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CATALYTIC AND NON-CATALYTIC PYROLYSIS OF BIOLOGICALLY TREATED MANURE

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Abstract

The utilization of manure for waste-to-bioenergy conversion processes may be a sustainable development choice rather than its traditional use as a fertilizer. Furthermore, the valorization of manure via thermochemical conversion routes and their integration with biological processes can provide an additional pathway in the utilization of residual biomass. On the other hand, the use of metal oxides might enhance the performance of thermochemical processes such as pyrolysis by either cracking the heavy hydrocarbon chains which turns into the production of a higher quality fuel or increasing the H_2 production by promoting secondary reactions as steam reforming or water-gas shift.

The derivate thermogravimetric (DTG) profiles of manure samples could be divided into four general stages: dehydration, devolatilization, char transformation and inorganic matter decomposition. For samples Pre and Dig R, the maximum DTG peaks were obtained at the same temperature. The first peak was lower for sample Dig R due to the removal of organic matter during the anaerobic digestion. On the other hand, the fourth step was not observed for sample Swine, which could be attributed to its low inorganic components (ash) content. The catalysts used in the catalytic pyrolysis process were: CaO, MgO and ZnO. The addition of these oxides modified the corresponding DTG profiles especially for sample Pre. These effects could be also observed in the mass spectra (MS) profile of the samples leading to a higher production of H_2, especially at high temperatures which could be attributed to the enhancement of secondary reactions that usually take place at temperatures higher than 500 ºC.

Key words: derivative thermogravimetry (DTG), manure, pyrolysis, thermochemical processes, waste-to-bioenergy

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