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Production of Karanja Methyl Ester from Crude Karanja Oil Using *Meretrix Lyrata* Synthesised Active Cao Catalyst

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ABSTRACT

Active calcium oxide catalyst was synthesised from *Meretrix Lyrata (M.Lyrata)* following calcination-hydration-dehydration technique. The catalytic feasibility of synthesised CaO was investigated in the production of Karanja methyl ester (KME) from crude Karanja oil (CKO). KME was synthesised through esterification using H_2SO_4 followed by transesterification utilising CaO in a two-step reaction process of CKO and methanol. The *M.Lyrata* shells were calcined at 900 ℃ and the catalyst samples were characterised using FTIR, SEM, PSA, and BET-BJH spectrographic techniques. A maximum fatty acid methyl ester (FAME) conversion of 97.3 % was obtained at optimum reaction conditions including methanol-to-oil ratio of 12:1, catalyst concentration of 2 wt.%, reaction temperature of 58 ℃ and reaction time of 2 hrs. In a comparative study with commercial CaO, *M.Lyrata* showed a higher catalytic activity. The catalyst reusability experiments ascertaining reusability of CaO up to four reuse cycles had shown good efficiency. The economic comparative study confirms that CaO derived from *M.Lyrata* can be used as an alternative and feasible catalyst for biodiesel production. The KME fuel properties complied to EN-14214 biodiesel fuel standards.

***Keywords*:** Seashells; heterogeneous catalyst; transesterification; Karanja biodiesel; spectroscopy.

INTRODUCTION

Biodiesel, also known as fatty acid methyl ester (FAME) or fatty acid ethyl ester (FAEE) can be obtained from vegetable oils or animal fats [1, 2]. The rapid depletion of fossil fuel, demand for engine fuels that keeps growing tremendously and its unpredictability in future availability, lead to the crucial factor to explore on alternative renewable fuel sources that will be able to supplement fossil fuels [3-6]. In recent years, biodiesel had shown exciting potential and received worldwide attention being recognised as a substitute for petro-based diesel fuel. Biodiesel is known for its sustainability, non-toxicity, biodegradability, reduced gaseous pollutant emissions and easy usability as fuel to be used in conventional diesel engines without major modifications as compared to petroleum diesel [7, 8]. Production of biodiesel globally was over 5 billion gallons in 2010. Transesterification is considered to be the most reliable method for biodiesel production using vegetable oil feedstocks [9, 10]. There are several types of catalysts used for biodiesel production via transesterification reaction such as homogenous catalyst, heterogeneous catalyst and certain enzymes [11-13]. Usually KOH or NaOH are