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MICROBIAL ELECTROCHEMICAL TECHNOLOGY FOR WASTEWATER TREATMENT AND HYDROGEN PRODUCTION

Technologie électro-microbienne pour le traitement des eaux usées couplé à la production d'hydrogène

Wastewaters can be seen as a renewable energy source rather than a waste to treat. Thanks to a microbial electrolysis cell (MEC), the organic matter contained in wastewater can be degraded and hydrogen can be produced in the same time.

In a MEC, the bioanode (electroactive biofilms colonising the anode) catalyses the extraction of electrons from the wastewater organic matter. Those electrons are then consumed on the cathode to generate hydrogen.

With this process, low cost and green hydrogen can be produced as the energy contained in wastewater is recovered.
The MEC technology was first described in 2005 but many obstacles still remain to adapt it industrially to wastewater treatment (low conductivity of the wastewater, CO_2 production on the bioanode, continuous reactor, …).

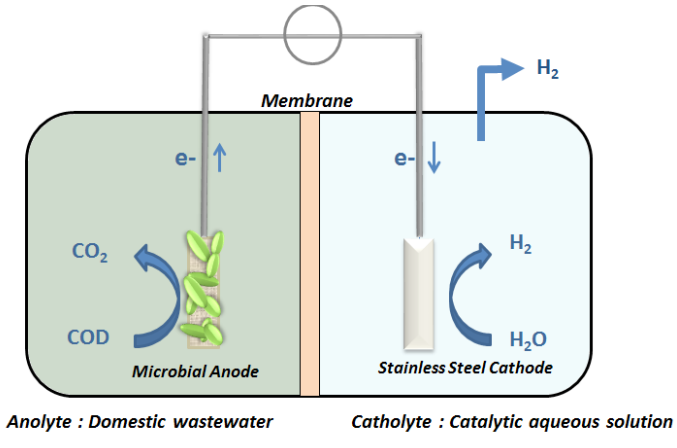

Figure 1 : Principle of a MEC

The global challenge of this PhD work is to succeed in the development of a pilot-scale MEC operating in real conditions (real domestic wastewater, unregulated temperature, long-term operation, …).

To do so, experimental work at increasing scales is carried out. The optimisation of the MEC technology requires choosing a suitable anode material, developing a surface treatment to boost bioanode performance and testing various electrolytes to catalyse the hydrogen evolution reaction on the cathode. Also, the modelling of the system with the software Comsol® should allow to understand both the effect of electrodes and reactor geometries on the MEC performances.