ISSN: 1391-8796
Proceedings of 10th Ruhuna International Science & Technology Conference
University of Ruhuna, Matara, Sri Lanka
January 18, 2023

Novel silica supported CaO rich catalyst from rice husk and coral rubble to produce biodiesel from waste cooking oil.

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Biodiesel from waste cooking oil (WCO) is an environment friendly renewable energy source. Generally, NaOH or KOH are used as catalysts to produce biodiesel from vegetable oil via transesterification reaction. Although, these homogeneous catalysts have high catalytic activity they have certain drawbacks such as difficulty in catalyst separation, high soap formation and requirement of large amount of water to wash biodiesel product. Alternatively, CaO has been used as catalyst for this reaction but its efficiency is poor. Coral rubbles are abundantly found in southern coast of Sri Lanka and calcinating them to 900 $^{\circ}$C yield CaO rich coral rubble catalyst (CRC). In this research, the catalytic performance of CRCs against the transesterification reaction to produce biodiesel and its improved efficiency by incorporating rice husk silica was tested. Rice husk contains around 20% of biogenic silica. Therefore, initially, silica was extracted from pyrolyzed rice husk ash via alkaline extraction. Subsequently, SiO_2 was incorporated to the CRC via wet impregnation. Catalytic efficiency of CRCs with different weight percentages of silica was investigated. Accordingly, 20% wt silica loaded CRC showed the highest catalytic performance. Optimum biodiesel yield was obtained at a methanol to oil molar ratio of 18:1 and catalyst dosage of 8% wt at 60 ºC for 2 hrs. Catalyst reusability was tested for 5 runs and it has shown a significant yield over 75%. Fourier transform infrared spectroscopic (FTIR) data revealed the presence of Ca-O-Si bond in silica incorporated CRCs. pH, density, acid value and saponification value of the produced biodiesel were tested and they were within the accepted ASTM limits.

Keywords: Rice husk, Silica supported catalyst, Coral rubbles, Transesterification, Biodiesel

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