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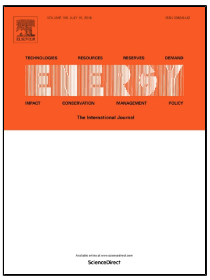

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Carlos E. Gómez Camacho, Francesco I. Romano, Bernardo Ruggeri

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MACRO APPROACH ANALYSIS OF DARK BIOHYDROGEN PRODUCTION IN THE PRESENCE OF ZERO VALENT POWERED Fe°

Carlos E. Gómez Camacho, Francesco I. Romano and Bernardo Ruggeri(*)

Dep. of Applied Science and Technology (DISAT), Politecnico di Torino, C/so Duca degli Abruzzi 24, 10129 Torino, Italy

(*) Corresponding author, Tel. +39 011 0904647, Fax +39 011 0904699, e-mail: bernardo.ruggeri@polito.it

Abstract

Recent studies suggest that the supplementation of powdered Fe° generates a positive effect on anaerobic fermentation processes but the exact relationship between metals with biological systems has not been fully elucidated. Experimental tests on dark fermentation (DF) were carried out at different Fe° concentrations. The anaerobic corrosion (AC) of Fe° and the production of H_2 through DF of Organic Waste Market (OWM) were tested separately, and subsequently DF tests with Fe° at 1 g/L and 2 g/L were carried out. A macroscopic dynamic study was conducted, using Röels approach based on relaxation times (τ_R) to establish whether interactions between AC and DF phenomena exist. Experimental bioH_2 production and Fe° AC were fit by Gompertz and saturative models, respectively to estimate τ_R. The results of the macro-analysis suggest that both phenomena are concurrent, with τ_R of the same order of magnitude, generating a positive symbiotic effect. The experimental tests of hydrogen production via DF in presence of 2 g/L of Fe° showed an increase of 46 % compared with the control tests, of amount of gas and a greater H_2/CO_2 ratio. The results suggest an enhancement of key enzymes activity due to the action of iron increasing bioH_2 production.

Keywords: dark fermentation, iron-supplementation, enzymatic enhancement, CO_2 reduction, relaxation time

1 INTRODUCTION

Iron cycles are being studied extensively in different areas, from groundwater remediation techniques [1] to iron fertilization in oceans due to geobiochemical effects [2]. Recent research in the field of anaerobic digestion (AD) has addressed the topic of metal supplementation to biological systems to enhance biomethane production [3]. The aim of such a supplementation is to raise the methane yields *in situ*, thus making the AD process even more attractive. However, the effect of metal particles and their interactions with the biological phase of AD has not been fully assessed, because of the great variety of microorganisms within the mixed cultures involved in these types of bioenergy recovery process. A mixed consortium is generally used as the standard inoculum in AD plants since pure