
Exploring the methanogenic activity of mangrove microbiota in bioelectrochemical system

Olivia Ozier*^{†1}, Prescilla Lambert², Saraï Mola¹, Véronique Thimon-Callier¹, Michaël Rimboud¹, Florent Robert¹, and Paule Salvin¹

¹Laboratoire des Matériaux et Molécules en Milieu Agressif L3MA - Université des Antilles – Martinique

²Laboratoire des Matériaux et Molécules en Milieu Agressif L3MA - Université des Antilles – Martinique

Abstract

Fossil energy sources serve as the backbone of energy production systems. However, these resources are limited, and their exploitation induces climate change, posing a threat to life. Developing renewable alternative energy sources is essential. Methanogenesis, a biological process in which organic matter is degraded by methanogenic archaea, reduces carbon compounds to methane. Electromethanogenesis, based on the electrochemical stimulation of these microorganisms, offers a promising approach to enhancing biogas production efficiency. Mangroves, as coastal ecosystems known for their high organic matter content and rich microbial biodiversity, represent an underexplored reservoir of this metabolic process, as evidenced by the limited number of studies on this subject. However, Mangroves provide favorable conditions for the development of methanogenic communities adapted to extreme environments, which could be of interest in bioelectrochemical systems (BES). While the electroactivity of mangrove bacteria has been demonstrated, their potential for electromethanogenesis remains unexplored. This study therefore aims to investigate their capacity to produce methane in a BES. Specifically, we seek to characterize the methanogenic community in mangrove sediments and evaluate its methane production potential within a microbial electrolysis-type bioelectrochemical system. Electrochemical techniques were applied using three-electrode systems immersed in inoculated electrolytes. The cathode potential was set at -744 mV vs. SCE. Chronoamperometry was used to monitor current intensity and assess electroactive bacterial activity, and biogas production was quantified volumetrically. The initial results obtained show that electrical stimulation increases biogas production by microorganisms, highlighting the role of microbial catalysis in biogas generation within the bioelectrochemical system compared to unstimulated controls.

Keywords: Methanogenesis, Bioelectrochemical system (BES), Electromethanogenesis, Mangrove microbiota, Methanogenic archaea, Biogas production

*Speaker

[†]Corresponding author: oli.ozier@gmail.com