and Calorimetry* 119 (2015) 1001-1009.
18. T. Dippong, C. Mihali, F. Goga, G. Ardelean, Mathematical modeling of the variation in water quality along the network of water supply of Satu Mare municipality, *Studia Universitatis Babes-Bolyai Chemia*, 61:3 (2016) 251-262
19. T. Dippong, C. Mihali, G. Ardelean, Seasonal variation of fizico-chemical parameters in the drinking water supply network of Satu Mare city, NW Romania, *Environmental Engineering and Management Journal*, acceptat
20. Z. Berinde, T. Dippong, C. Butean, QSPR Study on Transition Temperature of Tetraphenylethene - Derived columnar Liquid Crystals, *Studia Universitatis Babes-Bolyai*, 2016, 61, 1, 51-62.
21. E. Cical, C. Mihali, M. Mercea, A. Dumuța, T. Dippong, Considerations of the relative efficacy of aluminium sulphate versus polyaluminium chloride for improving drinking water quality, *Studia Universitatis Babes-Bolyai*, 2016, 61, 2, 225-238.
22. F. Goga, R. Dudric, L. Bizo, A. Avram, T. Dippong, G. Katona, G. Borodi, A. Anton, Influence of the Thermal Treatment on the Colour of  $\text{RO}\cdot\text{Al}_2\text{O}_3$  (R=Co, Ni) Type Spinel Pigments Prepared by a Modified Sol – Gel Method, *Studia Universitatis Babes-Bolyai Chemia*, 61:3 (2016) 263-274
23. C. Tănăsolia, O. Cadar, M. Câmpeanu, C. Bălăica, T. Dippong, Revised rare earth elements composition of mocs meteorite using HR-ICP-MS and ICP-QMS analysis, *Studia Universitatis Babes-Bolyai*, Volume 61:3, 401-407
24. T. Dippong, C. Mihali, Analysis of heavy metal content of different varieties of wines, *Scientific Bulletin of North University Center of Baia Mare, Series D, Mining, Mineral Processing, Non-ferrous Metallurgy, Geology and Environmental Engineering*, 2016, Volume XXX, No. 1, p.23-32.
25. Thomas Dippong, Barbara Gati, Zorica Voșgan, Cristina Mihali, Comparative analysis of physico-chemical, microbiological and sensory characteristics of some milk powder infant formulas, *Scientific Bulletin of North University Center of Baia Mare, Series D, Mining, Mineral Processing, Non-ferrous Metallurgy, Geology and Environmental Engineering*, 2015, Volume XXIX No. 1, p. 77-87.
26. C. Mihali, G. Oprea, A. Michnea, T. Dippong, C. Butean, L. Mihaiescu, A. Dumuța, O. Mare, Assessment of lead content in some vegetables grown near tailing deposits in Baia Mare area, *Scientific Bulletin of North University Center of Baia Mare, Series D, Mining, Mineral Processing, Non-ferrous Metallurgy, Geology and Environmental Engineering*, 2014, Volume XXVIII No. 2, p. 57-63.
27. T. Dippong, B. Gati, C. Mihali, F. Goga, Comparative study of thermal decomposition of several assortment of infant formula, *Scientific Bulletin of North University Center of Baia Mare, Series D, Mining, Mineral Processing, Non-ferrous Metallurgy, Geology and Environmental Engineering*.
28. Pop Flavia, Semeniuc Cristina Anamaria, Mihaiescu Lucia, Oxidative and hydrolytic stability of alimentary poultry fats under refrigeration and freezing, *European Journal of Lipid Science and Technology*, 2016, 118(11), 1795-1798.
29. Pop Flavia, Mihaiescu Lucia, Effects of  $\alpha$ -Tocopherol and Citric Acid on the Oxidative Stability of Alimentary Poultry Fats During Storage at Low Temperatures, *International Journal of Food Properties*, 2016, DOI 10.1080/10942912.2016.1199037.
30. Pop Flavia, Giurgiulescu Liviu, Dumuța Anca, Voșgan Zorica, Assessment of lipolytic and oxidative changes in fish oil stored under refrigeration and freezing, *Revista de Chimie*, 2013, 64(11), 1372-1376.
31. Pop Flavia, Giurgiulescu Liviu, Dumuța Anca, Voșgan Zorica, The influence of frozen storage on fatty acids composition for alimentary animal fats, *Studia Universitatis Babes-Bolyai. Seria Chemia*, 2013, LVIII, 3, 31-38.

#### Products and technologies:

1. Obtaining of  $\text{CoFe}_2\text{O}_4$  magnetic nanoparticles embedded in silica matrix
2. Method of determination of the microelements transfer factors from soil to plant
3. Method of assessment the risk on the health consumers due to the consumption of vegetables grown on contaminated areas with microelements
4. Data base on soil and plant microelement content on some anthropic polluted areas in Baia Mare zone and in a reference area without pollution sources.

<b>The offer addressed to the economic environment</b> Research & development	Determination of soil characteristics related to the transfer process of the pollutant elements from soil to plants: pH, hydrolytic acidity, cationic exchange capacity, organic matter content (humus), total nitrogen content, mobile phosphorus and potassium, granulometric analysis of soil and clay content. Studies on the historical and actual pollution sources with different microelements Quantifying the impact of microelements in soil on the plants grown in areas with historical anthropogenic pollution and comparison with unpolluted reference areas Studies on air pollution sources. Develop the "Action Plan for Good Air Quality Maintenance in Maramures County"
Consulting	Modeling the transfer factors soil-plant and the traceability of microelements on the food chain soil-plant-food-human. Human health risk assessment due to the consumption of vegetables and fruit grown in areas polluted with microelements.
Training	Training the students and high school students from Baia Mare and surroundings rural on the negative effects of microelements on soil, living organisms and human health, measures of minimizing the risk to the health. Training on the nanoparticles synthesis and their application in environment and food analysis