

Internship/Thesis Vacancy: Cultivation of Cyanobacteria on Urine for Nutrients Recovery

Background

Human urine has high nutrients content, containing up to 80% of the nitrogen (N) and 40% of the phosphorous (P) that end up in household wastewater, while accounting for only 1% of its volume¹. Technologies aiming to recover these nutrients from urine are generally limited by the difference in the N:P ratio of urine and that of the obtained product. The cultivation of microalgae in source-separated urine is one of these technologies. The microalgae *Chlorella sorokiniana* can be cultivated in source-separated urine when sufficient trace elements are supplemented. Microalgae cultivation in chemostat reactors fed with source separated urine (N:P of 37:1) resulted in a simultaneous recovery of 70% and 99% of nitrogen and phosphorous, respectively. Nitrogen recovery stopped when the microalgae growth was limited by the lack of phosphorous in the medium².

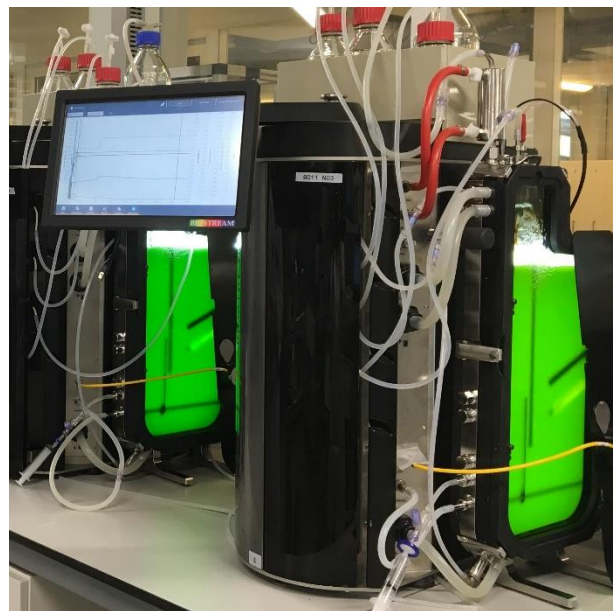
Previous studies show that the cyanobacteria strain *Synechocystis* PCC6803 can also be cultivated on synthetic urine giving N:P ratios up to 92:1³. Based on the high N:P ratio observed in *Synechocystis* it is expected to achieve simultaneous recovery of nitrogen and phosphorous from urine.

Project plan

After successful batch cultivation of cyanobacteria on urine in shaking flasks, we will cultivate cyanobacteria on urine in a continuous process. As a key person in the success of this project you will operate lab-scale flat panel photobioreactors (PBRs) cultivating cyanobacteria on synthetic and real urine. You will assess the performance and nutrient recovery of the process by performing experiments in the lab. This will require, among others, studying the concentration of nutrients and biomass in the influent and effluent of the PBRs and the elemental composition of the produced biomass. You will investigate the technical feasibility of this technology.

Requirements

- EU citizen or international student registered at a Dutch university enrolled in graduate (MSc) studies.
- Strong background in chemical, environmental, bioprocess engineering, applied microbiology or related areas.
- Fluency in English both spoken and written.
- Previous experience on operation of bioreactors is a plus.



Starting date: April/May 2022

Duration: 6 months (Either Internship or Thesis are possible within this project)

This project is carried out at Wetsus, Centre of Excellence for Sustainable Water Technology, located in Leeuwarden, the Netherlands www.wetsus.nl in cooperation with the Chair of Environmental Technology and the Division of Bioprocess Engineering of Wageningen University and Research www.wur.nl. At Wetsus, you will work in a young, dynamic and inspiring environment with around 60 PhD and 30 BSc/MSc students from many different nationalities working on a wide range of research topics in water technology

For questions about this project please contact Sebastian Canizales (sebastian.canizalesgomez@wur.nl) or apply directly by sending your C.V. with motivation letter to the same address.

¹ Canizales S, Sliwsczinka M, Russo A, et al (2021) Cyanobacterial growth and cyanophycin production with urea and ammonium as nitrogen source. *J Appl Phycol.*

² K. Tuantet, H. Temmink, G. Zeeman, et al (2014) Nutrient removal and microalgal biomass production on urine in a short light-path photobioreactor, *Water Res.*

³ Kujawa-Roeleveld K, Zeeman G (2006) Anaerobic treatment in decentralised and source-separation-based sanitation concepts. *Rev Environ Sci Biotechnol*