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SYNTHESIS OF $MgO/MgAl_2O_4$ NANOCATALYST BY COMBUSTION METHOD FOR BIODIESEL PRODUCTION

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$MgO/MgAl_2O_4$ Catalyst was synthesised by a simple, economical and rapid method with appropriate specification for the biodiesel production. First, $MgAl_2O_4$ spinel was synthesized by combustion method at different fuel ratios of urea and then active phase of MgO were deposited on the samples by impregnation method.

Catalysts were characterized by XRD, FE-SEM, EDX, BET and FTIR analyses to optimize the concentration of urea as fuel in the combustion synthesis. Finally, the transesterification reaction was performed at 110 °C, the molar ratio of alcohol to oil 12 and 3 wt.% of catalyst to feed for 3 hours was to evaluate the catalytic activity of samples in the biodiesel production that the conversion results were met expectations of the results of other analyses.

The XRD analysis confirmed the successful synthesis of $MgAl_2O_4$ spinels and showing the enhancement of the crystallinity by increasing the fuel ratio. The surface morphology of the synthesized catalysts ($MgO/MgAl_2O_4$) with different fuel ratios showed by FESEM analysis. It can be seen from the EDX analysis results that, Al, Mg, and O elements exhibited proper distributions with no agglomerated particles – very important parameters when it comes to catalytic activity[1]. The specific surface area, total pore volume and mean pore diameter of the prepared nanocatalysts using different fuel ratios were calculated from the isotherm data (BET-BJH analysis). Mean pore diameter over all samples was obtained to be over 2 nm by the BJH method, proving all catalysts to be mesoporous which there are reports indicating that, mesoporous catalysts with pore diameters of larger than 3.5 nm are appropriate for biodiesel production[2].

Analysing the effect of fuel ratio on the combustion synthesis of $MgAl_2O_4$, it was revealed that, the synthesized base catalyst with a fuel ratio of 1.5 was of the best specifications for biodiesel production process. The optimal catalyst had an average pore diameter and surface area of 6.3 nm and 60.6 m^2/g, respectively; indeed, the specifications are much suitable for biodiesel production process. Also, the results indicated that the optimized catalyst has the best specifications for biodiesel production which converted 95.7% of sunflower oil to biodiesel.

The optimum catalyst showed superior efficiency along with slight loss of reusability compared to other similar catalysts studied in related literatures under the same reaction conditions. Successfully used in biodiesel production reaction, the prepared optimal $MgO/MgAl_2O_4$ catalyst represented an efficient and cost-effective catalyst which can be readily synthesized. Future researches may investigate the catalyst reusability and mild reaction conditions, so as to achieve more economical production of biodiesel.

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