Naturally occuring cyanobacteria can form oxygenic photogranules to treat wastewater

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NATURALLY OCCURRING CYANOBACTERIA CAN FORM OXYGENIC PHOTOGRANULES TO TREAT WASTEWATER

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Abstract

Oxygenic photogranules (OPGs) are roughly spherical aggregates with diameters of several millimeters containing a syntrophic community of heterotrophic bacteria and cyanobacteria, predominantly of the order *Oscillatoriales* [1]. OPGs may potentially be used in wastewater treatment because their in-situ produced oxygen can replace costly mechanical aeration for pollutant removal [2]. Toxin production could however nullify their application.

OPGs can be produced from "activated sludge", the aerobic microbial 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 photogranule per vial. Curiously, in replicates using the same sludge, a granule does not always form: sometimes microbial mats result or the material remains unconsolidated.

We therefore aim to better understand the initial conditions for photogranulation, specifically the role of filamentous cyanobacteria. We hypothesize that the behavior of *Oscillatoriales* is key to photogranulation and that cyanobacteria type and their relative abundance determine granulation success, i.e., OPG formation.

We therefore investigate whether the formation of microbial mats, well-formed photogranules and intermediates, correlates to the presence of a specific microbial community. We performed nine granulation experiments which resulted in 135 qPCR corrected amplicons from both partial 16S (all bacteria) and 23S (cyanobacteria and algae) rRNA genes from samples on a gradient of granulation success.

From sequence analysis we learnt that several *Oscillatoriales* species are able to form photogranules. For an application in wastewater treatment, we now need to evaluate whether operational conditions may lead to toxin production.

References

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

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

Acknowledgements

This work was funded by GAIA Graduate School of Montpellier University of Excellence (100% PhD fellowship) and ANR project PSST ANR-16-CE04-0001.