Biocompatible P-FeMo/CP catalyst enabling efficient CO_2 fixation with *Ralstonia eutropha* H16

Chun-Wei Chou[1], *Ming-Hsi Chiang*[1]

[1]Institue of Chemistry, Academia Sinica, Taiwan

e-mail: zcw112023457@gapp.nthu.edu.tw

ABSTRACT

Hydrogen-driven microbial electrosynthesis (MES) represents a promising bio-electrochemical approach for converting CO_2 into value-added compounds. While the efficiency of microbial fermentation in MES is highly dependent on the rate of H_2 generation, conventional high-performance metallic H_2-evolving catalysts (HECs) often produce cytotoxic byproducts, such as H_2O_2 and metal ions, which may lead to a significant threat to microbial survival. Therefore, in this work, we evaluate cytotoxicity of different metal ions to design a biocompatible metallic HEC. Among them, 100 μM of Mo, V, W, Ca, Al, Mg, Fe shows good biocompatibility in bacterial culture. By electrodepositing and phosphorization these selected metal ions onto carbon paper (CP), the P-Fe-Mo/CP catalyst was fabricated and demonstrated the highest hydrogen evolution reaction (HER) activity, achieving an overpotential of 168 mV at 10 mA cm^{-2} in 1M potassium phosphate buffer (KPi), with the Tafel slope of 120 mV dec^{-1}. Moreover, under bulk electrolysis at 10 mA cm^{-1}, the P-Fe-Mo/CP catalyst shows negligible H_2O_2 and nearly 90% of Faraday efficiency (FE), which could stable up to 100hr, indicating great potential of the catalyst applied in bio-electrochemical CO_2 fixation system.