Integration of oxidation reactions relevant to formate production via continuous CO_2 electroreduction

Guillermo DIAZ SAINZ - *University of Cantabria, Spain*

Currently, the capture and utilization of carbon dioxide (CO_2), known as CCUs (Carbon Capture and Utilization), stands out as one of the most promising options for reducing emissions of this gas into the atmosphere (mitigating climate change) as well as generating value-added products from this compound. Among utilization strategies, electrochemical reduction of CO_2 is receiving much interest as it enables the storage of surpluses from renewable and intermittent energy sources, such as solar or wind, in the form of chemical products.

Particularly, there has been great interest in formic acid and formate, due to their usefulness as raw materials in various traditional industries, as well as their potential use as starting reagents in fuel cells and as hydrogen carriers. In this regard, one of the main lines of research of the "Development of Chemical Processes and Pollution Control" (DePRO) group focuses on the implementation of continuous processes for the electrochemical conversion of CO_2 to formate/formic acid. Recent efforts of the DePRO group have been focused on improving the cathode, through the use of new catalysts or new electrode configurations with different types of cathodic feedstocks. Meanwhile, at the anode, the oxygen evolution reaction was carried out simultaneously as a counter-reaction of little economic interest. Interestingly, recent techno-economic

approaches claim that coupling the glycerol oxidation reaction (GOR) with the CO_2 electroreduction process can offer excellent environmental and economic potential benefits. Glycerol is a plentiful by-product of the transesterification process in biodiesel production, making its valorisation highly desirable.

This communication aims to advance the coupling of GOR to continuous processes for the electrochemical conversion of CO_2 to formate. This will be carried out in a filter press-type reactor to efficiently obtain the formate at the cathode, while simultaneously carrying out the GOR at the anode to produce high-value-added products containing three carbons, such as dihydroxyacetone, glyceraldehyde, glycolate, tartronate, formate, among others, under alkaline conditions.