Title: **Effect of reactor configuration on performance of microbial electrolysis cell with anaerobic granular sludge for biohydrogen production**

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Abstract:

Hydrogen (H_2) is a promising clean and sustainable energy carrier that could potentially replace fossil energy carriers. It can play a crucial role in energy strategies, providing energy for passenger and freight vehicles as well as for power generation, to enable near-zero emissions in industrial processes (e.g. distributed power, combined heat and power). H_2 is commercially produced via electrolysis or thermochemical processes which are both highly energy-intensive and are responsible for the emission of atmospheric greenhouse gases. Therefore, environmentally friendly H_2 technologies with little energy consumption are needed. Electrohydrogenesis in microbial electrolysis cells (MECs) can yield more H_2 than thermochemical processes and is more energy efficient than electrolysis. Reactor configuration is an important consideration for electrochemical reactions and mass transfer in MECs. In this study, fed batch single- and dual-chamber MECs were operated to compare differences in the electrohydrogenesis performance at 0.8 V applied voltage and hydraulic retention time (HRT) of 48 h. The inoculum used was anaerobic granular sludge from a large-scale upflow anaerobic sequential batch reactor treating fruit processing wastewater. Results showed that current intensity, current density, COD removal efficiency, and H_2 production rate were higher in the dual-chamber MEC than in the single-chamber configuration. Electromethanogenesis

and homoacetogenesis scavenged the H_2 from electrohydrogenesis thus reducing H_2 generation, as demonstrated by cathodic efficiencies less than 10% in both reactor configurations. It appears that homoacetogenesis overshadowed H_2 production in the dual-chamber MEC, as reflected by a coulombic efficiency greater than 100%, likely induced by a high H_2 partial pressure. Higher H_2 recovery and production rates were obtained from the single-chamber MEC, but greater electromethanogenetic activity increased CH_4 concentrations in the biogas generated, potentially increasing the downstream processing costs from this reactor configuration. These results portray MECs as an energy-efficient (up to 50%) scheme for bioH_2 production in addition to removal of pollutants (COD). This study presented valuable information when deciding on suitable reactors and optimizing reactor design.

Biography:

Dr Maria Theresa Isla-Cabaraban is an experienced circular economy, energy, and environmental systems researcher with over 30 years of experience working on waste-to-energy R&D, including thermo- and biochemical conversion of waste streams. She is a professor at the Department of Chemical Engineering of Xavier University – Ateneo de Cagayan. She was the University's Research Ethics Coordinator and concurrently the Chairperson of the Xavier Ateneo Research Ethics Board. Before that, she was the Deputy Director of the Kinaadman University Research Office (KURO). As a Fulbright scholar, Dr Isla-Cabaraban finished her PhD in Environmental Resource Engineering at the State University of New York College of Environmental Science and Forestry in Syracuse, New York, USA. Fulbright also awarded her an Advanced Research Fellowship at the Michigan State University at East Lansing, Michigan, USA. She earned her Master of Science in Chemical Engineering at the University of the Philippines in Diliman, Quezon City and her Bachelor of Science in Chemical Engineering at Xavier University – Ateneo de Cagayan. She has led several energy-related funded and commissioned studies. Most of these research projects are published in Thomson ISI and Scopus indexed journals and were presented in national and international energy and environmental fora. Aside from research and teaching, she was also a Cleaner Production assessor for the Department of Science and Technology (DOST) Regional Office 10 and was part of the Metro Cagayan de Oro Airshed Governing Board in the province of Misamis Oriental. Dr Isla-Cabaraban is currently on secondment at the Department of Science and Technology in Bicutan, Taguig City working as a Science and Technology Fellow at the Philippine Council for Industry, Energy, and Emerging Technology Research and Development (PCIEERD).