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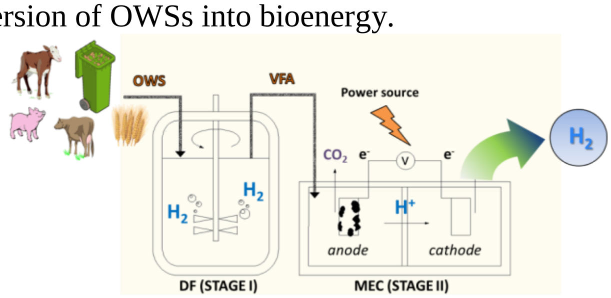
The aim of this work is the development of a feasible, cascade two-step BioH_2 production process from Organic Waste Streams (OWS), combining dark fermentation (DF) and Microbial Electrolysis (ME). Such coupling of DF and ME constitutes a technological cornerstone within the concept of an environmental biorefinery.
In this work, more than 20 different OWSs, were selected and collected from a wide range of industrial sectors (food, manufacturing, biofuel, wastewater treatment, among others). All the OWSs were fully characterized (i.e., total solids/volatile solids, COD, sugars, proteins, VFAs, organic acids, alcohols, N-tot, pH, density, electrical conductivity, nutrients,etc.) and tested for H_2 production by DF in batch reactors (pH 5.5, 37°C) using heat treated anaerobic sludge as inoculum. The fermentative metabolic patterns were analysed. Depending of the OWS the H_2 yield varied from 0 to 130 mLH_2/gCOD with acetate, butyrate and ethanol as main metabolic by-products. The H_2 recovered in DF was linearly correlated with the initial content of sugars and/or glycerol present in OWSs (R^2= 0.9). The most promising OWSs DF effluents were selected on the basis of fermentative conversion efficiency (i.e., both H_2 and metabolic by-product accumulation) to further recover H_2 in ME cells. Such experiments are currently ongoing. They are conducted in two chambers (400 mL wV) potentiostatically controlled systems (anode applied potential + 0.2V vs SCE, pH 7, 37°C) using an electroactive biofilm as biocatalyst previously enriched from anaerobic sediments using acetate as carbon source. Preliminary results show satisfactory performances in terms of electrical current production, 600 ± 10 mA/m^2 (up to 34 A/m$^3_{reactor}$), with a CE (Coulombic Efficiency) of about 30% and a biogas stream highly enriched in H_2 (60%).
These results showed that dark fermentation linked with ME is a feasible and highly promising option in order to maximize the conversion of OWSs into bioenergy.



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