

ABSTRACT

The increasing global energy demand and the declining availability of fossil fuels, along with their negative environmental impacts, have encouraged the development of more environmentally friendly renewable energy sources. One of these alternatives is biodiesel, which is chemically a mixture of fatty acid methyl esters. Waste cooking oil was selected as a potential feedstock due to its abundant availability and non-competitions with food resources. This study aims to evaluate the performance of calcium oxide (CaO) supported on natural zeolite as a catalyst for the transesterification of waste cooking oil into biodiesel. The CaO/Natural Zeolite catalyst was prepared through natural zeolite activation and CaO impregnation, followed by characterization using XRD and FTIR. The transesterification reaction was carried out using methanol at 70 °C for 4 hours with an oil-to-methanol molar ratio of 1:12 and a catalyst loading of 1% wt based on oil weight. The product was analyzed using GC-MS. The results showed that the 5%CaO/Zeolit-H produced the highest methyl ester content of 58%, while higher CaO loadings reduced catalytic performance due to agglomeration, which blocked the zeolite pores.

Keywords: *Natural zeolite, CaO catalyst, biodiesel, waste cooking oil*