BIOLOGICAL HYDROGEN PRODUCTION FROM BIOMASS SUGARS BY ELECTROCHEMICALLY-ASSISTED HYDROGEN PRODUCTION IN MICROBIAL FUEL CELLS

Miriam Rosenbaum [1,2], Michael A. Cotta[2], Largus T. Angenent[1]
[1]Washington University in St. Louis, One Brookings Drive, Campus Box 1180 St. Louis, MO 63130;
[2]NCAUR-ARS-USDA, 1816N University St., Peoria, IL 61604

Use of hydrogen as a fuel, energy carrier, and valuable chemical is increasing in interest. Electrolytic hydrogen synthesis requires high voltages and is thus very energy intensive. Hydrogen production in Microbial Fuel Cell (MFCs) combines microbial processes with electrolytic hydrogen synthesis, whereby the majority of the electrolysis voltage is provided by microbial processes. The goal of the current research was to a develop (MFC) device with a highly energetic, sugar substrate-adapted microbial anode used to produce molecular hydrogen at the cathode, where the external power supply could be kept as low as possible. A binary culture of *Lactococcus lactis* and *Shewanella oneidensis* was studied for an efficient conversion of glucose into electricity in a continuouslyoperated chemostatic electrochemical reactor. The homolactic fermentation bacterium *L. lactis* fermented glucose almost exclusively to lactate – the favorite electron donor for the electricigen *S. oneidensis*. The latter bacterium cannot utilize sugars directly as electron donor in microbial fuel cells. *L. lactis* alone showed no electrochemical activity, while the maximum obtained current density for *S. oneidensis* in a pure culture in lactate based medium was about 12 µA/ cm², which confirms literature reports about this microorganism. However, supplementing the media with the requirements for *L. lactis* resulted in much higher electrochemical activity of the *Shewanella* biofilm. In the binary culture with glucose as primary fuel, the current density was sustained compared to the lactate fed mono-culture. The examination of the metabolic interactions between two defined species of microorganisms eventually will help to understand the complex foodweb among mixed bacterial communities in microbial fuel cells treating complex organic compounds.

Contact: Michael A. Cotta, Fermentation Biotechnology Research, ARS-USDA, 1815 N. University Street, Peoria, IL 61604, USA. Tel: 309-681-6500. E-mail: Mike.Cotta@ars.usda.gov