Electrochemical oxidation of t-CNSL using selective cathodic and anodic strategies to simultaneously produce green hydrogen and acetic acid

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3º CONGRESSO DA REDE BRASILEIRA DE BIOQUEROSENE E HIDROCARBONETOS SUSTENTÁVEIS PARA AVIAÇÃO

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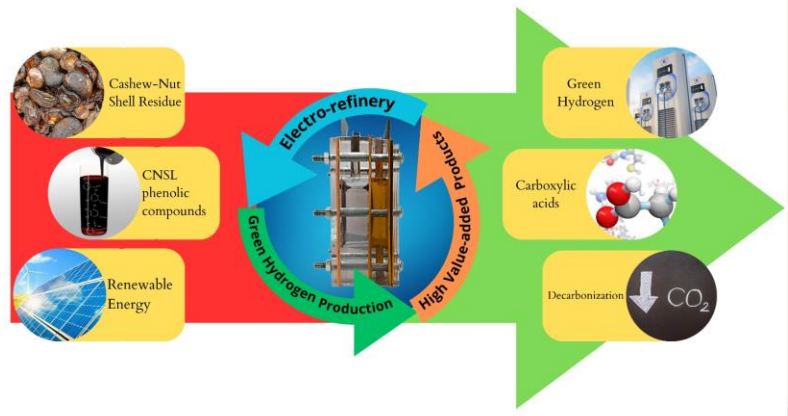
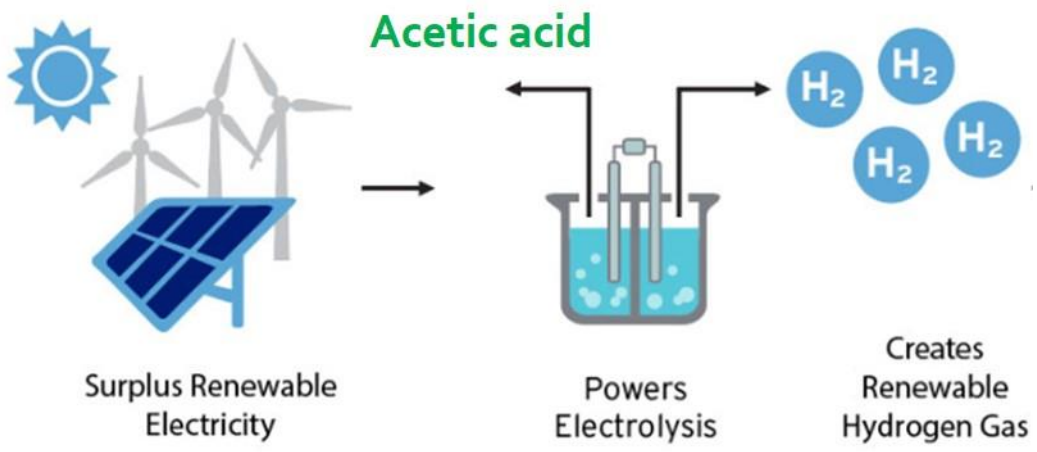
Introduction

In this study, the scale-up of electrochemical treatment was investigated by treating technical cashew nutshell liquid (t-CNSL) effluent using a divided-electrochemical reactor photovoltaically-driven, for the first time, with a boron-doped diamond (BDD) electrode as the anode and a Ni-Fe-based SS (stainless steel) mesh as the cathode. The results clearly demonstrated that a divided electrochemical reactor was successfully scaled up, favoring a selective accumulation of the acetic acid concentration (600 mg L^{-1}). Additionally, simultaneous production of green H_2 (0.73 L) was achieved when the biomass effluent of 0.10% t-CNSL in 1 mol L^{-1} NaOH was electrolyzed by applying 40 mA cm^{-2}.



