

Microwave-assisted fast catalytic pyrolysis and gasification of biomass for biofuels and bioenergy production

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Various biomass, such as crop residues, food wastes, and municipal wastes are a potential feedstock for the production of renewable energy and fuels. Gasification and pyrolysis are efficient ways for conversion and utilization of these wastes. Fluidized bed processes that are the most common methods employed in fast pyrolysis and gasification have some significant issues include a complex and expensive system and process, high ash particles in products due to violent agitation, the low energy density of syngas due to the dilution by carrying gases, etc. In this presentation, we will present our improvement and new development of a fast microwave assisted downdraft catalytic pyrolysis and gasification processes and system using the novel microwave heating mechanism in which microwave susceptors and catalysts are used to significantly improve the heating characteristics, and the yield and quality of the products. Solid feedstocks are directly fed onto the hot microwave absorbents efficiently and efficiently maintained at desirable temperatures, resulting in higher temperature rise rate of the feedstock and therefore much more efficient absorption of the microwave energy also, and in turn fast gasification and pyrolysis. A separated packed-bed catalysis for the volatiles was also developed to improve the quality and yield of the pyrolytic and gasification products. Results and discussion on the effects of key process variables such as microwave susceptor type, particle size, and loading, microwave power input and control, feedstock loading method, raw material and catalyst temperatures, and the ratio of raw material and catalyst loading on product yields and quality, and energy consumption will be presented.

Biography

Roger Ruan is the Director of Center for Biorefining and Professor of Bioproducts and Biosystems Engineering Department at University of Minnesota, and Fellow of ASABE. He has published over 400 papers in referred journals, books, and book chapters, and over 300 meeting papers and other reports, and holds many patents. He is also a top-cited author in the area of agricultural and biological sciences. He has served as guest editor and/or editorial board member of Bioresource Technology, etc. and an Editor-in-Chief and chairman of the board for International Journal of Agricultural and Biological Engineering.

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