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Spent Coffee Enhanced Biomethane Potential via an Integrated Hydrothermal Carbonization-Anaerobic Digestion Process

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Abstract

This study reports the implications of using spent coffee hydrochar as substrate for anaerobic digestion (AD) processes. Three different spent coffee hydrochars produced at 180, 220 and 250 °C, 1 h residence time, were investigated for their biomethane potential in AD process inoculated with cow manure. Spent coffee hydrochars were characterized in terms of ultimate, proximate and higher heating value (HHV), and their theoretical bio-methane yield evaluated using Boyle-Buswell equation and compared to the experimental values. The results were then analyzed using the modified Gompertz equation to determine the main AD evolution parameters. Different hydrochar properties were related to AD process performances. AD of spent coffee hydrochars produced at 180 °C showed the highest biomethane production rate (46 mlCH₄/gVS·d), a biomethane potential of 491 ml/gVS (AD lasting 25 days), and a biomethane gas daily composition of about 70%.

Keywords: anaerobic digestion, hydrothermal carbonization, spent coffee, biomethane, modified Gompertz

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