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Bacteria-electrodes interactions for bio-hybrid electrochemical systems

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ABSTRACT: Various bacteria are capable of transferring (and uptake) electrons to (from) electrode surfaces, a process defined as extracellular electron transfer. This unique capability paved the way to the development of bio-hybrid electrochemical systems for sustainable micro/low power production, biosensing, and bioelectrosynthesis. Interfacing photosynthetic bacteria with electrodes enables converting solar energy into electrical energy; however, the photosynthetic apparatus of these intact biocatalysts (i.e., purple bacteria and cyanobacteria) is physically separated from the electrode surface by the presence of various membrane layers, hindering the photoexcited electron transfer. Herein, recent works on the understanding of the extracellular electron transfer between intact purple bacteria and electrodes, and the development of sustainable artificial approaches for tuning this process will be discussed. Finally, enthralling future research directions will be presented, with the application of purple bacteria in bio-hybrid electrochemical systems for contaminants monitoring.

Keywords: Bio-hybrid electrochemical systems, photosynthetic bacteria

Short BIO: M. Grattieri received his BSc and MSc in Chemistry from Università degli Studi di Milano. He then obtained a PhD in Industrial Chemistry and Chemical Engineering at Politecnico di Milano in 2016. Within his PhD studies, he was a visiting researcher in the groups of Prof. Plamen Atanassov (University of New Mexico, USA) and Prof. Ernesto Calvo (Universidad de Buenos Aires, Argentina). After the PhD, he joined the group of Prof. Shelley Minteer at the University of Utah (USA) as a Postdoctoral Research Associate, focusing on extracellular electron transfer processes in extremophilic and photosynthetic organisms. Since October 2020 he is an Assistant Professor at the Università degli Studi di Bari, and his research focuses on utilizing photosynthetic organisms coupled to electrodes for developing biohybrid electrochemical systems.

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