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Effects of seeds pre-treatment on biodiesel yield from four varieties of castor seeds (Ricinus Communist L) oil

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The increasing awareness of the environmental effects (global warming) caused by the usage of fossil fuel and the L environmental benefits of using biodiesel which is renewable and environmental friendly energy resource has made biodiesel more attractive in recent times. Studies have been conducted on the transformation of castor oil into biodiesel. However, the varieties of castor oil used were not specified and little effort has been made to address the effects of oilseed pretreatment methods on biodiesel yield and properties. This study therefore, investigates the production and characterization of biodiesel using oil from four varieties of castor seeds. Four varieties of castor seeds identified on the basis of colour and size named; White Big Size (WBS), Black Big Size (BBS), Grey Medium Size (GMS) and Grey Small Size (GSS) were used. Castor oil was obtained from the raw and pretreated seeds of each variety at constant pressing pressure of 135 N/m², using a hydraulic press for a pressing duration of 12 min. Castor oil expressed from each of the varieties were transesterified by reacting it with anhydrous methanol, using potassium hydroxide (KOH) as catalyst. Castor methyl ester (CaME) process parameters used were catalyst concentration (1, 1.5 and 2%), reaction temperature (30, 45 and 60°C) and reaction time (15, 30 and 60 min). In all the experiments, a methanol/castor oil molar ratio of 6:1 was used. Biodiesel yield was calculated and the fuels obtained were characterized to determine the fuel properties. A regression model was developed for biodiesel yield and response surface method (RSM) was used to confirm the polynomial equation solved using the Design-Expert 7.0 Software. Comparative evaluation was carried out using statistical package stat-ease to investigate the best processing procedures that will give the optimum biodiesel yields and biodiesel properties. Highest biodiesel yield of 98.20% was obtained from raw dehulled GMS. Biodiesel yield varied with seed variety, and was influenced by heating method, reaction time, catalyst concentration, nature of seed and their interactions. The observed differences between the properties of biodiesel obtained from different castor seed varieties were significant at 5% level. The oil from raw seeds gave the highest biodiesel conversion, with the highest yield being obtained from GMS followed by the GSS, then the BBS and lastly the WBS. The GMS variety had the highest percentage of biodiesel yield when raw and dehulled seed is utilized. Biodiesel from the oil of GMS variety possessed the best set of fuel properties and is therefore recommended for use in biodiesel production. The developed mathematical models adequately simulated the biodiesel production process and can be trained to apply to the process involving oils of different origin.

Biography

Fasiu A Oluwole has completed his PhD from The University of Maiduguri, Nigeria. He is a Senior Lecturer in the Department of Mechanical Engineering, University of Maiduguri, Nigeria. He has published more than 27 papers in reputed journals and has been serving as a Faculty Board Member.

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