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Production of biodiesel at room temperature from waste cooking oil

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Introduction of alternative energy sources which are environmental friendly and renewable is required to solve the problem of limited availability of fossil fuels and their negative impacts on the environment. Biodiesel has been identified as a potential alternative for petrodiesel. Biodiesel is a mixture of alkyl esters of long chain fatty acids and commonly used method for industrial production is transesterification of triglycerides in refined vegetable oils. However, the price of biodiesel is higher than petrodiesel due to high production cost. Therefore, the objective of the present work was to develop a low-cost method to produce biodiesel. Waste cooking oil (WCO) which does not have an economic value was used as the feed stock. Miscibility of reactants was increased by using acetone as the co-solvent and this resulted transesterification at room temperature. Because of the high free fatty acid content (0.52 %) in WCO, acid-catalyzed (Methanol, conc.H_2SO_4) esterification was done prior to base-catalyzed (Na, MeOH) transesterification. Water treated bentonite clay showed a potential for refining of biodiesel. Under the best conditions (oil: methanol 1:9 molar ratio, acetone 25 % w/w, reaction period 2h.), the yield was 86.5 %. Fatty acid profile (oleic acid 43.6 %, palmitic acid 37.4%, linoleic acid 11.2% and stearic acid 4.4 %) was compatible with reported data for biodiesel from soya bean oil and palm oil. Further, the density (897 kgm^{-3}), kinematic viscosity (5.3 mm^2s^{-1} at 40 ^{0}C) and flash point (196^{o}C) of biodiesel satisfied the ASTM standards. Hence, this study proves that low cost, good quality biodiesel can be produced from waste cooking oil adopting the proposed method.

Keywords: biodiesel, fatty acid profile, transesterification and waste cooking oil

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