BIODIESEL PRODUCTION VIA TRANSESTERIFICATION OF WASTE COOKING OIL USING CLAMSHELL AND SEA SAND AS POTENTIAL HETEROGENEOUS CATALYSTS

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Arsyad Ismail Sanuzi

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ABSTRACT

BIODIESEL PRODUCTION VIA TRANSESTERIFICATION OF WASTE COOKING OIL USING CLAMSHELL AND SEA SAND AS POTENTIAL HETEROGENEOUS CATALYSTS

The study was carried out to produce biodiesel via transesterification of waste cooking oil (WCO) using clamshell and sea sand as potential heterogeneous catalysts. The feedstock, WCO was first pre-treated in order to purify the oil and to discard water soluble impurities. The treated WCO showed low number of free fatty acid percentages (%FFA), acid value (AV) and saponification value, 1.30%, 2.587 mg KOH/g, and 193.7 mg KOH/g, respectively. The FTIR spectrum of treated WCO showed no present of OH group, proved that water soluble impurities in WCO were fully removed during pre-treatment. The catalysts were prepared and characterized by using FTIR and XRD. FTIR and XRD results showed the $CaCO_3$ in uncalcined clamshell converted to CaO and $Ca(OH)_2$ eventually after reaction with moisture in atmosphere. FTIR and XRD results of sea sand showed presence of SiO_2 in both before and after calcination. Both sample showed the increase in crystallinity after calcination, as observed by increase in intensity of XRD peaks. Next, the treated WCO was used to obtain FAME using combination of clamshell and sea sand as a catalysts and methanol as an alcohol in transesterification reaction. Five ratios of clamshell-to-sea sand were studied; 1:0, 0:1, 1:1, 1:2, and 2:1. 2:1 ratio was found as the best ratio with 71.1% FAME yield. This ratio was used to study further the effect of loading amount of the catalysts in weight percentage (wt%) on the yield of biodiesel (%). Three wt% used were 5%, 7%, and 10%. From 5% to 7%, it showed the increasing of FAME yield. However, from 7% to 10%, it showed the FAME yield was reduced. The reason was high alkaline catalyst loading could gain more soap formation. The best loading amount of the catalysts (wt%) was 7% which obtain highest percentage FAME yield, 75.3%. Analysis of FAME using GC-MS showed the presence of myristic acid, palmitic acid and oleic acid. From this study, it can be concluded that clamshell and sea sand are good potential catalysts which can be used to produce FAME by transesterification reaction process.