

Development of Catalyst from Waste Egg Shell for Biodiesel Production by Using Waste Vegetable Oil

Authors : Victor Chinecherem Ejeke, Raphael Eze Nnam

Abstract : The main objective of this research is to produce biodiesel from waste vegetable oil using activated eggshell waste as solid catalysts. A transesterification reaction was performed for the conversion to biodiesel. Waste eggshells were calcined at 700°C, 800°C and 900°C for a time period of 3hrs for the preparation of the renewable catalyst. The calcined waste eggshell catalyst was characterized using X-Ray Florescence (XRF) Spectroscopy, which revealed CaO as the major constituent (90.86%); this was further confirmed by X-Ray Diffraction (XRD) and Fourier Transform Infrared (FTIR) analyses. The prepared catalyst was used for transesterification reaction and the effects of calcination temperature (700 to 900°C), Deep Eutectic Solvent DES loading (3 to 18 wt. %), Waste Egg Shell (WES) catalyst loading (6 to 14 wt. %) on the conversion to biodiesel were studied. The yield of biodiesel using a waste eggshell catalyst (91%) is comparable to conventional catalyst like sodium hydroxide with a yield of 80-90%. The maximum biodiesel production yield was obtained at a specific oil-to-methanol molar ratio of 1:10, a temperature of 65°C and a catalyst loading of 14g-wt%. The biodiesel produced was characterized as being composed of methyl Tetradecanoate (C₁₄H₂₈O₂) 30.92% using the Gas Chromatographic (GC-MS) analysis. The fuel properties of the biodiesel (Flashpoint 138°C) were comparable to commercial diesel, and hence it can be used in compression-ignition engines. The results indicated that the catalysts derived from waste eggshell had high potential to be used as biodiesel production catalysts in transesterification of waste vegetable oil with the advantage of reusability and also not requiring water washing steps.

Keywords : waste vegetable oil, catalyst, biodiesel, waste egg shell

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