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An insight into the synthesis of fuel grade esters over PE-Si composite

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Exploring and improvement of biodiesel preparation from non-edible vegetable oil is one of the efficacious ways to answer limited amount of traditional raw of higher prices. The main intention of this study is to optimize the biodiesel production process variables (lauric acid to methanol molar ratio, reaction temperature, reaction time and PE-Si catalytic material loading) of a biodiesel (methyl laureate) derived from lauric acid. Therefore, in the present work, silanol anchored sulfonic acid mediated polyol composite was prepared via chlorosulfonation of pentaerythritol and employed as an environmentally benign catalyst for single step conversion of lauric acid to fuel grade esters via esterification reaction. The catalyst was characterized by TGA-DSC, XRD, TPD-NH_3, FT-IR, SEM and BET surface area analysis, whereas, the synthesized methyl laureate was clearly characterized by FT-IR, 1H-NMR and ^{13}C-NMR spectroscopic techniques. It has been evidenced from experimental results, the best conditions to develop efficient process for the synthesis of methyl laureate via esterification of lauric acid within selected framework are, 1:10 lauric acid to methanol molar ratio, 5% catalyst (w/w), 120 °C reaction temperature and 9 hours reaction time for the 96.19% yield of methyl laureate. In addition, the fuel properties of fuel grade esters were measured and compared with ASTM fuel standards. Furthermore, being a heterogeneous in nature, PE-Si composite catalyst can be easily recovered from reaction mass and reused four times after simple recovery and reactivation.

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