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Thermochemical recycling of municipal solid waste

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In this work, recycling of municipal solid waste (MSW) by thermochemical methods such as pyrolysis and gasification was studied. A fraction of MSW generally separated from inorganic materials and biodegradable components, so called refuse-derived fuel (RDF), was studied by material characterization methods, laboratory scale experiments and modeling of industrial scale processes. Composition of RDF was determined by the separation of a representative sample into its basic components (paper, foils, hard plastics, textiles), which were homogenized by grounding in a cryogenic mill. All components of RDF and also a representative mixed sample of RDF were studied by thermogravimetric (TGA) analysis, differential scanning calorimetry (DSC), elemental analysis and bomb calorimetry to determine the kinetics of thermal decomposition, proximate and elemental composition, and heat of the reaction and higher heating value. The pyrolysis and gasification experiments were performed in a laboratory scale screw type reactor. The amount and composition of all product yields (solid, liquid, gas) were measured. Industrial scale gasification and pyrolysis processes were studied by mathematical modeling and computer simulation. All processes, pyrolysis, gasification with air, gasification with oxygen and gasification with both oxygen and steam were investigated under different conditions. RDF conversion of 100% was achieved by gasification with air at the air to RDF mass ratio of 3:2. However, the gas heating value was only 4:4 MJ/Nm^3. Gasification of RDF using oxygen enables producing a gas with the heating value of around 10 MJ/Nm3 at the oxygen to RDF mass ratio of 0:65. By increasing the steam to RDF mass ratio, the content of H_2 and CO_2 increased, however, the content of CO, reactor temperature and gas heating value were decreased.

Biography

Juma Haydary has completed his PhD at the Slovak University of Technology in Bratislava, Slovakia. From 1999, he has worked at different positions at the Institute of Chemical and Environmental Engineering at this University. At present time, he is an Associate Professor of Chemical Engineering at the Department of Chemical and Biochemical Engineering. He has published more than 25 papers in reputed journals, 4 books and textbooks and more than 80 papers in proceedings of national and international conferences.

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