Production of Biodiesel from Soybean Oil Using Calcium Oxide and Cow Bone as Catalysts

Authors: Ayodeji, Ayoola A.; Blessing, Igho E.; Rasheed, Babalola; Modupe, Ojewumi E.; Ajibola, Ogunbiyi; Oluwabunmi, Abatan G.; Ojo, Fayomi S.
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ABSTRACT

Biodiesel was produced from the transesterification of soybean oil using calcium oxide and cow bone (an animal waste bone that contains hydroxyapatite, a calcium phosphate mineral) as heterogeneous catalysts. The soybean oil used was characterized using gas chromatography mass spectrometer (GCMS) and the cow bone catalyst produced was characterized using X-ray diffractometer (XRD) and X-ray fluorescence (XRF) spectrometer. The effects of the variation of methanol/oil mole ratio (9–15), catalyst concentration (10–20 wt/wt%) and reaction temperature (55–65 °C) on biodiesel yield during the transesterification of soybean oil with methanol was investigated. Reaction time of 3 hours and stirring rate of 500 rpm were kept constant. It was observed that the calcination of cow bone catalyst (at 800 °C) enhanced its conversion to apatite [$Ca_5(PO_4)_3OH$] and increased the yield of biodiesel obtained. Biodiesel yield results revealed an optimum condition of methanol/oil mole ratio of 9, catalyst concentration of 15 wt/wt% and reaction temperature of 55 °C. Also, the results obtained showed that the performance trends of the two catalysts used were similar. And the close values of highest biodiesel yields obtained when the two heterogenous catalysts were used separately (yields of 94.8 and 92.2% using calcium oxide and calcined cow bone catalysts respectively) implies that the use of low-cost and readily available calcined cow bone catalyst is a promising alternative to CaO catalyst.

Keywords: BIODIESEL; CALCINED COW BONE; CALCIUM OXIDE; SOYBEAN OIL; TRANSESTERIFICATION

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