J Phys Chem Biophys 2017, 7:2(Suppl)
DOI: 10.4172/2161-0398-C1-020

Bacterial attachment and biofilm growth at electric fields in electrochemical water treatment installations

Yoram Oren[1], **Itai Gal**[1], **Soumya Pandit**[1], **Nathan Kalson**[1], **Meagan S Mauter**[2] and **Moshe Herzberg**[1]
[1]Ben-Gurion University, Israel
[2]Carnegie Mellon University, USA

Electrochemical technologies have been experiencing a recent renaissance in water treatment. These techniques are used for brackish desalination as well as in industrial applications. Examples of electrochemical separation processes include electrodialysis (ED) and capacitive deionization (CDI) and its advanced version, membrane CDI (MCDI). Very little is reported about the biofouling propensity of electrochemical treatment processes used for natural types of water. Adhered cells are not only likely to decrease the ion capacity of the electrical double layer, electrode's conductivity and transport properties of ion exchange membranes, but also as inactivated or dead cells they might present a beneficial substratum for the undesired attachment and proliferation of approaching planktonic bacteria. Surprisingly, only a few studies in the ED, CDI, and MCDI fields deal with the fundamental aspects of bacteria adherence to the electrodes and the development of biofilms under the influence of the electric fields prevailing in these installations. Most of the studies in this field refer to the problem from a sanitary point of view, preventing device-related infections in hospital environments or disinfecting contaminated liquids. The mechanisms of bacteria inactivation remained however rather speculative in most of the mentioned reports. The present study is focused on the factors governing bio-macromolecule and bacterial adherence and biofilm development on electronically conductive surfaces such as carbon, graphite and gold, as well as on ion exchange membranes, in the absence and the presence of an externally applied electric field. A two-electrode flow cell including one transparent (ITO) electrode for on-line microscopic observations is used for bacterial attachment and biofilm growth studies. The biofouled electrodes are analyzed for biovolume and live/dead bacteria by using confocal laser microscopy (CLSM). Quartz crystal microbalance with dissipation and electrochemical module (E-QCM-D) is used for studying mass and rate of electrosorption of model bio-macromolecules and bacteria.

yoramo@bgu.ac.il

Characterization of carbon supported Pt nanocatalysts generated by coaxial pulse arc plasma deposition

Yoshiaki Agawa[1], **Hironobu Araki**[1], **Hiroyuki Tanaka**[1] and **Satoshi Tominaka**[2]
[1]Advance Riko Inc., Japan
[2]NIMS Japan

Coaxial arc plasma deposition source (CAOD) has generated the catalysts for fuel cells, exhaust gas and photo catalysts by forming metal plasma and depositing them uniformity onto powders as being catalyst supports. Especially for fuel cell catalysts, 5 wt% Pt/C catalysts generated by CAPD got higher catalytic activity than commercial 20 wt%, 5 wt% Pt/C catalysts with MOR and ORR. We made the evaluation of electrochemical property and morphological change by setting its supporting rate as 8.8 wt% and also compared to that of TEC10E50E. We generated Pt/C catalyst by using CAPD, which a large amount of current flowed to metals as catalyst and generated the metal plasmas, and supported them onto carriers (carbon). We used SEM and TEM for morphological characteristics observation and made the evaluation of electrochemical property (ORR measurement) with 0.5M H_2SO_4 as electrolyte and set the temperature at 20°C. Scan rate was set at 10 mV/s and the counting of reduction electrons has been done with RDE and RRDE. From morphological observations and results obtained by using SEM and TEM, it was observed that there was not much difference between the amount of Pt/C catalysts generated by CAPD and that of nano-particles on the surface of carbon by TEC10E50E. Specific activities by CAPD showed approximately 2 times higher value than that of electrochemistry. Their electrochemistry specific surface area was same level and mass activities by CAPD were 2 times higher value than that of TEC10E50E. However, we considered that the number of reduction electrons is smaller than 4 because there are some areas without platinum particles and H_2O_2 were formed on the surface of the carbon. We could recognize it with SEM observation as well. The results showed that the supporting method needs to improve in order to deposit platinum nano-particles uniformly in future

yoshiaki_agawa@advance-riko.com