

Abstract

The study evaluated the potential use of agricultural waste, *Tamarindus indica* fruit shell ash, as a solid base catalyst for production of biodiesel. The catalyst was prepared by calcination of *T. indica* fruit shell at 800 °C in muffle furnace for 3 h. Branauer-Emmett-Teller, thermal gravimetric analysis, X-ray diffraction, scanning electron microscope, X-ray florescence, and Hammett indicator techniques were used to characterize the physicochemical properties of the produced catalyst. The catalyst had basic strength of greater than 9.7 and mesoporous structure with pore size $d = 3.2$ nm. The crystalline phase was made up of calcium oxide, potassium oxide, and magnesium oxide. The catalyst was tested for biodiesel production using *Parinari curatellifolia* seeds oil. The results showed that the best operating parameters for the production of biodiesel were 9:1 methanol to oil molar ratio, 125 mg catalyst (5 wt% of oil), 2 h reaction time, and 60 °C reaction temperature. These optimized operating parameters afforded a maximum yield of 96.2%. Also, fuel properties of biodiesel: acid value, viscosity, and flash, pour, and cloud points were investigated and compared to the ASTM standards limits D6751. The results were observed to be in good agreement with the ASTM standards limits for biodiesel. In addition, the catalyst was easily separated and subsequently reused for four runs in biodiesel production. Thus, Tamarind fruit shell derived catalyst is very promising for the production of biodiesel due to its high performance, low-cost, easy preparation and availability.