Universitatea Transilvania din Brașov

Interdisciplinary Doctoral School

ADMISSION TO DOCTORAL STUDIES Session September 2023

Field of doctoral studies: Environmental Engineering
Doctoral supervisor: Prof. Dr. Luminița ANDRONIC

TOPICS FOR THE ADMISSION TO DOCTORAL STUDIES

TOPIC 1: *Nature-Based Solutions: Leveraging Green Walls for Greywater and Air Quality in Urban Retrofitting*

Contents/Main aspects to be considered - Modern urban sustainability recognizes the importance of harmoniously combining technological advances with nature-based solutions (NBS). This blend is especially crucial when considering existing infrastructure, offering a compelling strategy for enhancing energy and water efficiency, fostering environmental resilience, and improving air quality. Greywater, primarily sourced from household activities (excluding sewage), represents a valuable but often underutilized resource for reuse in non-drinking applications. This research examines various methods of collecting, treating, and reusing greywater, particularly natural techniques like green walls and bio-filtration systems. Integrating plants on building facades brings multiple advantages: they provide extra insulation, amplify aesthetic appeal, mitigate urban noise, and play a vital role in removing air pollutants, contributing to cleaner urban air. The study explores the potential of vertical green walls as an all-in-one solution for managing and purifying greywater and stormwater while also serving as a mechanism for air pollutant removal.

Recommended bibliography:

Tsatsou, A.; Frantzeskaki, N.; Malamis, S. Nature-Based Solutions for Circular Urban Water Systems: A Scoping Literature Review and a Proposal for Urban Design and Planning. *J. Clean. Prod.* **2023**, *394*, 136325. https://doi.org/https://doi.org/10.1016/j.jclepro.2023.136325.

Kisser, J.; Wirth, M.; De Gusseme, B.; Van Eekert, M.; Zeeman, G.; Schoenborn, A.; Vinnerås, B.; Finger, D. C.; Repinc, S. K.; Bulc, T. G.; Bani, A.; Pavlova, D.; Staicu, L. C.; Atasoy, M.; Cetecioglu, Z.; Kokko, M.; Haznedaroglu, B. Z.; Hansen, J.; Istenič, D.; Canga, E.; Malamis, S.; Camilleri-Fenech, M.; Beesley, L. A Review of Nature-Based Solutions for Resource Recovery in Cities. *Blue-Green Syst.* **2020**, *2* (1), 138–172. https://doi.org/10.2166/bgs.2020.930

Seddon, N.; Chausson, A.; Berry, P.; Girardin, C. A. J.; Smith, A.; Turner, B. Understanding the Value and Limits of Nature-Based Solutions to Climate Change and Other Global Challenges. *Philos. Trans. R. Soc. B Biol. Sci.* **2020**, *375* (1794). https://doi.org/10.1098/rstb.2019.0120

Prerequisites / Remarks: While a background in Environmental Engineering, Materials Science, or Chemical Engineering is recommended, candidates with related degrees or

interdisciplinary backgrounds may also be considered based on their qualifications and research interests.

TOPIC 2: *Sustainable Metal Extraction from Mining Wastes: An Innovative Approach in Environmental Engineering for Resource Recovery and Environmental Remediation*

Contents / Main aspects to be considered

The Ph.D. program focuses on magnetic nanoparticles embedded with ligands for efficient and selective metal extraction from mining waste. The program aims to maximize resource utilization by recovering previously uneconomical metals while minimizing environmental impact. Adopting Advanced Oxidation Processes (AOP) for metal purification and integrating innovative extraction and purification methods contribute to comprehensive metal recovery and recycling. The program also emphasizes effective remediation of toxic metals in mining waste and seeks to develop environmentally friendly approaches for CO_2 capture and conversion into renewable hydrocarbons. The program aims to advance sustainable resource recovery and environmental remediation in the mining industry.

