

Production of methyl esters from waste cooking oil and chicken fat oil via simultaneous esterification and transesterification using acid catalyst

ABSTRACT

Low cost and environment friendly sulfonated carbon catalyst was prepared from glycerol and concentrated sulfuric acid via in situ carbonization and sulfonation. The physico-chemical properties of catalyst were determined using various techniques. The textural properties of glycerol derived sulfonated carbon catalyst (SCG) revealed amorphous structure with low surface area and pore volume. The total acid density of catalyst is found to be 35117.14 $\mu\text{mol/g}$. SCG catalyst showed remarkable catalytic performances for simultaneous esterification and transesterification using waste cooking oil (WCO) and chicken fat oil (CFO). By using WCO, the highest FAME yield achieved was 92.3% at an optimum conditions of 5 wt% catalyst loading with 22:1 methanol to WCO molar ratio and 100 °C reaction temperature for 3 h. The SCG catalyst also maintained FAME yield >90% for two consecutive cycle for reusability. Meanwhile, using CFO, the highest FAME yield obtained was 90.8% at an optimised condition of 5 wt% catalyst loading with 18:1 methanol to CFO molar ratio and 70 °C reaction temperature for 1 h. The quality assessment of WCO methyl ester met both international standards (EN14214 and ASTM D675). The amount of sulfur in biodiesel is lower than the maximum limit of ASTM D6751.