

## Biotechnology in Metal Extraction and Recycling (I002924)

**Course size** *(nominal values; actual values may depend on programme)*

**Credits** 4.0

**Study time** 120 h

**Course offerings in academic year 2023-2024**

A (Year)

English

Gent

**Lecturers in academic year 2023-2024**

Hedrich, Sabrina

FREIBE01

lecturer-in-charge

**Offered in the following programmes in 2023-2024**

[International Master of Science in Sustainable and Innovative Natural Resource Management](#)

**crdts**

4

**offering**

A

**Teaching languages**

English

**Keywords**

**Position of the course**

**Contents**

1. Microbial basics, cell structure, metabolism
2. Energy acquisition, redox reactions, microbial element cycling
3. Microbial habitats and biofilms, extremophiles
4. Biomining microorganisms, iron- and sulfur metabolizing acidophiles
5. Basics of bioleaching and biooxidation, mechanisms
6. Biomining technologies, stirred tank, heap and dump bioleaching, BIOX process
7. Bioleaching of primary and secondary resources, ores, technologies
8. Metal extraction from secondary resources, mine tailings, urban waste, advances in application and technologies
9. Stirred tank bioreactor operation, heap bioleaching, set up and control
10. Biological metal recovery from waste water, iron oxidizing and sulfate reducing microorganism, application examples
11. Biosorption, bioaccumulation, biosynthesis of nanomaterials
12. Analytical methods in biohydrometallurgy

**Initial competences**

Bachelor degree in natural science, mining- or metallurgy-related engineering.  
Basic knowledge in chemistry.

**Final competences**

- 1 After successfully completing the module, the students are able to:
  - describe basics in microbiology and the general concept of microbial lifestyle and metabolism
- 2 • balance the advantages and limitations of various biohydrometallurgical process options
- 3 • identify the role of different types of microorganisms in the process and how they catalyze metal recovery and interact with each other and their environment
- 4 • apply the taught methods and basics to analyze given case studies and present and discuss the results in a seminar

**Conditions for credit contract**

This course unit cannot be taken via a credit contract

#### **Conditions for exam contract**

This course unit cannot be taken via an exam contract

#### **Teaching methods**

Seminar, Lecture, Independent work

#### **Learning materials and price**

#### **References**

Michael T Madigan; Kelly S Bender; Daniel H Buckley; W Matthew Sattley; David Allan Stahl, Brock biology of microorganisms, Pearson, 2018.  
D. R. Lovley (Ed.): Environmental Microbe-Metal Interactions, ASM Press, 2014.  
D.B. Johnson, C.G. Bryan, M. Schlömann, F.F. Roberto (Eds.) - Biomining Technologies. Springer. 2022.  
E. R. Donati & W. Sand (Eds.) Microbial Processing of Metal Sulfides, Springer, 2007.  
L. G. Santos Sobral, D. Monteiro de Oliveira & C. E. Gomes de Souza (Eds.): Biohydrometallurgical Processes: a Practical Approach, CETEM/MCTI, 2011.

#### **Course content-related study coaching**

#### **Assessment moments**

end-of-term and continuous assessment

#### **Examination methods in case of periodic assessment during the first examination period**

Presentation, Written assessment

#### **Examination methods in case of periodic assessment during the second examination period**

Presentation, Written assessment

#### **Examination methods in case of permanent assessment**

Presentation

#### **Possibilities of retake in case of permanent assessment**

examination during the second examination period is possible in modified form

#### **Calculation of the examination mark**