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Enhanced Methane Yield from Organic Fraction of Municipal Solid Waste with Coconut Biochar as Syntrophic Metabolism Biostimulant

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Abstract : Biostimulation has recently become important in order to improve the stability and performance of the anaerobic digestion (AD) process. This strategy involves the addition of nutrients or supplements to improve the rate of degradation of a native microbial consortium. With the aim of biostimulate sytrophism between secondary fermenting bacteria and methanogenic archaea, improving metabolite degradation and efficient conversion to methane, the addition of conductive materials, mainly carbon based have been studied. This research seeks to highlight the effect that coconut biochar (CBC) has on the metanogenic conversion of the organic fraction of municipal solid waste (OFMSW), analyzing the surface chemistry properties that give biochar its capacity to serve as a redox mediator in the anaerobic digestion process. The biochar characterization techniques were electrical conductivity (EC) scanning electron microscopy (SEM), energy dispersive spectroscopy (EDS), Fourier Transform Infrared Transmission Spectroscopy (FTIR) and Cyclic Voltammetry (CV). Effect of coconut biochar addition was studied using Authomatic Methane Potential Test System (AMPTS II) applying a one-way variance analysis to determine the dose that leads to higher methane performance. The surface chemistry of the CBC could confer properties that enhance the AD process, such as the presence of alkaline and alkaline earth metals and their hydrophobicity that may be related to their buffering capacity and the adsorption of polar and non-polar compounds, such as NH4+ and CO2. It also has aromatic functional groups, just as quinones, whose potential as a redox mediator has been demonstrated and its morphology allows it to form an immobilizing matrix that favors a closer activity among the syntrophic microorganisms, which directly contributed in the oxidation of secondary metabolites and the final reduction to methane, whose yield is increased by 39% compared to controls, with a CBC dose of 1 g/L.

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