

## Synthesis of MnO-NiO-SO<sub>4</sub>-2/ZrO<sub>2</sub> solid acid catalyst for methyl ester production from palm fatty acid distillate

### ABSTRACT

Biodiesel is a found promising alternative biofuel to popular fossil fuel because of its renewable and biodegradable nature and thus is considered as environmentally benign. This paper reports on the synthesis of a novel heterogeneous manganese-nickel doped on sulfated zirconia catalyst (MnO-NiO-SO<sub>4</sub>-2/ZrO<sub>2</sub>) by using simple wet impregnation method for biodiesel production from palm fatty acid distillate (PFAD). The synthesized catalyst was characterized through ammonia temperature programmed desorption (TPD-NH<sub>3</sub>), X-ray diffraction (XRD), Fourier transform infrared (FTIR), pyridine adsorption via FTIR, scanning electron microscopy (SEM) and thermal gravimetric analysis (TGA) techniques. The synthesized catalyst was tested for PFAD through esterification reaction where more than 97% of biodiesel yield was observed under the optimized reaction conditions of 15:1 methanol to PFAD ratio, 70 °C reaction temperature, 3 wt% catalyst loading and 3 h reaction time. The reusability of the catalyst was tested and found that it could be reused for at least five times without significant reduction in activity. Hence, the catalyst was found suitable for biodiesel production from low grade feedstock.

**Keyword:** Biodiesel; Solid acid catalyst; Esterification reaction; PFAD