



Contribution ID: 283

Type: Poster Presentation

Assessment of the quality parameters of corn cob for energy conversion through gasification

Tuesday, 4 July 2017 17:10 (1h 50m)

Corn cob is an abundant agricultural by-product of the maize industry, which is one of the largest producers of biomass residues in South Africa. The performance of energy conversion systems such as the gasification systems, among other factors, rely on the characteristics of the feedstock for conversion, which are most often determined by the use of specialized analytical instruments. This study assessed the characteristics of corn cob relevant to gasification in a downdraft system and determined that the physical, chemical and thermal as well as structural characteristics related to morphology and reactive group of atoms analyses are among the properties of corn cob that impacts its gasification performance. The results of these characteristics were interpreted in relation to gasification with specific reference to existing data from the literature. The calorific value result of corn cob showed that about 18 MJ/kg of energy is available for conversion. Its high ash content of approximately 9% indicates that technical difficulties linked to fouling, slagging and sintering effects may be experienced, which may together contribute to low gasification efficiency. However, the weight percentages of other properties such as moisture, volatile matter and fixed carbon contents as well as the three major elemental components (C, H and O) of corn cob including its clearly exhibited fiber cells, which are an indication of carbon-orientation as revealed by SEM analysis, makes corn cob a suitable feedstock for gasification. Its internal structural analysis as revealed by FTIR analysis showed that $-OH$, $C-O$, $C-H$ and $C=C$ are the major functional group of atoms in its structure. These groups facilitate the formation of condensable and non-condensable liquid and gaseous products that impacts on the quality of the syngas produced during gasification. TGA analysis also established the maximum decomposition temperature of corn cob, ranging from 94–900°C.

Apply to be considered for a student award (Yes / No)?

No

Level for award (Hons, MSc, PhD, N/A)?

N/A

Main supervisor (name and email) and his / her institution

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Would you like to submit a short paper for the Conference Proceedings (Yes / No)?

No

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Session Classification: Poster Session 1

Track Classification: Track F - Applied Physics