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Electrochemical and photocatalytic treatments: an innovative coupled strategy for simultaneous hydrogen production and wastewater remediation

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Nowadays, the transition toward carbon-neutral energy production is imperative to mitigate climate change, ensuring a stable energy supply for the future generation[1]. Hydrogen (H_2) is a promising energy storage medium, whose market is expected to increase exponentially due to its use as an energy vector in the transportation sector. Nevertheless, just 4% its production comes from electrochemical water splitting. In this context, the high potential required for the Oxygen Evolution Reaction (OER) constrains H_2 evolution. Additionally, the use of noble metal-based electrodes complicates the practical application due to high costs and limited availability. In this frame, researchers are moving toward the development of noble metal-free electrodes mainly based on earth-abundant compounds.[2] Regarding the anodic reaction, organic pollutants in wastewaters containing high level of chemical energy are excellent electrons donors and suitable candidates for producing H_2 thanks to lower oxidation potential respect the one required for OER. For this reason, the electrochemical treatment of wastewater can represent a viable solution for hydrogen generation and simultaneous wastewater treatment, even if alone it is not sufficient. So, its coupling with other approaches can represent an interesting and efficient solution. Herein, we propose an innovative coupled process involving electrochemical treatment followed by heterogeneous photocatalysis for H_2 generation using noble-metal free cathode and the simultaneous wastewater treatment. In general, electrochemical treatment alone resulted insufficient for wastewater complete mineralization. So, the photocatalytic step using bismuth oxychloride was exploited.[2] This hybrid approach offers a novel and sustainable solution for energy generation and water purification in the face of increasing global industrialization and water scarcity.

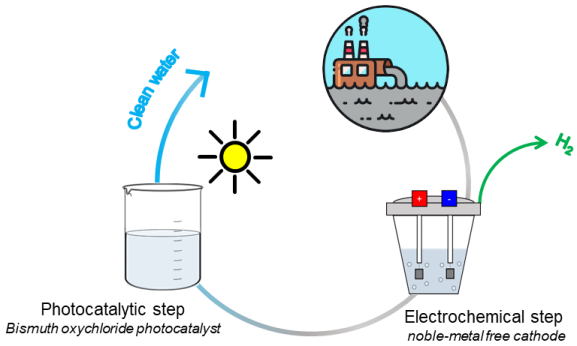

Figure 1: Proposed coupled process.

References:

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