Recommended bibliography:

Gilbert, C.; Ayanda, O. S.; Fatoba, O. O.; Madzivire, G.; Petrik, L. F. A Novel Method of Using Iron Nanoparticles from Coal Fly Ash or Ferric Chloride for Acid Mine Drainage Remediation. *Mine Water Environ.* **2019**, *38* (3), 617–631. https://doi.org/10.1007/s10230-019-00605-5.

Whitworth, A. J.; Vaughan, J.; Southam, G.; van der Ent, A.; Nkrumah, P. N.; Ma, X.; Parbhakar-Fox, A. Review on Metal Extraction Technologies Suitable for Critical Metal Recovery from Mining and Processing Wastes. *Miner. Eng.* **2022**, *182* (March), 107537. https://doi.org/10.1016/j.mineng.2022.107537.

Madden, D. G.; Babu, R.; Çamur, C.; Rampal, N.; Silvestre-Albero, J.; Curtin, T.; Fairen-Jimenez, D. Monolithic Metal–Organic Frameworks for Carbon Dioxide Separation. *Faraday Discuss.* **2021**, *231*, 51–65. https://doi.org/10.1039/D1FD00017A.

Prerequisites / Remarks: While a background in Environmental Engineering, Materials Science, or Chemical Engineering is recommended, candidates with related degrees or interdisciplinary backgrounds may also be considered based on their qualifications and research interests.

TOPIC 3: *Implementation of an Integrated Water Treatment System: Microplastics Degradation through Advanced Oxidation*

Contents / Main aspects to be considered

The PhD program aims to develop an integrated water treatment system that addresses the critical global problem of microplastic pollution. The innovative system focuses on microplastics' degradation by applying advanced oxidation processes. The research will also investigate the influence of photocatalysts on contaminants of emerging concern (CECs) that may be adsorbed onto microplastics. To ensure the safety of the treated water, ecotoxicity tests will be performed using various aquatic organisms. Moreover, this program will delve into the kinetics of decomposition, utilizing advanced surface analysis techniques to study microplastic erosion. This multi-faceted approach will provide valuable insights into the mechanisms of microplastic degradation and aid in the development of efficient water treatment technologies.

Recommended bibliography:

Rizwan, K.; Bilal, M. Developments in Advanced Oxidation Processes for Removal of Microplastics from Aqueous Matrices. *Environ. Sci. Pollut. Res.* **2022**, *29* (58), 86933–86953. https://doi.org/10.1007/s11356-022-23545-0.

Ricardo, I. A.; Alberto, E. A.; Silva Júnior, A. H.; Macuvele, D. L. P.; Padoin, N.; Soares, C.; Gracher Riella, H.; Starling, M. C. V. M.; Trovó, A. G. A Critical Review on Microplastics, Interaction with Organic and Inorganic Pollutants, Impacts and Effectiveness of Advanced Oxidation Processes Applied for Their Removal from Aqueous Matrices. *Chem. Eng. J.* **2021**, *424*, 130282. https://doi.org/10.1016/j.cej.2021.130282.

Dos Santos, N. de O.; Busquets, R.; Campos, L. C. Insights into the Removal of Microplastics and Microfibres by Advanced Oxidation Processes. *Sci. Total Environ.* **2023**, *861* (October 2022), 160665. https://doi.org/10.1016/j.scitotenv.2022.160665.

Tunali, M.; Uzoefuna, E. N.; Tunali, M. M.; Yenigun, O. Effect of Microplastics and Microplastic-Metal Combinations on Growth and Chlorophyll a Concentration of Chlorella Vulgaris. *Sci. Total Environ.* **2020**, *743*, 140479. https://doi.org/10.1016/j.scitotenv.2020.140479.

Prerequisites / Remarks: While a background in Environmental Engineering, Materials Science, or Chemical Engineering is recommended, candidates with related degrees or interdisciplinary backgrounds may also be considered based on their qualifications and research interests.

Doctoral supervisor,

Prof. Dr. Luminita ANDRONIC

Signature

Coordinator of the field of doctoral studies,

Prof. Dr. Luminita ANDRONIC

Signature