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Combined H_2S and CO_2 removal process for upgrading biogas

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Raw biogas can be simply used in CHP (combined heat and power) and boilers, but when it comes to vehicle fuel standards or injecting into a gas grid, it is more required to clean the biogas. Upgrading biogas involves removal of impurities such as H_2S and CO_2. Cleaning or upgrading of biogas increases the methane content from 60% to 99%. Many upgrading technologies are already established on a large-scale such as PSA, amine and water scrubbing. What is more lacking is the detailed knowledge on its use in small scale applications which is also highly cost consuming. The aim of this research involves developing an upgrading technology with combined CO_2 and H_2S removal. The research focuses on H_2S removal using biological process with sulfur oxidizing bacteria also known as desulphurization and CO_2 removal or carbonation process using bottom ash, a waste by-product produced in tons from an incineration plant each year. Results obtained from individual lab-scale processes demonstrated removal efficiency of 99 % in H2S removal with the loading rate of 14.285 g S-H_2S $m^{-3}.h^{-1}$ and CO_2 sorption capacity of 14.56 kg $CO_2.t^{-1}$ with wet bottom ash. The anticipated outcome of combining the above two processes and to study the interaction and feasibility of the combined removal technique can lead to low cost as well as an energy efficient approach to biogas upgrading.

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Kinetic characteristics of blends of hydrothermally carbonized and dry torrefied lignocellulosic biomass

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The main goal of this study is to investigate the kinetic characteristics and interaction of the carbon dioxide co-gasification of blends of coal and thermo-chemically processed Miscanthus (Miscanthus spp.) using thermogravimetric analysis (TGA) and Fourier transform infrared spectroscopy (FTIR). Thermo-chemically processed Miscanthus are prepared by wet torrefaction (WT), or hydrothermal carbonization (HTC) at 533K with residence time of 5 minutes at 5.5MPa pressure with 1:6 biomass-water mass ratio and dry torrefaction (DT) at 548K with residence time of 45 minutes at atmospheric pressure and blended with different ratios of coal. The kinetic characteristics show that the activation energy of the gasification of the processed biomass blends decreases with the increase in the biomass portion in the blends. Out of the blends tested, Coal-WT-DT at 60%:20%:20% shows the most synergistic interaction after analysis of TGA data. Hence, this ratio shows the most potential for replacing solid-fossil-fuel.

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