World Academy of Science, Engineering and Technology
International Journal of Environmental and Ecological Engineering
Vol:12, No:06, 2018

Small Scale Waste to Energy Systems: Optimization of Feedstock Composition for Improved Control of Ash Sintering and Quality of Generated Syngas

Authors : Mateusz Szul, Tomasz Iluk, Aleksander Sobolewski

Abstract : Small-scale, distributed energy systems enabling cogeneration of heat and power based on gasification of sewage sludge, are considered as the most efficient and environmentally friendly ways of their treatment. However, economic aspects of such an investment are very demanding; therefore, for such a small scale sewage sludge gasification installation to be profitable, it needs to be efficient and simple at the same time. The article presents results of research on air gasification of sewage sludge in fixed bed GazEla reactor. Two of the most important aspects of the research considered the influence of the composition of sewage sludge blends with other feedstocks on properties of generated syngas and ash sintering problems occurring at the fixed bed. Different means of the fuel pretreatment and blending were proposed as a way of dealing with the above mentioned undesired characteristics. Influence of RDF (Refuse Derived Fuel) and biomasses in the fuel blends were evaluated. Ash properties were assessed based on proximate, ultimate, and ash composition analysis of the feedstock. The blends were specified based on complementary characteristics of such criteria as C content, moisture, volatile matter, Si, Al, Mg, and content of basic metals in the ash were analyzed, Obtained results were assessed with use of experimental gasification tests and laboratory ISO-procedure for analysis of ash characteristic melting temperatures. Optimal gasification process conditions were determined by energetic parameters of the generated syngas, its content of tars and lack of ash sinters within the reactor bed. Optimal results were obtained for co-gasification of herbaceous biomasses with sewage sludge where LHV (Lower Heating Value) of the obtained syngas reached a stable value of 4.0 MJ/Nm3 for air/steam gasification.

Keywords : ash fusibility, gasification, piston engine, sewage sludge
Conference Title : ICEWM 2018 : International Conference on Environment and Waste Management
Conference Location : Copenhagen, Denmark
Conference Dates : June 11-12, 2018