

Extraction of Silica from Sugarcane Bagasse, Cassava Periderm and Maize Stalk: Proximate Analysis and Physico-Chemical Properties of Wastes

Waste and Biomass Valorization

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Abstract

Indiscriminate disposal and burning of agricultural wastes constitute environmental pollution and increase in greenhouse gases emission. Renewable nature and availability of agricultural wastes has stimulated researchers to explore “wastes to wealth creation” policy. Three agricultural wastes were investigated for potential use for silica production. Proximate analysis, thermogravimetric analysis (TGA), compositional analysis, calcination and statistical analysis were carried out to quantify the ash and establish presence of silica. Response surface methodology was used for statistical analysis of CP calcination. The proximate analysis showed that sugarcane bagasse, cassava periderm and maize stalk ash contents are 1.73, 4.93 and 4.80%, respectively. The EDS results showed that their ashes contain 5.22, 6.10 and 7.01% silicon, respectively. XRF results revealed presence of 38%

SiO₂ in CP ash. XRD revealed presence of silica and silicates phases. TGA shows that their calcination temperature must be above 500 °C. Numerical optimization of CP calcination gave optimum condition of 700 °C for 270 min to attain 82% weight loss. Calcination regression equation exhibited high coefficient of determination (R²) of 0.8225. The three wastes contain silica and silicates from which silica could be extracted. Calcination temperature and time have been established to be significant in ash content enhancement.

Keywords

Proximate analysis Calcination Agricultural wastes Cassava periderm Maize stalk
Sugarcane bagasse

Electronic supplementary material

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Notes

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Supplementary material

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Supplementary material 1 (XLSX 16 KB)

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Supplementary material 2 (TIF 435 KB)

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