Low-cost solid catalyst derived from waste Cyrtopleura costata (Angel Wing Shell) for biodiesel production using microalgae oil

ABSTRACT

In the present work, Cyrtopleura costata (Angel Wing Shell) is used for the first time to synthesis of CaO. The produced CaO was utilized as a catalyst for biodiesel production from microalgae Nannochloropsis oculata oil. The Angel Wing Shell (AWS) was calcined at 800 °C and 900 °C for 2 h to convert CaCO3 to activate metal oxide phase. The synthesized catalysts were characterized by using Thermogravimetric analysis (TGA), X-ray diffraction (XRD), Temperature programmed desorption of CO2 (CO2-TPD), BET surface area and Scanning electron microscopy (SEM) analysis. The calcined Angel Wing Shell at 900 °C (CAWS 900) was chosen as the best catalyst due to its high basicity and surface area. This also corresponded to optimization condition where, CAWS 900 showed highest FAME yield (84.11%) at oil to methanol molar ratio 1:150 and catalyst loading of 9 wt.% in 1 h reaction time. The CAWS 900 catalyst also can be reused more than three times with FAME yield greater than 65%. Overall, AWS appears to be an acceptable solid catalyst to convert microalgae oil to biodiesel.

Keyword: Calcium oxide; Waste shell; Microalgae; Biodiesel; Transesterification