

# MSCA COFUND Doctoral Fellowships “Sustainable Valorization of Industrial Mineral Residues: Comprehensive Characterization and Advanced Material Applications”

## Summary

*This PhD topic is part of the INNOCHEMBIO Doctoral Programme, which is funded through the Marie Skłodowska-Curie Actions (MSCA) COFUND action. The main objective of INNOCHEMBIO is to train future experts of sustainable chemistry and biotechnology, helping Europe to take the next steps in the green transition. This project aims to refine various mineral resources and mining residues that remain after the removal of organic fractions for various high-tech applications. The approach follows the cascade principle. These inorganic materials are going to be physicochemically thoroughly characterized to assess their feasibility in/as, e.g., catalysis, energy storage and construction materials. This PhD position will be hosted at TalTech with main supervisor Dr. Birgit Mets and will contain a secondment to co-supervisor Prof. Vesa-Pekka Lehto at The University of Eastern Finland (FI).*

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|-----------------------|-------------------------------------------------------------------------------------------------|
| Research field:       | Chemistry and biotechnology                                                                     |
| Supervisor:           | Dr. Birgit Mets                                                                                 |
| Availability:         | This position is available.                                                                     |
| Offered by:           | School of Science<br>Department of Chemistry and Biotechnology                                  |
| Application deadline: | Applications are accepted between July 01, 2025 00:00 and August 31, 2025 23:59 (Europe/Zurich) |

## Description

### 1. General description of programme and host

The PhD fellowship is part of the Marie Skłodowska-Curie Actions (MSCA) COFUND doctoral programme INNOCHEMBIO (<https://taltech.ee/en/innochembio>), which is co-funded by the European Union (Grant agreement 101217295). The main objective of INNOCHEMBIO is to train future experts to help Europe take the next steps in the green transition. The solutions and trained experts can reduce the environmental impact of the chemical and agricultural industries, offer eco-friendly analytical techniques, and assess the safety of new materials. INNOCHEMBIO funding will co-finance **15 PhD positions**, for which the application process in the first call will start on the **1st of July in 2025**.

For 12 PhD positions the hosting institution will be Department of Chemistry and Biotechnology (DCB) at Tallinn University of Technology (TalTech) which combines three divisions – Chemistry, Gene Technology and Biomedicine, and Food and Biotechnology. DCB is developing solutions to the great challenges of the 21st century – climate change, environmental protection, carbon neutrality, renewable energy, and biodiversity conservation. DCB hosts the second biggest PhD programme in TalTech with nearly a hundred enrolled students.

For 3 PhD positions the hosting institution will be the implementing partner – National Institute of Chemical Physics and Biophysics (NICPB). NICPB is a public research institution that conducts both fundamental and applied research, developing novel directions in fields ranging from material sciences to informatics. NICPB houses the Laboratory of Environmental Toxicology and several laboratories focused on fundamental research in NMR technologies with expertise dating back decades. The PhD training activities conducted by NICPB are funded through TalTech.

Importantly, each PhD project has one co-supervisor from another European country, which is detailed under the specific offer (see under supervisors' section). In total, INNOCHEMBIO has **19 associate partners from 11 European countries**.

### 2. Description of specific PhD project

The Industrial Chemistry Laboratory has developed a unique method for the production of dicarboxylic acids directly from oil shale, without the need for pyrolysis or combustion, thereby offering a way of security of supply of basic chemicals. In addition to dicarboxylic acids, the process also generates other organic acids and mineral by-products, all of which have potential for further valorization. Although there are several known applications for these versatile compounds, new fields need to be investigated to maximize their potential and further expand their use.

It is also important to emphasize that working with these materials is not limited to the direct conversion of oil shale — on the contrary, we believe the knowledge generated around both dicarboxylic acids and mineral residues has wide relevance, ex. from lignite (brown coal) to lignin processing residues, both of which involve the handling of hundreds of millions of tons of material globally. The goal of the project is to refine various mineral resources and mining residues that remain after the removal of organic fractions for various high-tech applications. These materials might possibly still contain some organic material which can be successfully utilized. The research can be split into two, depending on whether the focus will be set on the organic components or inorganic materials combined with materials science.

The first goal focuses on the analysis of the mineral parts that remain after the removal of organic matter. These inorganic materials need to be physicochemically thoroughly characterized (chemical composition, physical properties) to assess their feasibility in/as, e.g., catalysis, energy storage and construction materials. The potential use of light modification or treatment methods will be investigated, and their suitability will be assessed by determining whether the applicability was enhanced and to which extent. The advanced materials characterization will be carried out during the planned secondment at the University of Eastern Finland, at the laboratory of the distinguished professor Vesa-Pekka Lehto. This offers another perspective into the research thanks to the use of different analytical methods, and the international experience obtained will be highly useful.

The second goal is to convert compounds derived from organic matter into plasticizers. By transforming diacids into mono- or polymeric plasticizers, their properties can be improved and applications broadened — from defense to consumer plastics. A key innovation is the integration of inorganic residues from the same process (or other industry waste, like oil shale ash) as catalysts or fillers. Modified oil shale ash has already been successfully used in derivatization reactions (such as transesterification) and helps in reducing reliance on virgin mineral resources. Therefore, the focus of the second goal will be on developing new plasticizers, binders, and material systems by adapting the production process such as testing diacid mixtures with novel catalysts. Strong emphasis will be also placed on product composition and performance analysis.

