VALORIZATION OF CO_2-RICHED GASEOUS TO FORMIC ACID VIA ELECTROCHEMICAL ROUTES: CURRENT STATUS AND PERSPECTIVES

Federica Proietto, Dipartimento di Ingegneria, Viale delle Scienze, Università di Palermo, Italy
Federica.proietto@unipa.it
Claudia Prestigiacomo, Dipartimento di Ingegneria, Viale delle Scienze, Università di Palermo, Italy
Alessandro Galia, Dipartimento di Ingegneria, Viale delle Scienze, Università di Palermo, Italy
Onofrio Scialdone, Dipartimento di Ingegneria, Viale delle Scienze, Università di Palermo, Italy

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A thermochemical process of waste organic matrices produces a gaseous phase rich in CO_2 as co-product. In the framework of the sustainable development of this process, its integration with the CO_2 electrochemical conversion can be considered a promising novelty.

According to the literature the valorization of the waste CO_2 through electrochemical processes driven by green energy could prompt the economic sustainability of the entire conversion chain of the waste within the circular economy concept. The electrochemical conversion of CO_2 has been widely investigated since the 1870s as a promising strategy to convert waste-CO_2 into value-added chemicals. Among the emerging technologies for CO_2 conversion to value-added products on an applicative scale, electrochemical technologies are the closest to commercialization due to the numerous start-ups and established companies being invested in this area (e.g., Opus-12, Dioxide Material, and Carbon Recycling International) [1]. These technologies have attracted attention due to some unique advantages (including operating at low temperatures, easy scale-up stages, use of excess electric energy from intermittent renewable sources, and small environmental impact). However, to be suitable at an industrial scale, the process should present simultaneously high current densities, faradaic efficiencies, high concentrations, and long-term stability [2,3]. This work aims to show how far the electrochemical technology, using Sn-based cathodes, is from being implemented on an industrial scale and to critically discuss the main strategies to improve the electrosynthesis of formic acid. In addition, formic acid can be also used as a green liquid hydrogen donor in the hydrothermal liquefaction (HTL) of waste organic matrices. Prestigiacomo et al. [4] indicated that formic acid can be an effective additive to improve biocrude yields and quality in the HTL of municipal sludge, that is a very promising result in the perspective of industrial utilization of the process.

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