

## **Internship proposal at Photogranule team, INRA-LBE, Narbonne**

### **Project description**

Oxygenic photogranules (OPGs) are roughly spherical aggregates of a few millimetres in diameter consisting of a syntrophic community of motile filamentous cyanobacteria and heterotrophic bacteria (Milferstedt et., 2017). Photogranules may potentially be used to treat wastewater. Their in-situ produced oxygen can replace costly mechanical aeration for pollutant removal (Abouhend et al., 2018).

Oxygenic photogranules can be produced from activated sludge, the biological aggregates used for treating wastewater. This sludge is transferred into unagitated vials and exposed to light. Over the course of several weeks, the unconsolidated sludge transforms into one static photogranule per vial.

With my PhD thesis I aim to better understand the minimal requirements for photogranulation. I hypothesize that the behaviour of motile filamentous cyanobacteria is key to photogranulation and that cyanobacteria types and their relative abundance determine granulation success, i.e. OPG formation. I therefore isolated cyanobacteria from OPGs.

Research question for the internship

How do traits of isolated cyanobacteria relate to the development of photogranules?

The isolated strains of cyanobacteria need to be characterized to better understand which properties are specifically important for photogranulation. The proposed project investigates the cell surface properties, i.e., bound extracellular polymeric substances (EPS), of the cyanobacterial isolates. This project aims to relate the effect of EPS on aggregation and hydrophobicity of cyanobacterial isolates alone and with other microorganisms, i.e., in combination with activated sludge during static cultivation.

As an intern on this project...

(1) ... you will learn how to extract EPS from cyanobacterial filaments. This work will be done in part at LBAE-LISBP, Auch. Two stays in Auch with a length of two to three weeks is scheduled. In between the stays, you will optimize the protocol for EPS extraction for our cyanobacterial isolates at INRA-LBE in Narbonne. EPS extractions will be done in Narbonne, and the characterization of the EPS in Auch. In addition, you will produce photogranules from activated sludge augmented with the cyanobacterial isolates. These photogranules will also eventually be subjected to EPS characterization.

(2) ... you will characterize traits of the cyanobacterial isolates based on microscopy (gliding motility, cell dimensions, and other criteria to be developed).

### **Requirements**

- Relevant master study, e.g., microbiology, life sciences
- Experience and skills using microbiology techniques (aseptic work, culturing)
- A structured and accurate method of working as a large set of diverse data will be collected and treated
- Ability to work independently and proactively
- Good communication and cooperation skills
- Good level of English (oral and written)

**Additional information**

- Internship for 6 months (full-time), starting from January 2020
- Research stay at Auch for a few weeks at the start and end of your internship. Please note: Transport will be provided but no additional compensation can be paid in addition to the standard salary.

Contact [esmee.joosten@inra.fr](mailto:esmee.joosten@inra.fr) for questions!

**References**

Milferstedt K et al. (2017) The importance of filamentous cyanobacteria in the development of oxygenic photogranules. *Sci Rep* 7:1-15.

Abouhend AS et al. (2018) The oxygenic photogranule process for aeration-free wastewater treatment. *Environ Sci Technol* 52:3503–3511.