

TITLE: SUPPLEMENTATION OF TRACE ELEMENTS TO SULFATE-RICH SUBSTRATE AND THEIR IMPACT IN H₂S FORMATION AND METHANE PRODUCTION

AUTHORS: CALEGARI, R. P.¹; ŠAFARIČ, L.²; SHAKERI YEKTA, S.²; BJÖRN, A.²; ADIYA, P.²; HUANG, B.²; FARIA, T. M.³; ARTHUR V.¹; BAPTISTA, A. S.⁴; ENRICH-PRAST, A.²

INSTITUTION: ¹Center for Nuclear Energy in Agriculture – University of São Paulo. Piracicaba – SP (Av. Centenário, 303, CEP 13400-970). ²Linköping University. Linköping – Sweden (Campus Valla, 581 83, Linköping). ³Nuclear and Energy Research Institute – University of São Paulo. São Paulo – SP (Av. Lineu Prestes, 2242, CEP 05508-000). ⁴Luiz de Queiroz College of Agriculture – University of São Paulo. Piracicaba - SP (Av. Pádua Dias, 11, CEP 13418-900).

ABSTRACT

In the present work the anaerobic digestion (AD) of vinasse and the anaerobic co-digestion (AC) of vinasse (V) with filter cake (F) and sugarcane straw (S) were investigated. The aim was to evaluate the trace elements (TE) supplementation and their impact on the processes, especially on H₂S formation and methane yield from a sulfate-rich substrate. The study was conducted through a continuous experiment in 4 CSTR reactors with monodigestion of vinasse (R1), vinasse and TE supplementation (R2), co-digestion of V, F, S and TE supplementation (R3 and R4). The reactors were supplemented with Fe, Ni, Co, Se, Mo, and Zn over time to circumvent the problems caused by the high sulfate concentration and volatile fatty acids (VFA) accumulation. The reactors were monitored through the parameters pH, total solids, volatile solids, VFA, ammonium, chemical oxygen demand, gas volume, and gas composition (CH₄, CO₂, H₂, and H₂S). Iron played an important role in decreasing the H₂S production. In addition, the other metals made it possible to increase the methane yield of the process. The vinasse AD and TE reactor (R2) reached a yield between 222.29-411.39 Nml CH₄g⁻¹ VS, and the H₂S in biogas remained below 500 ppm after addition of all the TE. The control reactor that did not received TE (R1) reached 36,000 ppm of H₂S and failed due to acidification. However, after pH correction and TE addition, it was possible to re-establish AD in R1 with similar methane yield to R2. In the AC reactors R3 and R4 after the addition of all TE, a yield between 54.61-109.14 Nml CH₄ g⁻¹ VS was observed in R3, and between 54.15-110.21 Nml CH₄ g⁻¹ VS in R4. In addition, the H₂S concentration remained below 186.42 in R3 and below 70.74 ppm in R4. In general, anaerobic co-digestion with the addition of metals maintained greater stability over the 238 days of experiment, with low accumulation of volatile fatty acids and H₂S.

Keywords: Biogas, sugarcane vinasse, metals supplementation, iron

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