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Biomass to fuel gas conversion through low pyrolysis temperature induced by gamma radiation

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The continuous dependence on the fossil fuel as a main source of energy, in which its combustion usually produces greenhouse and toxic gases (such as SO_2, NOx and other pollutants), take part directly in causing global warming and environmental pollution. In line with, the biomass based wastes can be harmful for the environment if unutilized. Unused ones would otherwise be burned, land filled, degrade or accumulate in ecosystem and habitat. Biomass landfill leads to greenhouse gas emission, soil and water contamination, and depresses watershed and productivity. Utilization of biomass and wastes can be considered one of the promising renewable sources in term of abundance, widely distributed worldwide as well as being costly effective source for energy production. Adding value to low or waste negative feed stocks by converting them to marketable bio-fuel gases, to replace the current one, as a renewable resource for energy via pyrolysis or gasification technology is the aim of this work. As a promising thermal conversion method in terms of high reliability, good flexibility through processing and versatile range of products can be obtained, pyrolysis/or gasification technology has been considered as an important process for the generation of sustainable energy and chemicals technologies from biomass. Gasification/pyrolysis process converts biomass carbon-containing materials into a combustible gas composed primarily of carbon monoxide, hydrogen, and methane. This is however the available literature over the last few decades reported that pyrolysis/gasification processes should be carried out at elevated temperature which is at least 500°C. The current research work has focused on the conversion of some of the biomass into a certain fuel gas at low temperatures assisted by radiation. At the first place, using raw untreated biomass, gas mixtures composed of different percents carbon dioxide and methane were obtained under different operating conditions of time and temperatures. In practical, maximum temperature and timing of 300°C and four hours respectively were applied through this conversion process. A complete shift in the produced gas composition towards pure methane (natural gas) was obtained at the same operating conditions via introducing gamma ray-treated biomass samples in the pyrolysis system. On the other hand, nano-carbon particles were obtained as the by-product of the thermal conversion of the radiated biomass whilst a morphs carbon was obtained when untreated biomass was applied. The gas composition determination analysis was done using GC equipped with TC detector and the carbon particles characteristics were carried out by HR TEM and Raman spectroscopy.

Biography

Ahmed M A El Naggar has completed his PhD from Newcastle University, UK and Postdoctoral studies in the EPRI. He got a UK patent in chemical engineering and advanced materials entitled “Integrated Intensified Biorefinery for Gas-to-Liquid Conversion”. He has published 6 papers in reputed journals and 4 conference publications and has been serving as a reviewing board member in several well reputed international journals.

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