Data in Brief 18 (2018) 512–517

Contents lists available at ScienceDirect

Data in Brief

journal homepage: www.elsevier.com/locate/dib

Data Article

Data on calcium oxide and cow bone catalysts used for soybean biodiesel production

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ARTICLE INFO

Article history:
Received 25 January 2018
Received in revised form
28 February 2018
Accepted 13 March 2018
Available online 17 March 2018

Keywords:
Biodiesel
Calcined cow bone
Catalyst
Soybean

ABSTRACT

Biodiesel was produced from soybean oil using calcium oxide and cow bone as heterogeneous catalysts, through transesterification process. The soybean oil used was characterized using gas chromatography mass spectrometer (GCMS) and the cow bone catalyst produced was characterized X-ray fluorescence (XRF) spectrometer. The effects of the variation of methanol/oil mole ratio, catalyst concentration and reaction temperature on biodiesel yield during the transesterification of soybean oil were investigated. Reaction time of 3 h and stirring rate of 500 rpm were kept constant. Using Response Optimizer (Minitab 17), the optimum conditions for biodiesel production were established. It was observed that the calcination of cow bone catalyst enhanced its conversion to apatite-CaOH. Also, the results obtained showed that the performance trends of calcined cow bone catalyst and the conventional CaO catalyst were similar.

Subject area	*Materials Science Engineering*
More specific subject area	*Renewable Energy*
Type of data	*Table, image*

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https://doi.org/10.1016/j.dib.2018.03.057

How data was acquired	The physio-chemical characteristics (chemical compositions) of the uncalcined cow bone catalyst, calcined cow bone catalyst and CaO catalyst were determined using XRF spectroscopy principle. The fatty acids profile in the soybean oil used was analysed using GCMS. Experimental work involving transesterification process (using Box Benkhen design) was employed in generating data on biodiesel yield. Laboratory tests to generate properties of both the soybean oil used and soybean biodiesel produced were carried out.
Data format	Raw, Analyzed
Experimental factors	The cow bone sample was calcined and a portion was left uncalcined. Parameters varied during biodiesel production (transesterification process) are methanol/oil mole ratio, catalyst concentration and reaction temperature.
Experimental features	Oil sample was introduced into GCMS at oven temperature of 60 °C using 99.99% Helium with column length of 30 m, column thickness of 0.25 μm and internal diameter of 0.25 mm. The column temperature was programmed to increase to 200 °C at the rate of 10 °C per minute. The flame ionization detector (FID) temperature was set at 220 °C. Determination of the elemental composition of unclacined and calcined cow bone catalysts involved the use of XRF analysis. Phillips 1404 XRF Wavelength Disperse Spectrometer coupled with X-ray tube and a Rh anode (X-rays source) having HVPS 60 kV, 7.0 mA, a LN_2 cooled Si(Li) detector with a resolution of 131 eV at, Mn Kα (5.9 keV) X-ray and a 6-sample turret (that permits the mounting and analyzing of 6 samples at a time) was used. XRF spectrometer operation was based on the emission of the excited elemental components of the given sample through the bombarding of the sample with high energy X-rays. During biodiesel production, methanol/oil mole ratio of 9–15, catalyst concentration of 10–20 wt/wt% and reaction temperature of 55–65 °C were considered. Reaction time of 3 h and a stirring rate of 500 rpm were kept constant.
Data source location	Department of Chemical Engineering, Covenant University, Ota, Nigeria and Metallurgical and Chemical Engineering Department, Amadu Bello University, Zaria, Kaduna State, Nigeria.
Data accessibility	Data are available within this article.

Value of the data

- The data on biodiesel production can be modelled to examine the relationship between the process variable (for instance methanol/oil mole ratio, catalyst concentration and reaction temperature) as it affects the yield of biodiesel.
- The data could be used at investigating the relationship between the fatty acid profiles of soybean oil and the yield of biodiesel.
- The given data will show authors in the field of material science and chemical engineering that the calcination of cow bone will enhance cow bone conversion to apatite-CaOH catalyst ($Ca_{10}P_6O_{26}H_2$) for biodiesel production.
- The data obtained for both the calcined and uncalcined cow bone catalyst can be used as inference to determine the chemical composition of other animal bones, under the same experimental conditions.
- The data reveals that calcined cow bone catalyst is a very promising heterogenous catalyst that can be used in the place of the conventional CaO catalyst during oil transesterification.