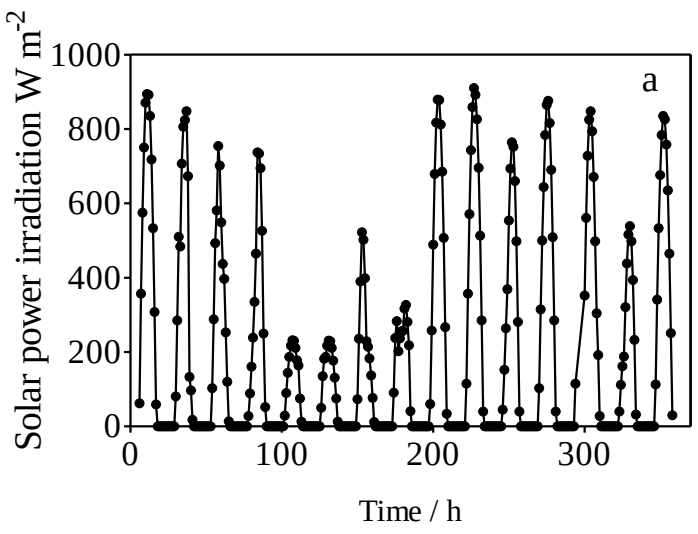
Methodology

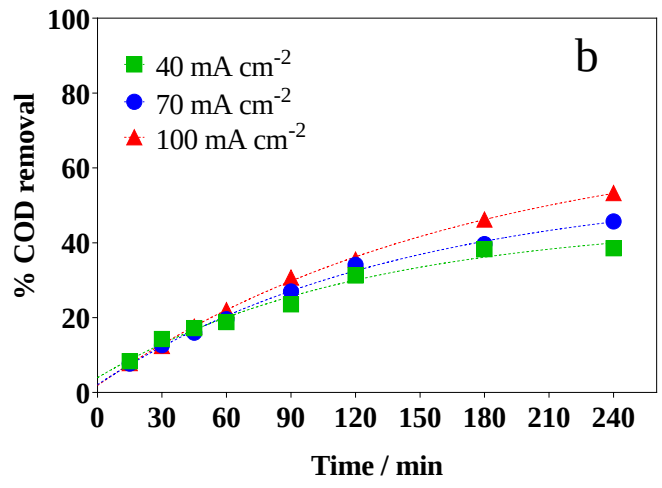


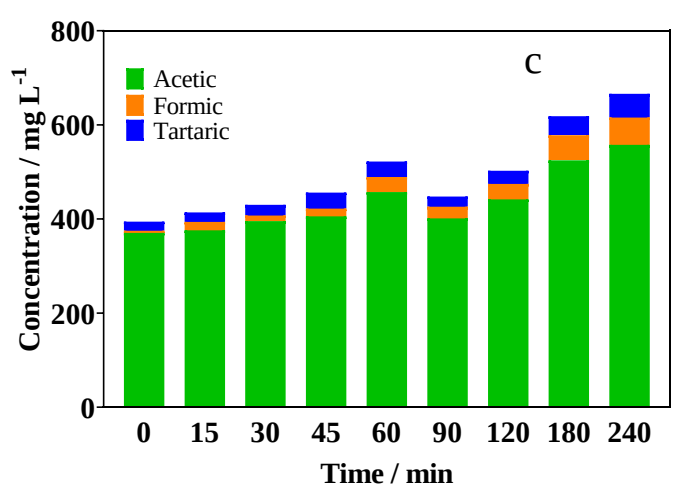
t-CNSL was acquired from a cashew nut processing plant located in Mossoró, Rio Grande do Norte, Brazil. The experiments were conducted using galvanostatic conditions during 240 min. AEM-type E-reactor, in a sandwich configuration, consists of an anodic and cathodic compartment, separated by an AEM with a BDD (10 cm^2) as anode and Ni-Fe based SS mesh as cathode

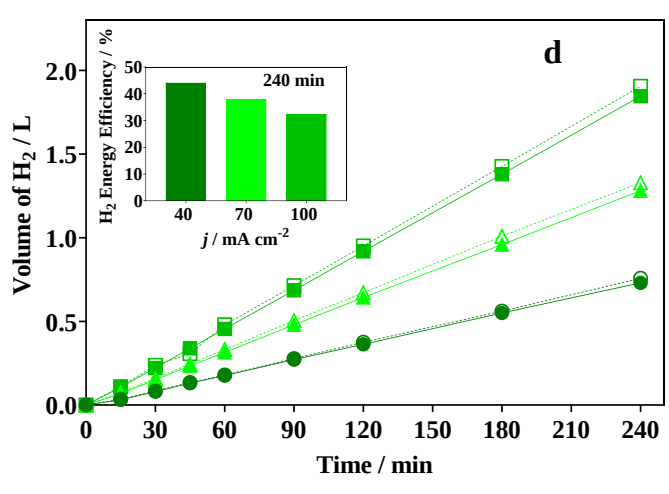
Results

Electrochemical treatment of 0.01% t-CNSL in 1.0 mol L^{-1} NaOH removed 38.54% of organic matter with 40 mA cm^{-2}. Using 0.05% t-CNSL, the concentrations of acetic, tartaric and formic acids were 565.3, 41.2 and 61.2 mg L^{-1} after 240 min of electrolysis. Green H_2 production was linear over time, with volumes of 0.73 L, 1.28 L and 1.84 L for 40, 70 and 100 mA cm^{-2}, respectively, and energy efficiencies of 44%, 38 % and 33%.









Conclusion

In conclusion, this work has demonstrated an effective strategy for energy-saving electrochemical H_2 production by replacing the conventional water splitting with the electrochemical treatment of biomass effluent. Overall, our work presents a promising approach to enhance the cost-effectiveness of the electrochemical H_2 production by reducing the electrolysis voltage and simultaneously biomass upgrading obtaining high value-added products (like acetic acid).

Contact