Laccase-Catalyzed Bioelectrochemical Oxidation of Water Assisted with Visible Light

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Water splitting has been a top matter of research for the last decades because of its potential to provide H_2 while avoiding hydrocarbon sources. The biggest challenge to overcome is minimizing the energy barriers, which convey high overpotentials that increase the process' energy demand. Many catalysts have been researched for both water reduction and water oxidation, although few enzymatic biocatalysts have been. Hydrogenases' family have been matter of top research and many advances have been accomplished on this side whereas biocatalytic water oxidation process is more challenging and still demands more research on new biocatalysts. In fact, the only biocatalytic complex able to naturally oxidize water into O_2 is PSII, although recently was described the possibility to force a multicopper oxidase immobilized on a carbon electrode to oxidize water [1]. Herein we present the modification of FTO electrodes with In_2S_3 - a n-type semiconductor chalcogenide that absorbs visible light ($\lambda \geq 600$nm) and its further use as active scaffold for laccase-catalyzed oxidation of water. Irradiation of FTO-In_2S_3-laccase electrode yields O_2 production at much lower applied potential than the previous example where only electric energy was applied. The present system allows a diversification of the energy applied to accomplish the water splitting, taking a portion from the Sun. Advances on SnS_2 modified electrodes as well as other chalcogenides will also be presented.

[1] Marcos Pita, Diana M. Mate, David Gonzalez-Perez, Sergey Shleev, Victor M. Fernandez, Miguel Alcalde, Antonio L. De Lacey. Bioelectrochemical Oxidation of Water. J. Am. Chem. Soc. 2014, 136, 5892−5895.