COMPARISON OF DIFFERENT NUTRIENT SOLUTIONS FOR BIOGAS PURIFICATION USING A BIOTRICKLING FILTER

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The population growth requires an increase in food production and energy availability, which leads to an increase in the productive demand of the agricultural and farming sectors. Consequently a greater generation of waste. Therefore, it is necessary to think about strategies for managing and treating this waste. One of the treatment strategies applied to agricultural waste is Anaerobic Digestion (AD). AD is a biological process where associations of microorganisms convert organic matter into biogas. Biogas is a mixture of gases that has an average of 65% CH_4, 35% CO_2 and trace concentrations of other gases such as hydrogen sulfide (H_2S), which even at low concentrations must be managed due to human health and equipment toxicity and corrosiveness, respectively. Desulfurization can be done by physical, chemical or biological processes. Due to the low cost of implementation, the high efficiency, biological desulfurization processes are feasible and applicable. For biological processes, the biotrickling filter (BTF) stands out, due to its high removal capacity and low implementation and operating costs. In this biological process nitrate is one of the electron acceptors, which is supplied from commercial reagents. As alternative is to use a nitrate-rich solution obtained from a biological nitrification/denitrification treatment process. Thus, in this work, kinetic desulfurization was compared, on a real scale BTF, using NO_3^- from two sources: from effluent of an aerobic biological reactor (ABR) installed in the Swine Manure Treatment System (SMTS) at Embrapa Swine and Poultry; and using a synthetic medium solution prepared with commercial $NaNO_3$. The BTF used in the study was previously acclimatized for 57 days. The kinetic studies were conducted in 6 days batches, with an continuous biogas flow average of 10 m^{-3} d^{-1} (1400 ppm of H_2S). The nutrient solution was completely renewed at the beginning of each batch. The parameters evaluated were: removal efficiency (RE), elimination capacity (EC), pH, nitrate consumption and NO_3^--N/H_2S ratio. For the first experiment was used ABR effluent containing NO_3^--N = 388 mg L^{-1} and Alkalinity = 432 mg $CaCO_3$ L^{-1} (EC= 1,40 gH_2S m^{-3} d^{-1}, ER= 98,2%) and the second synthetic solution containing NO_3^--N = 389 mg L^{-1} and Alkalinity = 435 mg L^{-1} (EC = 1,49 gH_2S m^{-3} d^{-1}, ER= 96,2%). The NO_3^--N consumption rate obtained using the pseudo-first order kinetics by the modified Akaike model and described as: $C(t)= C_0 e^{(-kt)}$ (mol L^{-1}). The coefficients were obtained by linearizing the equation and applying the least squares method. The following equations found were $C(t)= 388,13e^{(-0,2498t)}$ with $R^2=0,9558$ and $C(t)= 388,88e^{(-0,6356t)}$ with $R^2=0,9858$ with the resulting the molar ratios (molNO_3-N/molH_2S) of 0.1035 and 0.1093 for the ABR effluent and the synthetic medium respectively. The results corroborate to demonstrate that the NO_3^- from the aerobic biological process can be an alternative supply as nutrient medium solution for biogas desulfurization via BTF, since the results obtained were similar for both cases. This work was funded by the TECNOVA/FAPESC program.