https://doi.org/10.7250/CONECT.2023.084

SYNTHESIS OF NANO-CALCIUM OXIDE FROM INDUSTRIAL BRINE SLUDGE WASTE WITH NANOCRYSTALLINE CELLULOSE (NCC) AS ADDICTIVE/COMPOSITES AND MODELLING USING ARTIFICIAL NEURAL NETWORK (ANN) FOR BIODIESEL PRODUCTION

Shonisani SALVATION MUTHUBI[1], Hilary LIMO RUTTO[2*], Lay SHOKO[3], Musamba BANZA[4]

[1–4] *Clean Technology and Applied Materials Research Group, Department of Chemical and Metallurgical Engineering, Vaal University of Technology, Private Bag X021, South Africa*

[*] ***Corresponding author.*** *E-mail address: hilaryr@vut.ac.za*

Abstract – Biodiesel production as a fuel in diesel engines has expanded dramatically in recent years and is likely to increase more in the near future. Increasing biodiesel consumption requires optimized production techniques that allow for large production capacities, simplified operations, high yields, and the usage of more cost-effective feedstocks such as waste oils and fats. In this study, biodiesel was produced from waste vegetable oil (WVO) and Methanol (CH_3OH) in the presence of a catalyst which was derived from industrial waste that mainly consists of Calcium Carbonate ($CaCO_3$). The produced nano-particle catalyst was characterized by using Fourier Transform infrared (FTIR), Scanning Electron Microscope (SEM) and X-ray diffraction (XRD). The optimum operating conditions for the highest biodiesel yield after applying the artificial neural network (ANN) approach was found to be 96.41 % yield at a temperature of 55 °C, catalyst loading of 1.25 % w/v, Methanol to oil ratio of 1:5 w/w and reaction time of 75 min. The FTIR showed the presents of CaO and NCC functional group. SEM image revealed that the produced catalyst is more porous, with small particle size, and XRD pattern presented the presence of cellulose (NCC) and Calcium Oxide (CaO) nano particles in the synthesized catalyst. The R^2 of 0.977 was found to be for the mathematical models to predict biodiesel production.

Keywords – Biodiesel; composites; nanocrystalline cellulose; nano-catalyst; nanoparticles