



Study of $\text{NH}_4[\text{NbO}(\text{C}_2\text{O}_4)_2(\text{H}_2\text{O})] \cdot n \text{H}_2\text{O}$ as a catalyst in transesterification of soybean oil to produce Biodiesel

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INTRODUCTION

Transesterification is the predominant process in the conversion of vegetable oils into biodiesel fuel. In this process, triglycerides are reacted with an alcohol, ethanol or methanol, and catalyst or base.¹

Niobium materials are presently of great interest in heterogeneous catalysis where they are used as catalyst active ingredient, carrier or auxiliary agent^{2,3}. Ammonium niobium oxalate is an excellent water-soluble complex. It is insensitive to moisture and easily handled in ambient atmosphere.⁴ In this study are shown the results of using ammonium niobium oxalate as a catalyst to prepare biodiesel.

RESULTS AND DISCUSSION

The reactions were made with the addition of ethanol (1.0 ml), soybean oil (0.5 g), DMSO (2.5 ml) as solvent to increase the boiling point of the mixture, and the catalyst in the proportions shown in Table 1. One reaction was made without the use of catalysts.

The reactions were made under heating conditions of 25 °C and 80 °C in a reflux system, and the reaction time ranged from 4 to 48 hours. For the reactions of 24h and 48h, 0.5 mL of ethanol were added every 8 hours. After the end of the reaction time, the products went through multiple extractions. Through the use of ¹H-NMR spectroscopy the products obtained were analyzed and quantified by the follow expression:

$$\text{Conversion rates (\%)} = \frac{\text{Ab}}{\text{Ao} + \text{Ab}} \times 100\%$$

Such expression relates the area of integration of the signal referring to the ethoxy hydrogen's ester (Ab) and the area of integration of the signal referring to methylene hydrogen's glyceride (Ao) from triglyceride.

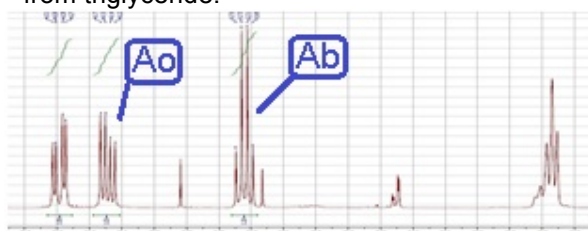


Figure 1. Methylene hydrogen's of the triglyceride (Ao) and ethoxy hydrogen's ester of the biodiesel (Ab).

Table 1. Time, temperature, proportions and conversion rates for each products.

Time	Temperature	Cat/Oil(m/m) %	Conversion rates (%)
4 h	25 °C	20%	16.0%
		100%	17.4%
	80 °C	20%	16.7%
		100%	17.4%
24 h	25 °C	20%	20.1%
		100%	28.6%
	80 °C	20%	38.7%
		100%	54.5%
48 h	25 °C	20%	27.4%
		100%	38.3%
	80 °C	20%	50.3%
		100%	71.2%

The increase in conversion rates is related to the increase in time, temperature and mass ratio of Ammonium Niobium Oxalate, because there is increased availability in the reaction.

CONCLUSION

We found that the use of Ammonium Niobium Oxalate as a catalyst promotes higher conversions in the transesterification of soybean oil in very satisfactory yields. The best conversion rate (71.2%) was the reaction using Ammonium Niobium Oxalate under condition of 80 °C and the proportion of 100% [(Cat/Oil).100%] for 48 hours.

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