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Biodiesel production from waste cooking oil using calcium oxide /nanocrystal cellulose/polyvinyl alcohol catalyst in a packed bed reactor (Article)

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Abstract

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In this study, biodiesel was synthesized from a reaction of waste cooking oil (WCO) and methanol in the presence of catalyst which was derived from chicken bone and coconut residue in a packed bed reactor. Calcium oxide (CaO) was extracted from calcined chicken bone and nano-crystal cellulose (NCC) was isolated from coconut residue by acid hydrolyzed and were supported with polyvinyl alcohol (PVA). The catalyst was analyzed using Fourier transform infrared (FTIR), Field emission scanning electron microscopy (FESEM), Thermogravimetric analysis (TGA) and X-ray diffraction (XRD) to study its elemental composition and surface morphology. The parameters used for the reaction were optimized by Design of Experiment (DOE) using Central Composite Design (CCD) to maximize the biodiesel yield. The maximum yield of 98.40% was obtained at optimum temperature, methanol to oil and catalyst loading of 65 °C, 6:1 and 0.5 wt%, respectively. Investigation on the kinetic of the reaction specified that the reaction followed pseudo first order reaction with k-value ranged from 0.0092 min^{-1} to 0.0151 cm^{-1} and Thiele modulus was less than 2. The activation energy E_a for the transesterification reaction was 45.72 kJ/mol. © 2020 Elsevier Ltd

SciVal Topic Prominence

Topic: Transesterification | Cooking Fats and Oils | Rubber Seed Oil

Prominence percentile: 99.868

Chemistry database information

Substances

calcium oxide

Author keywords

Biodiesel production | Chicken bone | Heterogeneous catalyst | Nano-catalyst | Nano-cellulose | Packed bed reactor

Indexed keywords

Engineering controlled terms: Activation energy | Animals | Biodiesel | Calcium oxide | Catalysts | Cellulose | Chemical reactors | Design of experiments | Field emission microscopes | Fourier transform infrared spectroscopy | Lime | Methanol | Morphology | Packed beds | Scanning electron microscopy | Surface morphology | Synthetic fuels | Thermogravimetric analysis

Engineering uncontrolled terms: Biodiesel production | Central composite designs | Elemental compositions | Field emission scanning electron microscopy | Fourier transform infrared | Poly (vinyl alcohol) (PVA) | Pseudo-first order reactions | Transesterification reaction

Engineering main heading: Oils and fats

GEOBASE Subject Index: activation energy | biofuel | catalyst | cellulose | chemical reaction | detection method | essential oil | inorganic compound | polymer | temperature effect

PaperChem Variable: Activation Energy | Animals | Calcium Oxide | Catalysts | Cellulose | Chemical Reactors | Gravimetry | Thermal Analysis

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