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Triazine-Based 2D-Covalent Organic Frameworks Enhances Electrochemical Performance of Enzymatic Biosensors

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Well-ordered two dimensional porous materials such as zeolites, covalent organic frameworks (COFs) and metal organic frameworks (MOFs) have impressed remarkable attention thanks to their great numbers of existing and potential applications. While researchers have utilized from these materials for the purpose of energy storage, optoelectronics or even drug delivery, there have been only a couple studies dealing with biosensor applications of organic frameworks [1, 2], yet, best to our knowledge, there have not been a study that uses COFs as biosensor matrix. In this study, we have focused on the synthesis and characterization of triazine based COFs (CTF-1), followed by application towards electrochemical enzymatic biosensors. We firstly modified screen-printed carbon electrode surface with gelatine-CTF-1 gel, and immobilized superoxide dismutase (SOD) enzyme, that catalyzes the dismutation reaction of superoxide radicals ($O_2^{-\cdot}$) into H_2O_2. Electrochemical impedance spectroscopy measurements showed that the charge transfer resistance (R_{ct}) of gelatine-CTF-1 modified electrode was nearly 21.7% lower than that gelatine modified electrode (Figure 1A). The amperometric spectrum demonstrated that the gelatine-CTF-1-SOD electrode showed an amperometric response that was 25.4% higher than that gelatine-SOD modified electrode (Figure 1B). These findings suggest that CTF-1 is a promising candidate to be used as electrochemical enzymatic biosensor component.

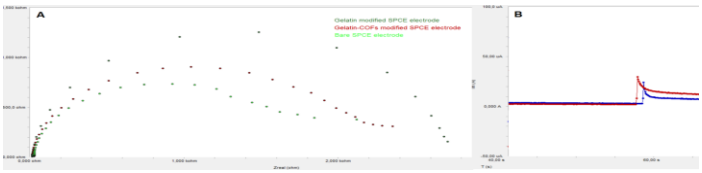

Figure 1: (A) EIS spectra, and (B) Amperometric spectra of gelatine-CTF-1-SOD biosensor

[1] Miller SE, Teplensky MH, Moghadam PZ, Fairen-Jimenez. Interface Focus. 2016 Aug 6;6(4):20160027.
[2] Xiao-Qin Wu, Jian-Gong Ma, Han Li, Di-Ming Chen, Wen Gu, Guang-Ming Yang and Peng Cheng. Chem. Commun., 2015,51, 9161-9164