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Catalytic Potential of Double Perovskite $Sr_{0.5}K_{0.5}TiCu_{0.25}O_3$ in the Synthesis of Biodiesel via Ethyl Route

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Introduction

Currently, various studies and efforts have been applied to the synthesis of catalysts for production of biofuels from vegetable oils. Double perovskite structure catalysts have shown high efficiency for the production of biodiesel via heterogeneous catalysis[1]. This work has been investigated the preparation of a new catalysts for the production of biodiesel, which can be reused, of double perovskite structure with $Sr_{0.5}K_{0.5}TiCu_{0.25}O_3$ stoichiometry, with yields above 99%.

Results and Discussion

$Sr_{0.5}K_{0.5}TiCu_{0.25}O_3$ nanostructured powder (JCPDS card number 35-0734) was prepared by modified polyol method [2]. Transesterification reaction was performed with absolute ethanol in a round bottom flask fitted with a reflux condenser containing soybean oil, catalyst and ethanol. The reaction mixture was maintained under reflux and stirring for a period of 8 hours at 78 °C. Biodiesel obtained was characterized by gas chromatography coupled the mass spectrometry. From this technique it was possible to identify and determine the molecular masses of the constituent esters of biodiesel. From the integration of peak areas, analyzed by gas chromatography, was quantitated the esters obtained and the calculation of the reaction yield. For quantification of masses obtained of glycerol and of fractions called biodiesel was investigated the transesterification reaction, ranging the ratio of $Sr_{0.5}K_{0.5}TiCu_{0.25}O_3$ catalyst mass of 5%, 10% and 15% in relation to the mass of the oil with reaction time of 8 hours. The data obtained are listed in Table 1.

Table 1. Glycerol and biodiesel mass obtained with 5%, 10% and 15% mass of catalyst in relation to the mass of soybean oil.

Catalyst (%)	Soybean oil mass (g)	Glycerol mass (g)	Biodiesel mass (g)
5	27.30	1.98	26.60
10	27.05	2.37	26.50
15	27.10	3.36	26.75

According to Table 1, the ratio of 15% mass of catalyst showed higher activity. Figure 1 shows the chromatogram of the ethyl biodiesel obtained in the presence of $Sr_{0.5}K_{0.5}TiCu_{0.25}O_3$ with 15% mass and reaction time of 8 hours.

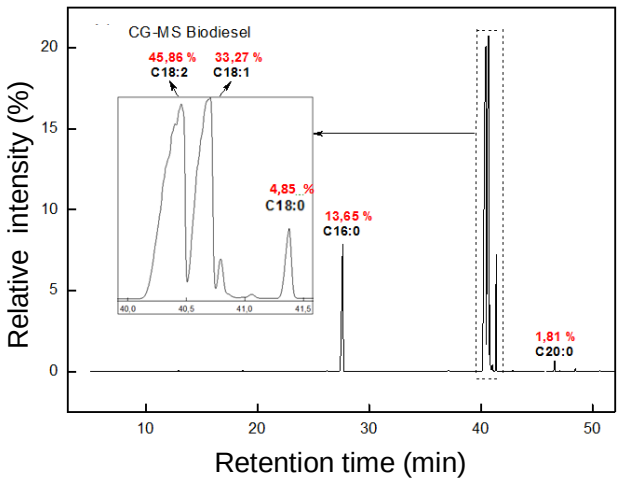

Figure 1: Chromatogram of determination and quantification of esters of ethylic biodiesel.

The peaks identified in Figure 1 are: ethyl palmitate ester (C16:0), ethyl stearate (18:0), ethyl oleate (18:1), ethyl linoleate (18:2) and arachidate acetate (20:0). Table 2 lists the reaction yield with the $Sr_{0.5}K_{0.5}TiCu_{0.25}O_3$ catalyst analyzed by gas chromatography.

Table 1. Yield of $Sr_{0.5}K_{0.5}TiCu_{0.25}O_3$ catalyst.

catalyst	Oil (g)	Glycerol (g)	Biodiesel (g)	Yeld (%)
$Sr_{0.5}K_{0.5}TiCu_{0.25}O_3$	27.10	3.36	26.75	99.44

Conclusions

The new $Sr_{0.5}K_{0.5}TiCu_{0.25}O_3$ catalyst showed high efficiency for the production of biodiesel via heterogeneous catalysis with 99.44% yield. Still, this catalyst can be reused, with the consequent reduction of energy costs and produces low amount of inputs and waste, exempting neutralization.

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