The candidate can decide whether they are interested in both goals or would prefer to focus primarily on one, while actively collaborating with other ongoing research directions in the lab. He/she is expected to describe their preference in the motivational letter, along with some general ideas on how they would approach the topic.

This project can be considered as a combination of organic synthesis, analytical chemistry, materials characterization, it also includes development and requires an in-depth analysis of the properties of the resulting material to determine their applicability in a wide variety of applications. The ultimate aim is to create materials that match or exceed current standards, while leveraging local raw materials and integrated process design.

Link to the project: <https://taltech.ee/en/innochembio/mets>

### 3. Supervisory team

- Tallinn University of Technology (main supervisor): Dr. Birgit Mets
- University of Eastern Finland (Finland): Prof. Vesa-Pekka Lehto (The PhD student will stay 6-16 months at the co-supervisor's lab as mutually agreed upon).
- Tallinn University of Technology: Dr. Kristiina Kaldas

### 4. Requirements

- Excellent command of written and spoken English.
- MSc degree or equivalent in chemistry or biotechnology, or equivalent.
- Compliance with the rules of INNOCHEMBIO (e.g. eligibility, adhering to MSCA mobility rules, etc.).
- The primary workplace will be in Estonia. Therefore, candidates from outside the EU must be eligible to obtain a visa. The position is expected to start in the first half of 2026.
- A successful candidate is expected to have a background in chemistry – experience in organic synthesis and material science are prerequisites, with knowledge about natural resources and raw materials being crucial as well.
- Additionally, experience in analytical chemistry (the use of different methods) is needed to be able to investigate the structure and properties of the materials obtained.
- The candidate must have at least 4 years of experience working in a research laboratory dealing with similar topics.
- Beneficial features include willingness to learn, independence, good teamwork skills, curiosity and high analytical abilities.

### 5. Duties and Responsibilities

- Undertake postgraduate research for specific doctoral research project at TalTech or NICPB, respectively.

- Present and publish research in both academic and non-academic audiences. Attend and participate in academic and non-academic conferences, events and seminars.
- Attend and participate in all training events and supervisory meetings.
- Be seconded to the associated partner as necessary to fulfil the grant obligations.
- Prepare progress reports and similar documents on research for funding bodies, as required.
- Actively contribute to the public engagement and outreach activities of the project.
- The above job descriptions are not exhaustive, the PhD candidate may be required to undertake other tasks, which are broadly in line with the above duties and responsibilities.
- Full-time employment (40 hours per week), temporary contract for 4 years.

## 6. Eligibility requirements

- The applicant must be a doctoral candidate (i.e. not already in possession of a doctoral degree at the date of the recruitment).
- At the time of recruitment, the researcher must not have resided or carried out their main activity (work, studies, etc.) in Estonia for more than 12 months in the three years immediately prior to the recruitment date. Compulsory national service and/or short stays such as holidays are not taken into account.

## 7. Benefits

- Competitive funding scheme, with a minimum gross monthly salary of EUR 2500. Topped by additional mobility allowances as well as optional family allowances (if applicable).
- Covered tuition costs, research costs and funding for short term mobility (i.e. conference attendance).
- Interdisciplinary and international research projects.
- Early-stage researcher position, with corresponding social and medical benefits in Estonia.
- Becoming a Marie Skłodowska-Curie PhD fellow.

## 8. How to Apply

All applications must be sent through TalTech's official application platform Glowbase and only applications submitted here will be considered for the programme. We ask the candidates not to contact the supervisors directly, in case of questions please write at [innocembio@taltech.ee](mailto:innocembio@taltech.ee). Each application must include the following material: CV, 1-page motivation letter, copies of BSc and MSc study records and diplomas, scanned copy of valid photo ID, 2 reference letters, eligibility statement. **NB! Details on the exact nature of these documents and how to insert them in Glowbase can be found at our official INNOCHEMBIO website:** <https://taltech.ee/en/innocembio/application-process>

## 9. Selection Process

The selection and recruitment process will be in accordance with the European Charter and Code of Conduct for the Recruitment of Researchers. The recruitment process will be open, transparent, impartial, equitable, and merit-based. There will be no overt/covert discrimination based on race, gender, sexual orientation, religion or belief, disability or age. To this end, the following selection criteria will be considered.

The application deadline is 31 August 2025. The application process will be carried out in 3 steps. In short, first an eligibility check is performed. All eligible candidates will proceed to stage 1, where they will be evaluated by independent evaluators based on the application documents. Lastly, shortlisted candidates from stage 1 will proceed to stage 2, where they will be interviewed via teleconference, which will be used to determine a candidate to whom an offer will be made. All candidates will be informed about the progress in due course after each step of the process. The selection process is described on the guide for applicants available here: <https://taltech.ee/en/innocembio/application-process>.

## 10. Disclaimer

By applying for this position, the applicants

1. give their consent to circulate their application and personal data within the INNOCHEMBIO consortium and with the evaluators;
2. confirm that the data provided is valid and accurate;
3. confirm compliance with the eligibility requirements;



4. commit to undertaking the planned secondment at the co-supervisor's institution.



To get more information or to apply online, visit <https://taltech.glowbase.com/positions/1028> or scan the the code on the left with your smartphone.