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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  $0.0092 \text{ min}^{-1}$  to  $0.0151 \text{ cm}^{-1}$  and Thiele modulus was less than 2. The activation energy  $E_a$  for the transesterification reaction was 45.72 kJ/mol. © 2020 Elsevier Ltd

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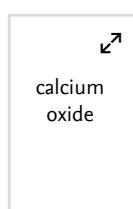
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