Research Unit
Environmental Engineering and Biotechnology

SusBioTech

IP Sustainable Biotechnology and Bioeconomy
Lecture

Prof. Annemiek ter Heijne
Wageningen University & Research, The Netherlands

Friday, 15 November 2019, 09:00
Leipziger KUBUS, Lecture Hall 2
Permoserstr. 15, 04318 Leipzig

Bioelectrochemical Nutrient Recovery

Microbial Electrochemical Technologies have seen many advances over the past decade. I will give an overview of promising applications of Microbial Electrochemical Technologies for nutrient recovery.

First of all, many streams that are rich in ammonium are currently discharged into wastewater treatment plants, where ammonium is removed via the traditional nitrification/denitrification process. When these concentrated streams are collected at the source, bio-anodes can be employed to drive ammonium recovery from anode to cathode, where ammonia can be concentrated and recovered. I will show how different reactor configurations and experimental approaches can be used to study and improve ammonium recovery from, e.g., urine.

Secondly, biological desulfurization under haloalkaliphilic conditions is widely applied in industry for removal and conversion of H_2S gas. Sulfide-oxidizing bacteria (SOB) oxidize dissolved sulfide with oxygen as electron acceptor at high pH and high salinity. This process requires energy for aeration. We studied sulfide oxidation at the anode in presence and absence of SOB at high initial sulfide concentrations. In presence of SOB, a current could be maintained, whereas in absence of SOB, current rapidly decreased, probably due to electrode passivation as a result of sulfur deposition. We also studied sulfide oxidation by SOB in the absence of oxygen. When SOB were exposed to a solution with low sulfide concentration (0.1 mM), they removed all sulfide from solution. After SOB were transferred to an electrochemical cell, they released electrons to an anode in absence of free sulfide. SOB can therefore shuttle electrons between sulfide and an electrode.

Since bio-anodes are the key to different nutrient recovery technologies, I will show how we can use in-situ optical techniques to quantify and understand biofilm growth on electrodes.

After receiving her PhD in 2010, Annemiek ter Heijne worked as Postdoctoral Researcher on the topic of bioelectrochemical systems and biobased economy at Wageningen University. Since 2012, Annemiek ter Heijne is Assistant Professor at the same university. In this position, she combines teaching in the field of renewable energy from a thermodynamic perspective with research on microbial electrochemical technologies. Her current projects focus on metal recovery, ammonium recovery, capacitive bio-anodes for wastewater treatment, and the conversion of electricity and CO_2 into methane. Annemiek ter Heijne was awarded this year's prestigious Dutch VIDI grant and she is Vice-president Europe of the International Society for Microbial Electrochemistry and Technology (ISMET).

All interested colleagues are kindly invited.