



EVALUATION OF THE USE OF PROTEOLYTIC ENZYME IN THE ANAEROBIC DIGESTION OF NON-SLAUGHTERED SWINE CARCASSES

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The generation of waste in swine production is an inevitable consequence of the process. The destination and treatment of this waste must be sustainable and economically viable. In addition to manure, a large amount of routine mortality waste is generated. Anaerobic digestion (AD) is a well-known process and can be used to treat these organic wastes, as swine carcasses have a high potential for biofuel production. In this sense, this study investigated the degradation of previously comminuted swine carcasses using a proteolytic enzyme (Alcalase - Novozymes 2.4 AU g⁻¹) during AD. The enzyme was tested both as a pre-treatment of the carcasses and in batch AD, in reactors of 1 L, at temperature of 37 °C, with automatic stirring and in triplicate (batch fermentation system - RITTER). Four different AD tests were performed: carcass only, carcass plus alcalase enzyme, pre-hydrolyzed carcass, and inoculum only as control. The same conditions were applied to replicate batch assays in a shaker incubator using 200 mL erlenmeyer jars in which destructive sampling for volatile fatty acid (VFA) determination was performed, following the same ratios and inoculum/substrate ratios. Pre-hydrolysis was performed in a 1/1 ratio of water and pork carcass using an enzyme concentration of 5 ml enzyme kgcarcass⁻¹ in the shaking incubator at 37 °C for 24 hours. Experimental responses were related to biochemical biogas potential (BBP), pH, total organic carbon (TOC), total concentration of VFA, and total ammonium nitrogen (TAN). The pretreatment experiments of the carcasses treated with enzymes showed good results in terms of TOC and TAN dissolved in the hydrolyzed material, namely 81.7% and 102.2%, respectively, compared to hydrolysis without enzymes. The BBP of the carcass after pretreatment with enzymes was similar to that of the carcass without pretreatment, namely 1081 ± 158 mLN gVS⁻¹ and 1109 ± 67 mLN gVS⁻¹, respectively. The test with the carcass and the addition of enzymes in AD was the one that gave the best result with a BBP of 1337 ± 129 mLN gVS⁻¹. In the analysis of VFA, it was possible to identify the behavior of the mediators during the tests. Only in the test with addition of the enzyme in AD, a considerable amount of VFA was present after 24, 48 and 96 hours, at concentrations of 1414, 2806 and 1198 mg L⁻¹, mainly acetic acid (93.5%, 90.9% and 60.4%, respectively). Nevertheless, this does not seem to have negatively affected the tests. Although hydrolysis parameters can still be optimized, pretreatment with enzymes was similar to raw carcass in terms of BBP. However, the use of enzymes during AD of carcasses showed an increase in BBP of about 20%. Pretreatment of swine carcasses with enzymes produces a liquid material that facilitates handling and storage of the swine. The use of proteolytic enzymes can contribute to AD residues with high protein concentrations.