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Abstract

Steam gasification with torrefaction as pretreatment to enhance syngas production from kitchen food waste

Dharminder Singh

Department of Chemical Engineering, School of Engineering, Shiv Nadar University, Greater Noida, 201314, India.

Abstract:

In the present work, steam gasification of kitchen food waste was carried out with torrefaction as pretreatment. The food waste used in this study was collected from one of the Dining Halls of Shiv Nadar University, India, which comprised of a mixture of various vegetables, grains, pulses, and meats. Various samples of torrefied food waste was prepared by heating food waste at different temperature of 230 °C, 260 °C, and 290 °C for one-hour residence time in a fixed bed reactor. Proximate, elemental, and ligno-cellulosic composition analysis were carried along with, HHV, mass yield, energy yield, energy density and bulk density determination of each food waste sample pre and post torrefaction. Raw as well as torrefied food waste were used as the feedstock for steam gasification reactions and its effect on food waste quality and in turn, on syngas production was determined. Gasification was carried out with steam as gasification agent and the flow of steam was kept at 0.625 ml/min with steam to biomass ration of 1.25. The temperature for gasification was chosen as 700 °C. Syngas characteristics such as syngas yield, syngas composition, and H2 yield were evaluated and it was found that their values varied in different proportion on changing the food waste torrefied at increasing temperature. The highest syngas yield and H2 field was found to be 3.49 m3/Kg and 2.15 m3/Kg for TFW 290 respectively. However, H2 fraction in syngas did not vary much for raw as well as food waste torrefied at different temperature except at 230 °C. Cold gas efficiency and carbon conversion efficiency were also determined to evaluate the performance of proposed pretreatment on steam gasification.

Biography:

Dharminder Singh is pursuing PhD in Department of Chemical Engineering, School of Engineering at Shin Nadar University, India. Prior to that, he has did his

B.Tech in Electronics and Communications Engineering from Guru Gobind Singh College of Modern Technology and M.Tech. in energy studies from Guru Nanak Dev Engineering college Ludhiana . His areas of interest include Biomass conversion by Torrefaction, Pyrolysis and Gasification process and studies performance and process parameters of the Packed/Fixed bed gasifier, Bubbling Fluidization bed gasifier and energy analysis for these technologies for industrial applications. His areas of expertise include Lignocellouse, physical and chemical compositions analysis of biomass and syngas with different standard methods (ASTM, TAPPI, NERAL (LAP) and different instruments X-ray diffraction (XRD), Thermogravimetric Analysis (TGA) and DTGA, Ultraviolet-Visible (UV-Vis or UV/Vis) spectrophotometry, Gas chromatography (GC).

Publication of speakers:

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2. N. Reyhanian, V. Shah-Mansouri, B. Maham, and C. Yuen, "Renewable energy distribution in cooperative cellular networks with energy harvesting," in IEEE PIMRC, 2015, pp. 1617–1621.
3. C. Hu, X. Zhang, S. Zhou, and Z. Niu, "Utility optimal scheduling in energy cooperation networks powered by renewable energy," in APCC, 2013, pp. 403–408.

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