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Analytical and thermal evaluation of carbon particles recovered at the cyclone of a biomass gasification system

Nwabunwanne Nwokolo, Sampson Mamphwelia and **Golden Makaka**
University of Fort Hare, South Africa

Gasification of biomass for the generation of heat and power gives off product gases that are contaminated mostly by carbon particulates and tars. The degree of contamination depends on the gasification process, type of gasifiers and type of biomass used. The use of downdraft gasifiers minimizes the production of tar to a tolerable limit; however, carbon particles still pose a challenge particularly with integration of heat exchanger for heat recovery from the product gas. Although, the presence of carbon particles in the product gas does not affect the quality and quantity of heat contained in the product gas, but it does influence the heat recovery process and materials used in the recovery. Hence, there is a need for characterization of these carbon particles to ascertain their chemical compositions, thermal properties and morphological features. This study aims at evaluating the characteristic features of carbon particles recovered from the syngas stream during gas cleaning at the cyclone. The elemental analysis of the carbon particle sample was performed using energy dispersive X-ray spectroscopy. An electron beam from scanning electron microscopy was passed through the sample surface at a magnification of 1000 and accelerating voltage of 15 kV to determine the morphological features. The thermal properties were investigated using thermo gravimetric analyzer. Silicon, oxygen and carbon were found to be the dominating elements in the carbon particulate. In the final paper, the final result will be presented.

nnwokolo@ufh.ac.za

The use of selected agro-based waste biomass for remediation of wastewaters

Upenyu Guyo
Midlands State University, Zimbabwe

Various wastewater treatment methods have been reported and many of them pose serious technological and technical problems. Most of the methods have various demerits such as incomplete pollutant removal, high capital investments, operation costs, high energy consumption and low selectivity. Adsorption is a recent technology that is gaining popularity as it is perceived to be relatively rapid, reversible, economical and environmentally friendly. The technology utilizes naturally occurring waste materials (biomaterials and agricultural by-products) for the removal pollutants from wastewaters. This work explores the potential applicability of raw and modified biomaterials such as marula seed husk biomass, *Moringa oleifera, Opuntia ficus indica* and agricultural by-products such as *Zea Mays* and *Vigna unguiculata* biomass for the adsorption of selected heavy metals (Pb(II), Cd(II) and Ni(II)) and dyes (methylene blue and methyl red). The biomass materials were applied either as raw or as magnetite and biopolymer derivatives. The results revealed interesting transformations of the biomass materials as characterized by FTIR, XRD and SEM-EDS techniques. The effectiveness of the biomass materials as adsorbent materials was evaluated based on the maximum adsorption capacities following adsorption isotherm modeling. The results from the studies show that biomass materials may be used as a low-cost, eco-friendly and effective adsorbents to remediate environmental wastewaters.

guyou@msu.ac.zw