Estágio UCS

Strategy for stabilizing a microbiological inoculum to determine methanogenic activity

Metanogênicas

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INTRODUCTION / OBJECTIVE

The emission of greenhouse gases (GHG) is linked to the increase in global temperatures. In Brazil, only 1% of organic waste is reuse (ABRELPE, 2022) much of it is sent to landfills where it is decomposed, releasing methane gas, which can be up to 108 times more polluting than CO2. (IPCC, 2023) Biogas appears as an alternative, as it promotes the use of organic waste in the anaerobic digestion (AD) process to generate thermal and electrical energy and, when purified, as vehicular energy, contributing to the circular economy and GHG mitigation. To analyze the potential of organic matter and effective biogas production, a stabilized inoculum is necessary as a bioindicator of biological processes. Parameters such as determining the FOS/TAC ratio allow the evaluation of the inoculum balance, where: FOS is the content of volatile fatty acids; TAC is the buffer capacity of the sample. The reference value is 0.3 to 0.4. Therefore, the objective of this study was to determine metrics for the ideal conditions for a methanogenic inoculum.

MATERIAL AND METHODS

Two inocula, composed of 50% swine manure and 50% cattle manure, were kept in 20L gallons at a temperature of 37°C and named inoculum α and β. To determine FOS/TAC in both inocula, a volume of 5 mL was collected and added to 50 mL of distilled water for pH measurement. The samples were then titrated with H2SO4 solution (0.05 M) until reaching pH 5.0, recording the amount of acid added. To calculate the TAC value. FOS was obtained by a second titration from pH 5.0 to pH 4.4. The β inoculum was purposely adjusted to 8.00, an ideal value for DA.

RESULTS

The α inoculum (Fig. 1.) started with a FOS/TAC value of 7.20 and pH 5.43 on 21/02/24. After a period of 35 days the FOS/TAC ratio reduced to 0.4 and the pH increased to 8.00 on 26/03/24.

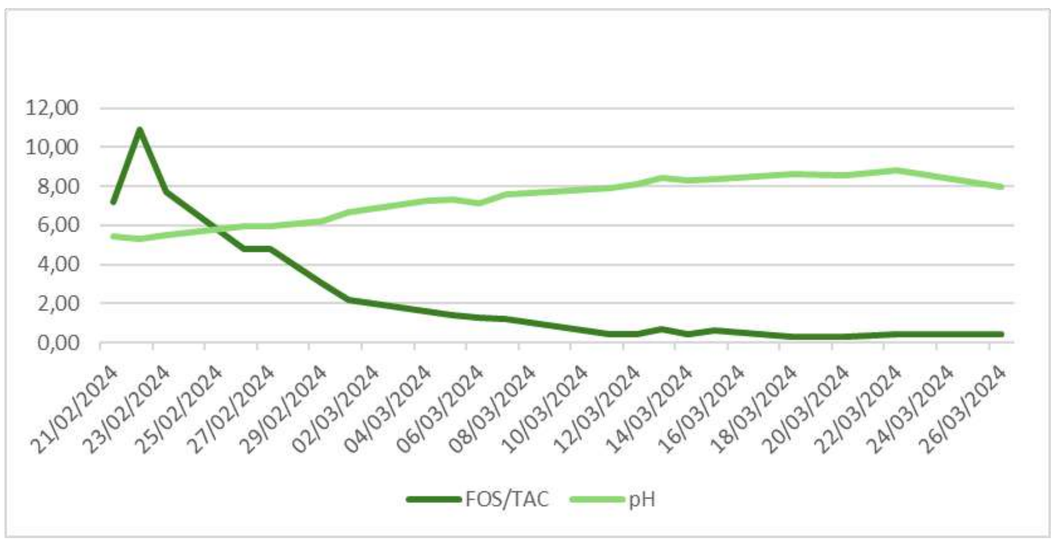

Fig. 1. FOS/TAC ratio and initial pH of the α inoculum.

RESULTS

The pH of the β inoculum (fig. 2.) was purposefully adjusted from 5.84 to 8.00 using NaOH (1 M). After three days, the FOS/TAC value began to decline, from 2.10 to 0.85. On the 11th day, it reached 2.63, exceeding the initial value.

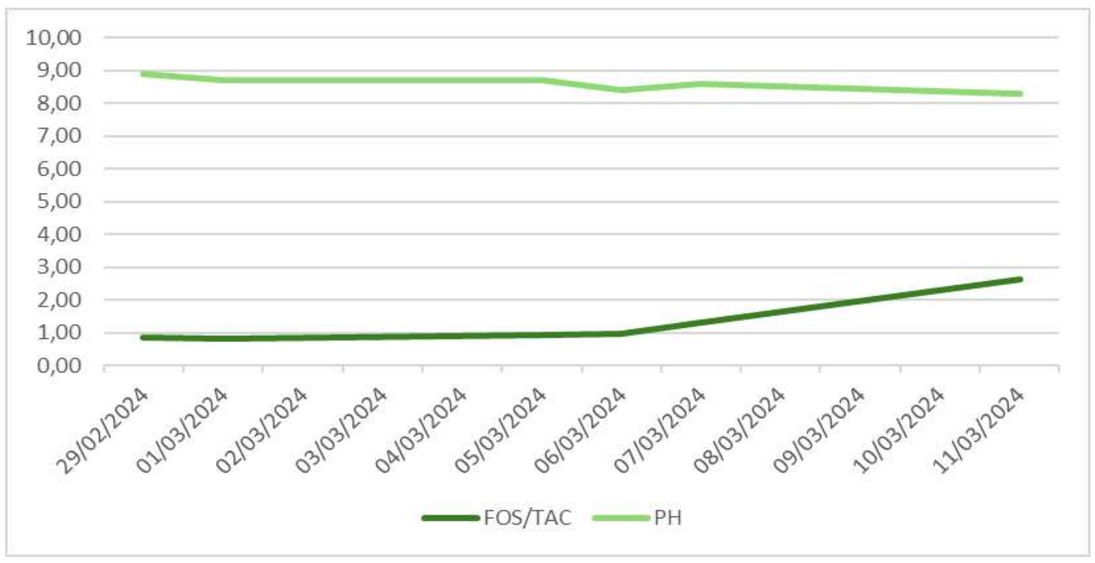

Fig. 2. FOS/TAC ratio and initial pH of the β inoculum.

FINAL CONSIDERATIONS

The inoculum α reduced to an optimal value of 0.4. Simultaneously, the pH underwent a beneficial increase for methanogenic activity, reaching 8.0. The alkalinization of pH and the decrease in FOS/TAC is due to a stabilized anaerobic process, since the inoculum under these conditions will be favorable for evaluating the biogas production capacity of a waste. The pH of the β inoculum was purposefully adjusted from 5.84 to 8.00 using NaOH. It was observed that after 3 days, the FOS/TAC value began to decline, from 2.10 to 0.85, not reaching an ideal value. On the 11th day, it reached 2.63, exceeding the initial value, showing that pH regulation is a method that does not keep the microbiota stabilized for a long time. Indicating low activity of the microorganisms responsible for AD that use these compounds for their metabolic processes. Implementing methodologies for evaluating potential biogas production is essential for reducing the environmental impact generated by organic waste. To achieve this, a stabilized inoculum can contribute to energy generation metrics and, consequently, reduce GHG emissions on the planet.

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