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DEVELOPMENT AND CHARACTERIZATION OF CHICKEN EGGSHELLWASTE AS POTENTIAL CATALYST FOR BIODIESEL PRODUCTION

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Abstract

An average of 369800 cases of chicken eggs are consumed per week in South Africa. Disposal of the resultant shells, which constitute about 10% by weight of eggs, has been problematic and costly. Conversion of chicken eggshell waste to useful substances has engaged the attention of researchers in recent years. This work is geared towards exploring chicken eggshell waste as a low cost, sustainable, and readily available source of calcium oxide (CaO) for use as a possible catalyst for biodiesel production. Raw, boiled and calcined eggshell 75 μ m powder were prepared and characterized. The results of the X-ray diffraction (XRD) showed that while raw and boiled chicken eggshell contained 79.3% and 99% (calcium carbonate [CaCO₃]) respectively, whereas eggshell powder calcined at 900°C for 3h contained 63.8% lime (CaO). This was due to the thermal decomposition of CaCO₃ to CaO and portlandite (Ca(OH)₂) during calcination. Thermogravimetric analysis (TGA) revealed a 44.5% and 42% weight loss of the boiled and raw eggshell samples respectively, which occurred between 700°C and 900°C, whereas the calcined powder sample only witnessed 5.5% weight loss at 400°C. Scanning electron microscope (SEM) analysis showed that raw, boiled, and calcined eggshell samples contained 41.31%, 21.91%, and 46.08% of calcium, 14.93%, 26.40% and 6.22% of carbon, and 43.76%, 51.68%, and 47.70% of oxygen respectively. The results of transmission electron microscopy (TEM) image analysis and Fourier-transform infrared spectroscopy (FTIR) revealed that boiling has no significant effect on the structure, composition and thermal degradation of waste chicken eggshell, unlike calcination. Complete conversion of CaCO₃ to CaO through calcination enhances the properties and usefulness of waste chicken eggshell powder as a heterogeneous catalyst for biodiesel production.

Author Keywords

Calcination, Characterization Chicken Eggshells, Heterogeneous Catalyst

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